Development of school functioning of children with Cerebral Palsy in the Netherlands.

An evaluation of school choice and relapse

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Master Orthopedagogy 'werkveld Gehandicaptenzorg en Kinderrevalidatie'

June 2010

Abstract

Background: Even though children with Cerebral Palsy (CP) often show difficulties in the development of school functioning and this topic is considered to be very important, it is not broadly investigated. *Aim:* The aim of this study was to investigate which child factors (motor functioning, cognition, behaviour) at age 2.5 are the best predictors of school type at age 4.5. Furthermore, this study aimed to investigate relapse in school type or level at age 7 or 9 and factors considered to be important in this process. *Method:* This study was part of the PERRIN-CP research programme (PEdiatric Rehabilitation Research In the Netherlands Cerebral Palsy) cohorts 0-5 and 5-9. The following instruments were used: the GMFCS, the GMFM, the BSID-II-NL, the MACS, the SON-R 2.5-7, the CBCL and anamnesis/interviews with parents. Data were analysed using quantitative and qualitative research methods. *Results:* Discriminant analysis revealed a combination of motor functioning and cognition as the best predictor of school type at age 4.5. Qualitative analysis revealed emotional functioning as the most occurring theme involved in relapse, followed by cognitive and motor functioning. *Conclusion:* It seems to be that the choice for a certain school type is mostly based on the motor and cognitive capacities of a child. However, when a relapse in school type or level during the school career is necessary, it appears that other factors such as emotional functioning become more important.

Prologue

From September 2009 till June 2010, we participated in the PERRIN-CP research project at the Centre for Excellence for Rehabilitation Medicine of rehabilitation centre ‘De Hoogstraat’ in Utrecht. This research report was written as the result of this internship and was part of the final year of the Master study Orthopedagogy at Utrecht University.

Participating in the PERRIN-CP research project was a great experience in our development towards educational psychologists and academics. As full members of the organisation, we were given the opportunity to experience different facets of the research project. We joined in different meetings, gave presentations in various settings and participated in the organisation of a workshop regarding to school and cognition at the PERRIN-CP symposium 2010. We have learned to explore a practical relevant matter extensively and look at our data critically. Therefore, we have learned to look beyond first impressions and get to the bottom of a topic. We autonomously made important decisions within our research project and have learned to be responsible for these decisions. We experienced our intense cooperation in our research project as gratifying and useful, but most of all as incredibly enjoyable. Through frequent dialogue with each other we were able to develop our research project independently. Within a very enjoyable and stimulating environment of motivated researchers with an incredible heart for scientific research, we were able to develop ourselves towards future academics.

We would like to thank our supervisor Marjolijn Ketelaar for the useful feedback with respect to the content of our project during the weekly meetings, but most of all for her support during the entire internship. We would like to thank our supervisor Chiel Volman for giving us the opportunity for the internship at rehabilitation centre ‘De Hoogstraat’ and for his contribution and statistical approach. In conclusion, we would like to thank the researchers and fellow students of the ‘children’s room’ for making our internship the pleasant and great experience that it has been for us.

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June 2010

Development of school functioning of children with Cerebral Palsy in the Netherlands

Cerebral Palsy (CP) describes a group of disorders of the development of movement and posture, causing activity limitation, that are attributed to non-progressive disturbances that occurred in the developing fetal or infant brain. The motor disorders of CP are often accompanied by disturbances of sensation, cognition, communication, perception, behaviour and/or by seizure disorder (Rosenbaum et al., 2007). CP refers to a heterogeneous group. Children diagnosed with CP have difficulties in various areas of functioning. Early indicators of CP are differences in the development of motor milestones or quality of movement. A delay in milestone development has consequences for the capacity to actively explore the environment and to become independent (Rosenbaum, 2003). The prevalence of CP in the Netherlands is about 1 to 2 per 1000 live born children and raised since the seventies (Wichers, van der Schouw, Moon, Stam & van Nieuwenhuizen, 2001).

Due to the heterogeneous group, children diagnosed with CP attend various school types. In the Netherlands, children with a disability have the possibility to attend mainstream schools. Special Needs Support Services (SNSS) can be provided when a child attends a regular school and needs extra help. This means that a child gets individual assistance during school time. Some children, however, are unable to attend mainstream schools for various reasons; e.g. a high need for physical care or severe learning disabilities. These children attend schools for special education or day-care centres. In the Netherlands, schools for special education are divided into four so-called ‘clusters’. Children with an intellectual and/or physical disability and children with a chronic illness attend ‘cluster 3’ schools. At Mytylschools, part of ‘cluster 3’, education is provided in different levels. These are called, ‘Leefleer’, ‘A stream’, ‘M stream’ and ‘B stream’. Children diagnosed with CP can be found in all types of education: mainstream schools with or without SNSS, schools for special education (usually ‘cluster 3’) and day-care centres.

Research of Jenks and colleagues (2007) showed that children with CP often have problems in school functioning. School functioning refers to the daily functioning of a child at school and includes all kind of activities during school time. By matching the school type to the abilities of the child, the child can achieve the greatest educational progress (Schenker, Coster & Parush, 2005). There are different factors that might influence the choice for a certain school type at the beginning of primary school, which can be divided into motor, cognitive and behavioural factors (Tieman, Palisano, Gracely & Rosenbaum, 2004) (McDermott et al., 1996; Jenks et al., 2007).

Motor functioning

The child's level of motor abilities first of all influences the choice for a certain school type in a practical way. For instance, the level of motor ability has consequences for the required furnishing of a school. Various contextual features such as surfaces, distances, time constraints and social expectations, may influence the type of mobility the child is able to perform in the school setting (Tieman et al., 2004). In order to be able to participate in a certain school, these contextual features must fit the child's motor abilities. Besides these practical matters, motor abilities influence cognitive functioning. For example, the gross motor function of a child with CP influences the construction of analytical and sequential representations in the brain (Zabalia, 2004).

Cognitive functioning

With regard to cognition, evidence-based research showed problems in school functioning of children with CP with respect to arithmetic and literacy development. Over 70 percent of the total population of children diagnosed with CP has problems with mathematics and reading (Jenks et al., 2007).

Mathematics or arithmetic problems refer to specific problems in the area of mathematics when compared to what might be expected of a child given the cognition and performance on overall learning tasks (Jenks, de Moor & van Lieshout, 2009a). The impact of problems in the arithmetic area should not be underestimated, as early math skills appear to be the best predictor of later academic achievement (Japel et al., 2007). Arithmetic problems seem to be caused by a combination of environmental factors and neurological impairments resulting from early brain damage (Jenks, van Lieshout & de Moor, 2009c). An important environmental factor contributing to arithmetic difficulties is the fact that children with CP, especially in schools for special education, receive a significant shorter amount of instruction time than their non-disabled peers in mainstream schools (Jenks, de Moor, van Lieshout & Withager, 2009b). Reasons for this shorter instruction time include provision of medical services, health-related issues and curriculum content. A relatively small amount of instruction time is provided for example for mathematics in the curriculum (Jenks et al., 2009c).

Aside from a lower general cognition, children diagnosed with CP show decreased automaticity compared to children without a neurological impairment. However, this impairment in automaticity does not seem to contribute significantly to difficulties in mathematic skills (Jenks et al., 2009a). A relationship between deficits in working memory

and arithmetic problems has been shown. Nonetheless, studies by Jenks showed that the environmental factors, in particular instruction time, appear to be the primary contributing factors in arithmetic difficulties in school age children diagnosed with CP (Jenks et al., 2007; Jenks et al., 2009a; Jenks et al., 2009b; Jenks et al., 2009c).

Beside arithmetic problems, it has been found that many children with CP show disturbances in intellectual and speech related abilities putting them at risk for delays in their literacy development (Peeters, Verhoeven, van Balkom & de Moor, 2008; Foy & Mann, 2003). Literacy skills consist of letter knowledge, phonological awareness, comprehension of text structuring, relationships of print to speech and awareness of print (van Kleeck, 1990) and are crucial for later forms of literacy learning at school (Peeters, Verhoeven & de Moor, 2009). The development of these skills in young children is influenced by the home literacy and educational environment (Light & McNaughton, 1993). Not all young children acquire these skills as easily as others (Peeters et al., 2009). A study by Peeters and colleagues (2008) showed that children with CP have a lower score on emergent phonological awareness compared with their peers without impairment. General cognition and speech abilities were the best predictors of phonological awareness. The results of the study by Peeters and colleagues (2009) showed that children with CP have a delay in their literacy development in the second group of primary school, which is still present in the third group of primary school. According to this study, parents of children with CP are undertaking more leisure activities with their children compared with parents of children without a disability. The study showed that parents of children with CP are playing with their child more frequently and are watching more television together than parents of non-disabled children. Despite a stimulating environment, it has been found that disturbances in intellectual and speech related abilities still negatively influence the amount of literacy learning opportunities at home and at school. Children with CP are less involved during storybook reading compared with peers without an impairment (Peeters et al., 2009). Furthermore, children who attend schools for special education receive less instruction during literacy as more time is needed for various therapies, which influences the amount of literacy learning (Peeters et al., 2008). Intellectual, speech related abilities and environment are important factors in the literacy development of children with CP during primary school (Peeters et al., 2009; Sandbergh, 1998).

Behavioural functioning

With respect to behaviour, Sigurdardottir and colleagues (2010) showed that motor impairment can affect behavioural expressions of children with CP. The striking finding of

this study was that behavioural and emotional problems, as rated by parents as well as preschool teachers, are common already in preschool children with CP. In addition, McDermott and colleagues (1996) showed that the majority of children with CP experience behavioural problems such as dependency, headstrong behaviour and hyperactivity, which are related to school functioning. Also, emotional adjustment is associated with the severity of CP and the functional limitations. Emotional resilience subsequently influences school functioning and the choice for a specific school type, as mentioned in the 'Guideline diagnostics and treatment of children with spastic CP' (VRA, 2009).

Problems at a later stage

Even though CP is a non-progressive disorder, deficits of children diagnosed with CP are not always present from the beginning. They are only recognised when cognitive and social-emotional functions do not develop when they should. This may occur when brain structures are not adequate enough to develop these functions. For example when children fail to make decisions in new situations or fail to solve problems. This phenomenon of later recognition is called 'growing into deficit' (Bouma, König & de Vries, 2008). For many children diagnosed with CP this means that many of these children only show problems in school functioning at a later age (Hendriksen, de Moor & Vles, 2009). Even though children with CP are at risk of showing problems in school functioning and this topic is considered to be very important (Bouma et al., 2008), it is not broadly described in the 'Guideline diagnostics and treatment of children with spastic CP' (VRA, 2009). Given the fact that this guideline aims to summarize all knowledge of CP, this is very remarkable. The findings that are available from Bouma and colleagues (2008) and Hendriksen and colleagues (2009) are based on a large amount of experience without reference to evidence-based research. In addition, several educational psychologists within Mytylschool 'Ariane de Ranitz' in Utrecht, the Netherlands, indicate some important practical findings. They reported that children diagnosed with CP regularly end up at a lower educational level than they started with. These children's educational development is slower than what is expected by educational psychologists. This can result in either changing to another school (relapse in school type) or changing to another level within the same school type (relapse in school level). Although based on a large amount of experience, these findings have not been tested in scientific research.

Both Bouma and colleagues (2008) and educational psychologist pointed to the importance of longitudinal research in this area in order to assess the long-term effect of brain damage on school functioning of children diagnosed with CP. In order to be able to provide

education to children with CP, it is important to pay attention to issues arising from practice. Specific research is necessary to gain more knowledge about the process around school functioning and school choice. Therefore this was the starting point of this study.

The aim of this study was to investigate the relationship between several child factors (motor functioning, cognition, behaviour) and the choice for a certain school type (regular with or without SNSS, school for special education, day-care centre) at the beginning of primary school. Furthermore, this study investigated which child factors at age 2.5 are the best predictors of school type at age 4.5. Lastly, this study investigated relapse in school type or level at the age of 7 or 9 and which factors are considered as imported in this process. To attain the aim of the study the following research questions[1] were posed:

1a. Is there a relationship between child factors of children with CP at age 4.5 and school type at this age?
1b. Is there a relationship between child factors of children with CP at age 2.5 and school type at age 4.5?
1c. Which child factors of children with CP at age 2.5 are the best predictors of school type at age 4.5?

2a. Is there a group of children with CP that shows a relapse in school type at age 7 or 9, compared to school type at age 5 or 7?
2b. Is there a group of children with CP that shows a relapse in school level at age 7 or 9, compared to school level within the same school type at age 5 or 7?
2c. Which factors are involved in relapse in school type of children with CP at age 7 or 9, compared to school type at age 5 or 7?
2d. Which factors are involved in relapse in school level of children with CP at age 7 or 9, compared to school level at age 5 or 7?

[1] In all research questions *child factors* refer to motor functioning, cognition and behaviour. *School type* refers to regular schools, regular schools with SNSS, schools for special education (cluster 1-4) and day-care centres. Finally, *school level* refers to the 'Leefleer', 'A' stream, 'M' stream and 'B' stream within the 'cluster 3' school type Mytylschool, repeating a class within school type regular schools or a relapse in school type within school type special education.

It was expected that there is a relationship between particular child factors at age 2.5 as well as age 4.5 and school type at age 4.5. Motor functioning, cognition and behaviour were expected to predict school type at age 4.5. Furthermore, a relapse in school type or school level at age 7 or 9 in comparison to age 5 or 7 was expected in circa 50% of the children. Factors expected to be involved in this process of relapse were the need for extra care, the feeling of being different and the abilities in the classroom. Since there is no current research concerning the specific topic of predicting school choice and relapse for children with CP, expectations were formulated on the basis of dialogue with the educational psychologists of Mytylschool 'Ariane de Ranitz' in Utrecht, the Netherlands.

Methods

Design

This study was part of the PEdiatric Rehabilitation Research In the Netherlands Cerebral Palsy (PERRIN-CP) research programme. The International Classification of Functioning, Disability and Health (ICF) was used as a conceptual framework. Activities and participation were the central concepts in the programme. More than 400 children, adolescents and young adults with CP in four age-cohorts (0-5 years, 5-9 years, 9-16 years and 16-24 years) were followed longitudinally to obtain insight in the development of daily activities and participation, in relation to their disorder, impairment, contextual and personal characteristics. This study used data from the age-cohorts PERRIN-CP 0-5 and PERRIN-CP 5-9 which had a longitudinal prospective cohort design. In these projects measurements took place on a yearly basis. The PERRIN-CP 0-5 data were analysed using quantitative research methods and the PERRIN-CP 5-9 data were analysed using qualitative methods.

Participants

Participants were recruited as part of the PERRIN-CP 0-5 and 5-9 project. All participants were reported by paediatricians, child neurologists or rehabilitation physicians of medical centres and rehabilitation centres and clinics in the Netherlands. Inclusion criteria were that the children required a diagnosis of CP and had to be 1.5 or 2.5 years of age during the first measurement for PERRIN-CP 0-5 and 5 or 7 years of age for PERRIN-CP 5-9. Furthermore, parental consent was necessary. Children were excluded if they were diagnosed with an additional disorder affecting movement besides CP or if their parents had insufficient knowledge of the Dutch language. The protocol of the PERRIN-CP study has been approved by the Ethics Committee of the University Medical Centre Utrecht.

The total study population of PERRIN-CP 0-5 consisted of 92 children. Depending on the age of inclusion (1.5 or 2.5 years) the participants were measured three or four times. In this study two measurements of all participants were used. In the first measurement used the participants were in the age-range of 2.1-2.7 years (*M*=2.6; *SD*=.1) and during the second measurement used the participants were in the age-range of 4.4-4.7 (*M*=4.5; *SD*=.1). Since school type at age 4.5 was only obtained from 76 children of the PERRIN-CP 0-5 population, the current study consisted of these 76 participants for research question 1. Participant characteristics are represented in table 1.

The total study population of PERRIN-CP 5-9 consisted of 116 children. In the Amsterdam cohort 49 children were included and 67 children were included in the Utrecht cohort. In this study only the Utrecht cohort was used. Depending on the age of inclusion (5 or 7 years) the participants were measured three or four times. In this study two measurements of all participants were used. During the first measurement used the participants were assessed at the age of 5 years (*M*=5;3) or 7 years (*M*=7;2) and during the second measurement used the participants were assessed at the age of 7 years (*M*=7;4) or 9 years (*M*=9;3). The data were used to answer research question 2.

Table 1. *Characteristics of participants PERRIN-CP 0-5 (N=92)*

Characteristics				
		Total	**Male**	**Female**
School type age 4.5	Regular	17	8	9
	Regular with SNSS	12	6	6
	School for special education	42	26	16
	Day-care centre	5	5	0
	Missing	16	7	9
	Total	92	52	40
Type of CP age 2.5	CP spastic bilateral	49		
	CP spastic unilateral right	20		
	CP spastic unilateral left	19		
	CP dyskinetic	2		
	CP atactic	0		
	CP other	1		
	Missing	1		
	Total	92		
GMFCS age 2.5	Level I	29		
	Level II	12		
	Level III	23		
	Level IV	18		
	Level V	10		
	Missing	0		
	Total	92		

Instruments

The following instruments were used to collect information about the determinants (child factors) within this study. *Motor functioning* was measured by the Gross Motor Function Classification System (GMFCS), the Gross Motor Function Measure (GMFM) and the motor scale of the Dutch Bayley Scales of Infant Development (BSID-II-NL). Fine motor functioning was obtained by the Manual Ability Classification System (MACS). *Cognition* was measured using the mental scale of the BSID-II-NL (until 3.5 years of age) and the Snijders-Oomen Non-verbal cognition test revised version 2.5 – 7 (SON-R 2.5-7) (from 4 years of age). *Behaviour* was measured by the behaviour scale of the BSID-II-NL (at the age of 2.5) and the Child Behaviour Checklist (CBCL) (at the age of 4.5). The outcome measure *school type* and *school level* were obtained through anamnesis and interviews with the parents of the children at age 4.5 for research question 1 and at age 5 and 7 or 7 and 9 for research question 2. The measurements were conducted by experienced researchers with a background in educational psychology.

GMFCS. The GMFCS is a classification system for children with CP to represent the child's present abilities and limitations in motor function, developed by (Palisano et al., 1997a). In this study, the Dutch translation of the GMFCS was used (Gorter, van Tol, van Schie & Ketelaar, 2009). In the GMFCS, children with CP are classified into five different levels whereby the first level is the highest level of functioning. Level five is the lowest level and represents a high level of dependence, even in basic antigravity postural control (table 2). The distinctions between the different levels are based on functional limitations, need for resources (such as a walker or wheelchair) and quality of movement.

The GMFCS has descriptions for 5 age groups: 0-2, 2-4, 4-6, 6-12 and 12-18 years. Classification occurs through observation of spontaneous locomotive behaviour. The GMFCS is an ordinal system: the distance between the levels are not considered to be equal (Palisano et al., 1997b). Indications were provided that the GMFCS is a reliable and valid classification system (Rosenbaum et al., 2008). The GMFCS is valid for the classification of gross motor abilities and limitations in motor function (Palisano et al., 2000). The inter-rater reliability is relatively good for children above 2 years of age (k=.75) (Palisano et al., 1997b).

GMFM. The GMFM is a clinical observational measure to assess the gross motor function of children diagnosed with CP. The original test consisted of 85 items and was modified to the GMFM-88 in 1993, which consists of 88 items (Russell et al., 1993). Items

Table 2. *Age-specific age band of the Gross Motor Function Classification System Levels I to V*

Level	Between 2nd and 4th Birthday
I	Children floor sit with both hands free to manipulate objects. Movements in and out floor sit are performed without adult assistance. Children walk as the preferred method of mobility without the need for any assistive mobility device.
II	Children floor sit but may have difficulty with balance when both hands are free to manipulate objects. Movements in and out of sitting are performed without adult assistance. Children pull to stand on a stable surface. Children crawl on hands and knees with a reciprocal pattern, cruise holding onto furniture and walk using an assistive mobility device as preferred method of mobility.
III	Children maintain floor sitting often by 'W-sitting'(sitting between flexed and internally rotated hips and knees) and may require adult assistance to assume sitting. Children creep on their stomach or crawl on hands and knees (often without reciprocal leg movements) as their primary methods of self-mobility. Children may pull to stand on a stable surface and cruise short distances. Children may walk short distances indoors using an assistive mobility device and adult assistance for steering and turning.
IV	Children floor sit when placed, but are unable to maintain alignment and balance without use of their hands for support. Children frequently require adaptive equipment for sitting and standing. Self mobility for short distances (within a room) is achieved through rolling, creeping on stomach, or crawling on hands and knees without reciprocal leg movement.
V	Physical impairments restrict voluntary control of movement and the ability to maintain antigravity head and trunk postures. All areas of motor function are limited. Functional limitations in sitting and standing are not fully compensated for through the use of adaptive equipment and assistive technology. At Level V, children have no means of independent mobility and are transported. Some children achieve self-mobility using a power wheelchair with extensive adaptations.

represent five separate dimensions of gross motor function: 'Lying & Rolling' (17 items), 'Sitting' (20 items), 'Crawling and Kneeling' (14 items), 'Standing' (13 items) and 'Walking, Running & Jumping' (24 items). To improve clinical usefulness, scoring and interpretation the Rasch model of item analysis was applied to the GMFM-88 in 2000. The 66 items that form a one-dimensional hierarchical scale (measuring only the ability of gross motor function) were identified from the original 88 items (Russell et al., 1993). Since items were arranged in order of difficulty, interpretability is improved and the test takes less time to administer. In administrating the result, the GMFM-66 takes account of the gross motor function level of a child and possible missing values in the calculation of the total score. Therefore, the Dutch translation (Ketelaar et al., 1999) of the GMFM-66 was used in the current study.

The GMFM is criterion-referenced, which means that scores are compared to certain pre-set criteria of gross motor function. This way, change in gross motor function of children with CP can be evaluated. The GMFM is appropriate for children whose motor skills are at or below those of a five year old child without motor disability (Russell et al., 1993). The test is usually administered by a child's physiotherapist and takes about one hour to carry out,

depending on the child's level of motor function. Items of the GMFM-66 are scored on a four-point ordinal scale, in which scores of 0 to 3 can be administered which define the level of partial or complete achievement on each item. Scores for each item are expressed as a percentage of the maximum score on a specific dimension. The total score of the GMFM-66 is obtained by use of the Gross Motor Ability Estimator (GMAE) software (Russell et al., 1993).

The GMFM shows good inter-rater reliability (ICC =.87-.99) and test-retest reliability (ICC = .99) (Russell et al., 1993). The Dutch translation also shows good inter-rater reliability (ICC = .75-1.00) and test-retest reliability (ICC = .96-.99) (Ketelaar et al., 1999).

The GMFM and GMFCS were proven to be highly related in measuring motor functioning. The study of Rosenbaum and colleagues (2002) described the distinction between five motor development curves classified with the GMFCS, based on GMFM assessments. It described the important and significant differences in the rates and limits of gross motor development among children with CP by severity. It suggested that distinctions between GMFCS levels are clinically meaningful. However, the current study started the quantitative analysis with both the GMFM and GMFCS to assess the usefulness of both instrument in determining the relationship between motor functioning and school type.

BSID-II-NL. The BSID-II is a revision of the original Bayley Scales of Infant Development, published in 1969. The BSID-II is a widely used standardized and norm-referenced instrument which has been used over the last two decades to evaluate the development of a child in the (developmental) age of 1 - 42 months (Bayley, 1993). The BSID-II was translated into the Dutch BSID-II-NL (Van der Meulen, Ruiter, Lutje Spelberg & Smrkovsky, 2002). The BSID-II-NL consists of three scales: the mental scale, the motor scale and the behaviour rating scale. The mental scale consists of 178 items that measure cognitive skills such as processing of visual and audit information, eye-hand coordination, imitation, memory and problem solving. The motor scale consists of 111 items that measure children's gross motor skills such as rolling, crawling, sitting and standing. This scale also measures fine motor manipulations. The behaviour scale consists of 30 items and is meant to measure behaviour and temperament of the child, for example with regard to adaptation to surrounding.

Normally, the chronological age of the child is used to score motor capacities (Van der Meulen et al., 2002). Given the fact that children with CP have a lower level of capacities, the chronological age was not used as starting point or ending point in the PERRIN-CP

programme. Instead, developmental age was used as a reference point. As the aim of the PERRIN-CP programme was to evaluate development, children were compared with themselves instead of with the norm group. The children's developmental index was used for the analyses.

According to the manual of the BSID-II-NL, the scales are reliable and valid (Van der Meulen et al., 2002). The COTAN qualified the psychometric qualities of the BSID-II-NL as moderate and good, except for criterion validity (no studies available) and the reliability of the behaviour rating scale which was classified as insufficient.

SON-R 2.5-7. The SON-R 2,5-7 (Tellegen, Laros & Winkel, 1998) is designed to investigate a broad spectrum of mental capacities of an individual child without being dependent on language. The test is appropriate for children between the age of 2.5 to 7 years. The spectrum of cognition covered by the SON-R 2.5-7 consists of six subtests which contain about 15 items each. The subtests are divided in two main scales of cognition: the reasoning scale and the spatial scale. The reasoning scale is designed to measure abstract and concrete reasoning and entails the subtests 'Categories', 'Analogies' and 'Situations'. The spatial scale, measuring performance on spatial tasks, entails the subtests 'Mosaics', 'Puzzles' and 'Patterns'. The SON-R 2.5-7 is norm-referenced, which means that scores provide an indication of results compared to a certain age group. Norm data are available for both subscales separately and together as a total score. Results can be expressed as an IQ-score, a percentile score and as an age of reference. In this study the percentile scores on the two different subscales as well as on the total scale were used. Both subscales were of equal importance in calculation of the total result. The SON-R 2.5-7 takes about one hour to perform. Instructions can be given verbally or non-verbally, which makes the test very suitable for children with difficulties in communication and (spoken) language (Tellegen et al., 1998).

The psychometric qualities of the SON-R 2.5-7, as evaluated by the COTAN, have been proven to be good on all domains. The reliability of the outcome measure as expressed in an IQ score increases with age.

MACS. The MACS (Eliasson et al., 2006) is a classification system to classify how children with CP use their hands when handling objects in daily activities, such as using knife and fork or playing with cubes. The MACS classifies what a child does when using one or both hands during activities and can be used for children in the age range 1-18. Classification

occurs through observation of a few minutes by someone who knows the child well. The MACS has good psychometric qualities for children between 2 and 5 years of age. The overall inter-rater reliability is moderate for children in the age range 1-5 (*k*=.62) (Plasschaert, Ketelaar, Nijnuis, Enkelaar & Gorter, 2009).

CBCL. The CBCL is an instrument by which parents, or other individuals who know the child well, rate the child's problem behaviours and competencies. This can be self administered or through a personal interview. The CBCL is useful to measure a child's continuity or change in behaviour over time. The CBCL consists of two sections. The first section consists of 20 items concerning the overall competencies of the child and the second section consists of 120 items concerning behaviour or emotional problems during the last 6 months. Parents provide information by using a 0-1-2- scale (0=not true, 1=somewhat or sometimes true, 2=very true or often true). This instrument is appropriate for children between 1.5 and 18 years of age and takes about 15 minutes to administer. In this study, the percentile scores on the scales measuring total problems, internalizing problems and externalizing problems were used.

The COTAN describes the psychometric qualities of the CBCL as good. The test-retest reliability is .95 to 1.00, the inter-rater reliability is .93 to .96 and the internal consistency is .78 to .97.

Anamnesis and interview. The outcome measure school type was obtained during anamnesis with the parents at the children's age of 4.5, 5 and 7 or 7 and 9 years. The distinguished types of school were: regular school, regular school with SNSS, school for special education ('cluster 1-4') and day-care centre. Different school levels were distinguished within the 'cluster 3' school type Mytylschool: 'Leefleer', 'A stream', 'M stream' and 'B stream', where 'Leefleer' was the lowest level and 'B stream' the highest level (figure 1). Within school type regular, school relapse in school level was defined as the repeating of a class and within school type special education school relapse was defined as a change in specific cluster. In this study 'change' is used as a synonym for relapse, which means a switch to a lower school type or level. Information about the factors involved in the relapse in school type or school level was obtained through a face-to-face semi-structured interview with the parents of the children at the age of 5 and 7 or 7 and 9. The interviews

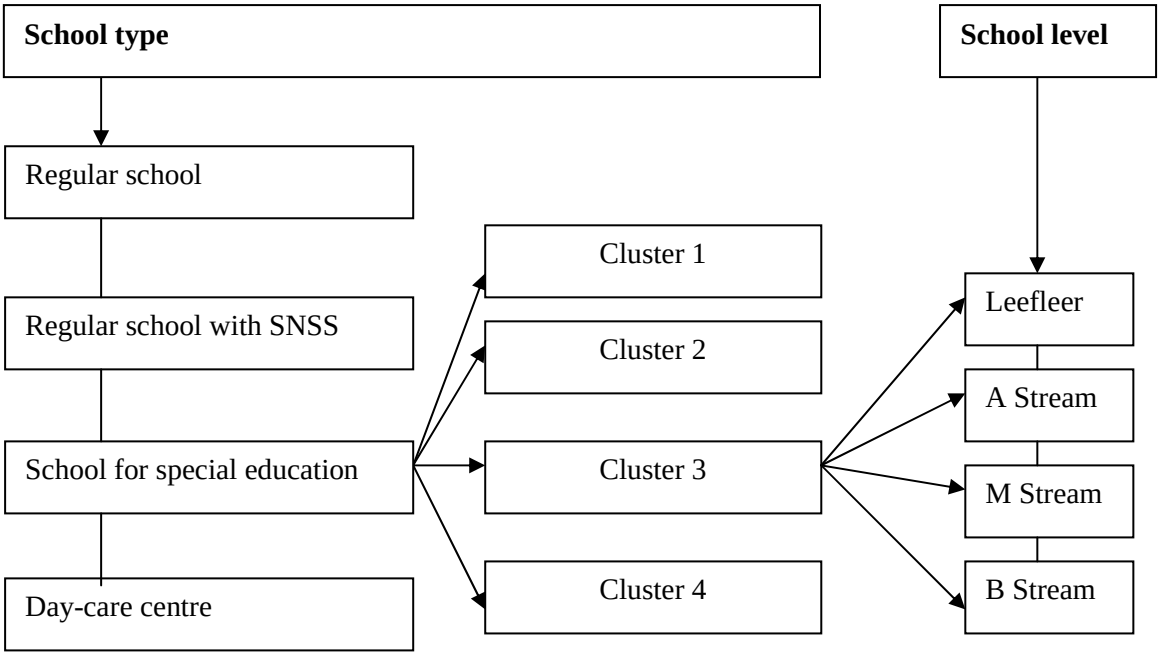

Figure 1. Distinguishing school type and school level.

consisted of a broad spectrum of questions concerning school. For the current study a selection of relevant questions with regard to a relapse in school type or level was made. Table 3 shows the selection of relevant questions involved in the semi-structured interview. The interviews were conducted by experienced researchers with a background in educational psychology who were familiar with interviewing techniques. The interviews lasted between 15 and 45 minutes per interview and were saved on audio tape.

Procedure

The university medical ethics committees of the Utrecht Medical Centre approved PERRIN-

Table 3. *Relevant interview questions*

1.	Which school does your child attend to?
2.	What kind of school is this (school level, classroom, teachers etc.)?
3.	Has your child switched schools recently?
4.	If so; why did your child switch schools?
5.	Are you satisfied about the current school?
6.	Did you have any expectations about the school before attending?
7.	Do you expect your child to attend to the current school in the future?

CP 0-5 in April 2003 and PERRIN-CP 5-9 in March 2006. The recruitment period for both projects lasted over one year. Subsequently, baseline and follow up measurements were conducted. In both PERRIN-CP 0-5 and 5-9 each child was measured three or four times, depending on the age at recruitment. Children were seen once a year within two months of the yearly scheduled date. The measurements of the cohort of children within PERRIN 5-9 that show a relapse in school type or school level were included in this study (age 5 and 7 or age 7 and 9). All measurements were conducted by a research assistant in a couple of hours. The measurements took place at medical centres, rehabilitation centres and clinics in the Netherlands. Each measurement consisted of several tests and questionnaires measuring various kinds of factors. The interviews with parents took place separately from the child's measurements.

Data analysis

The Statistical Package for Social Sciences (SPSS, version 16.0) was used to compute descriptive statistics, correlations and to apply Discriminant analysis. An alpha of 5% was used during all analyses. The dependent variable in this study for research question 1 was *school type*. The independent variables were the child factors motor functioning, cognition and behaviour. As categorical variables are often used for interpretation in practice, the Chi-square measure of association was computed for research question 1a and 1b, concerning the relationship between child factors and four groups of school type. The Chi-square method is suited for measuring statistical correlation between two categorical variables. The instruments GMFM, BSID-II-NL motor scale, SON-R 2.5-7, BSID-II-NL mental scale, CBCL and BSID-II-NL behaviour scale were of interval measurement level. Therefore, raw scores of these variables were recoded into several categories to create ordinal variables. The BSID-II-NL motor and mental scale developmental index scores were recoded into four categories ranging from 'severely delayed' to 'above average'. The 'severely delayed' category referred to a developmental index score of 69 and below, the 'delayed' category to an index score between 70 and 84, the 'average' category to an index score between 85 and 114 and the 'above average' category to an index score of 115 and above (Bayley, 1993). The percentile scores of the SON-R 2.5-7, the CBCL and BSID-II-NL behaviour observation scale were recoded into seven categories ranging from 'very low' to 'very high'. The categories referred to the following percentile scores: 'very low': 5 or below, 'low': between 5 and 14, 'below average': between 15 and 24, 'average': between 25 and 75, 'above average': between 76 and 85, 'high' between 86 and 95 and 'very high': 95 and above (Bayley, 1993). The GMAE-66

score remained of interval measurement level, since it was not possible to recode these scores into an ordinal variable in a proper way. Analysis of variance (One-Way Anova) was used to determine the possibility of classifying children into groups of school type based on the level of gross motor functioning as measured by the GMFM. Since analysis of variance is suited for testing group differences with independent variables of categorical measurement level and dependent variables of interval/ratio measurement level, the dependent variable school type and the independent variable motor functioning were switched. Post hoc Tukey analysis was used to determine which groups differed significantly on GMFM score in case of a significant ANOVA.

For research question 1c, concerning the prediction of the dependent variable, Discriminant analysis was used. Discriminant analysis is suited for measuring the predictive value of independent variables of continue measurement level on dependent variables of nominal measurement level. The analysis was computed with the dependent variable school type and the independent variables or discriminant functions motor functioning, cognition and behaviour. All independent variables were measured on interval measurement level, except for GMFCS level, which was computed on ordinal level as it is a classification system.

Assumptions for Chi-square and Discriminant analysis were checked before the analyses were computed. Although not all expected celfrequencies were equal to or higher then 1 and the percentage of expected celfrequencies between 1 and 5 was higher then 20% in all variables, it was decided to continue with the Chi-square analyses. The assumption of normality was analysed with histograms for the Chi-square analyses and with Skewness values for the Discriminant analysis. Almost all variables showed a normal distribution (GMFCS Skewness=.17; BSID-II-NL mental scale Skewness=-.68; BSID-II-NL motor scale Skewness=1.30; BSID-II-NL behaviour observation scale Skewness=-.85) and therefore, analyses were continued. The assumption of equality of variances was tested with Levene's test for Equality of Variances. Not all the variances were assumed to be equal, p values were respectively .00 (GMFCS), .00 (BSID-II-NL mental scale), .57 (BSID-II-NL motor scale), and .00 (BSID-II-NL behaviour observation scale). Nevertheless it was decided to continue with the Discriminant analysis.

To answer research question 2, qualitative analysis was used. All interviews were administered in Dutch and were audio taped. Interviews were transcribed into MS Word files. Text files were analyzed using Maxqda, a qualitative software package designed to assist with the organization and thematic analysis of qualitative data. The coding list was developed with the research questions in mind. The codes identified were transformed into themes after

analysing the interviews. The researchers coded the interviews separately; afterwards differences were discussed until equal labels were accomplished. In the end, quotes were translated into English.

Results

Quantitative analysis

Relationship between child factors and school type for children with CP. Concerning the relationship between the child factors and school type, table 4 shows the mean, median and standard deviation for all child factors at age 2.5 and 4.5 per school type at age 4.5. Table 5 shows crosstabs statistics for all child factors at age 4.5 per school type at this age. The

Table 4. *Mean, median and standard deviation at age 4.5 and 2.5 per school type at age 4.5*

Age 4.5

	School type at age 4.5											
	Regular (N=17)			*Regular with SNSS (N=12)*			*Special education (N= 42)*			*Day-care centre (N=5)*		
	Median	Mean	SD	Median	Mean	SD	Median	Mean	SD	Median	Mean	SD
Motor functioning												
GMFCS	1	1.4	.8	2.0	2.1	.9	3	3.0	1.5	5	4.6	.9
MACS	2	1.7	.6	1.5	1.5	.5	2	2.5	1.2	3	3.2	1.5
GMFM	70.9	71.8	9.3	65.7	66.4	12.4	49.9	49.4	15.9	30.0	30.5	9.2
Intelligence												
SON total	53.0	52.7	6.0	52.5	51.2	7.3	32.5	49.4	21.1	.0	.0	.0
Behaviour												
CBCL total	58.0	62.2	23.2	29.0	33.0	28.2	62.0	56.4	26.0	71.5	63.0	33.8

Age 2.5

	School type at age 4.5											
	Regular (N=17)			Regular with SNSS (N=12)			Special education (N= 42)			Day-care centre (N=5)		
	Median	Mean	SD	Median	Mean	SD	Median	Mean	SD	Median	Mean	SD
Motor functioning												
GMFCS	1	1.3	.8	2	2.1	.9	3	3.0	1.2	5	4.6	.5
BSID-II motor	93.0	84.4	21.8	55.0	71.3	20.8	55.0	58.2	9.9	55.0	55.0	.0
Intelligence												
BSID-II mental	31.0	30.9	3.01	30.5	28.4	5.7	22.0	21.1	7.6	7.5	8.0	2.8
Behaviour												
BSID-II BOS	38.5	38.6	24.6	35.5	35.3	19.1	14.0	15.2	13.4	8.5	8.5	10.6

Table 5. *Crosstabs child factors at age 4.5 and school type at age 4.5*

	School type 4.5				
Child Factor 4.5	Regular	Regular SNSS	School for special education	Day-care centre	Total
GMFCS I	13	3	10	0	26
GMFCS II	3	6	6	0	15
GMFCS III	0	2	11	1	14
GMFCS IV	1	1	5	0	7
GMFCS V	0	0	10	4	14
Total	17	12	42	5	76
MACS I	6	6	7	1	20
MACS II	10	6	20	0	36
MACS III	1	0	7	2	10
MACS IV	0	0	4	1	5
MACS V	0	0	4	1	5
Total	17	12	42	5	76
SON Very low	2	2	26	4	34
SON Low	1	0	4	0	5
SON Below average	2	2	0	0	4
SON Average	11	7	5	0	23
SON Above average	1	0	1	0	2
SON High	0	1	1	0	2
Total	17	12	37	4	70
CBCL Very low	0	1	0	0	1
CBCL Low	0	1	3	0	4
CBCL Below average	2	1	1	1	5
CBCL Average	8	2	13	1	24
CBCL Above average	1	1	8	1	11
CBCL High	0	0	2	1	3
CBCL Very high	2	0	0	0	2
Total	13	6	27	4	50

Chi-square showed a statistical significant correlation between GMFCS and school type ($X^2(12)=41.27$, $p<.01$). The crosstabs show that children with GMFCS level I and II often attending regular schools or regular schools with SNSS. All five GMFCS levels were represented in schools for special education. A striking fact was the child with GMFCS level IV attending a regular school. The Chi-Square showed no statistical significant correlation between MACS and school type, although a trend to significance was found ($X^2(12)=20.55$, $p=.06$). A one-way ANOVA analysis revealed a statistically significant difference in school type on the GMFM scores ($F(3)=117.92$, $p<.01$). Post hoc Tukey analysis showed that children attending regular schools with and without SNSS differed significantly on GMFM score from children attending schools for special education ($p<.01$) and day-care centres ($p<.01$). Children attending schools for special education also differed significantly from

children attending day-care centres (p<.05). Both the GMFM and the GMFCS showed a significant correlation with school type at age 4.5, which was comparable with the literature where the GMFM and GMFCS were proven to be highly related in measuring motor functioning (Rosenbaum et al., 2002). Therefore, it was decided to continue further analysis with only one of both instruments. Since the GMFCS was more practical in use and the method of switching the dependent and independent variables was not statistically substantiated, it was decided to exclude the GMFM.

Significant correlations between SON-R 2.5-7 spatial scale and school type (X^2(9)=32.74, p<.01), between SON-R 2.5-7 reasoning scale and school type (X^2(18)=37.13, p<.01) and between the total score of the SON-R 2.5-7 and school type (X^2(15)=36.86, p<.01) were found. Children with an average or above average score often attended a regular school or regular school with SNSS. Remarkable was that all levels of the SON-R 2.5-7 were found in schools for special education. In day-care centres, only children with a very low score were found.

The Chi-square showed no significant correlations between internalizing problems and school type X^2(15)=18.77, p=.23), between externalizing problems and school type (X^2(18)=21.84, p=.24) or between the total amount of problems and school type (X^2(18)=24.75, p=.13).

Table 6 shows crosstabs statistics for all child factors at age 2.5 per school type at age 4.5. Chi-square showed a significant correlation between GMFCS and school type (X^2(12)=54.37, p<.01). The crosstabs show that children with GMFCS IV and V were found more often in schools for special education or day-care centres. Children with GMFCS level I or II often attended a regular school. Remarkable was that all levels were found in schools for special education. Since only 45 children of the sample were classified according to the five levels of the MACS at age 2.5 and the reliability of the classification system for children of younger ages is significantly lower then for older children, it was decided to exclude all measurements of the MACS in further analyses. Significant correlations between BSID-II-NL motor scale and school type were found (X^2(6)=19.87, p<.01). Crosstabs show that children who were more severely delayed, attended more often a school for special education.

BSID-II-NL mental scale and school type also showed a significant result (X^2(9)=34.48, p<.01). Crosstabs show that children with low intellectual capacities more often attended schools for special education and day-care centres. A significant correlation was also found between BSID-II-NL behaviour observation scale and school type (X^2(7)=32.63, p<.01). Crosstabs show that less behaviour problems were found in children attending schools

Table 6. *Crosstabs child factors at age 2.5 and school type at age 4.5*

	School type 2.5				
Child factor 2.5	Regular	Regular SNSS	School for special education	Day-care centre	Total
GMFCS I	14	4	7	0	25
GMFCS II	2	3	5	0	10
GMFCS III	0	5	14	0	19
GMFCS IV	1	0	13	2	16
GMFCS V	0	0	3	3	6
Total	17	12	42	5	76
BSID BOS Very low	1	0	2	1	4
BSID BOS Low	2	2	10	0	14
BSID BOS Below average	0	1	12	1	14
BSID BOS Average	9	7	1	0	17
Total	12	10	25	2	49
BSID Motor Severely delayed	4	4	28	4	40
BSID Motor Delayed	1	0	0	0	1
BSID Motor Average	8	3	3	0	14
Total	13	7	31	4	55
BSID Mental Severely delayed	0	0	18	4	22
BSID Mental Delayed	0	1	6	0	7
BSID Mental Average	15	9	11	0	35
BSID Mental Above average	1	0	1	0	2
Total	16	10	36	4	66

for special education and day-care centres and more behaviour problems were found in children attending regular schools (with or without SNSS).

Prediction of school type for children with CP. The Discriminant analysis was computed for 42 children (figure 2), since the remaining 34 children of the total population of 76 children had at least one missing variable. It was decided to exclude these 34 children with

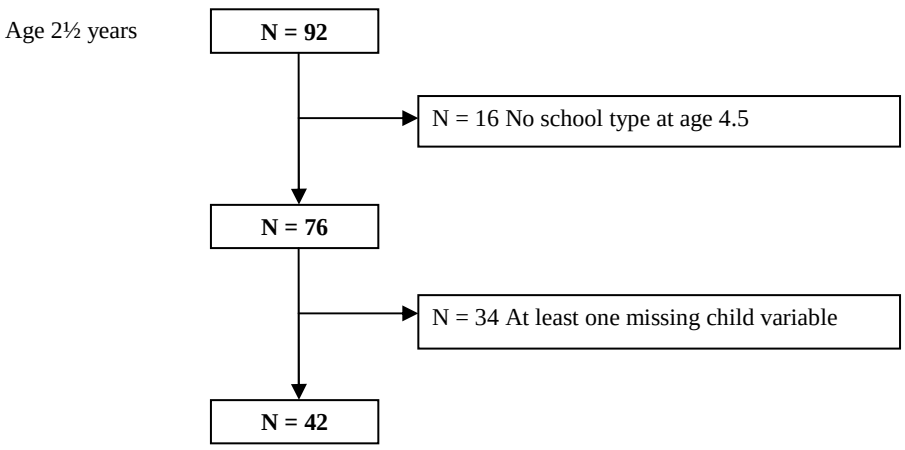

Figure 2. Flowchart children PERRIN-CP 0-5.

at least one missing child variable as imputation of these variables would reduce the reliability of the study. Because the approval of PERRIN-CP 0-5 by the university medical ethics committees did not include the possibility to contact participants after the original period of data collection, it was not possible to retrieve the missing variables with regard to school type.

Within the population, 11 children were situated in the regular group, 6 children in the regular with SNSS group, 23 children in the special education group and 2 children in the day-care centre group. The analysis revealed three discriminant functions. The first function explained 86.7% of the variance (canonical R^2=.77), the second function 12.2% (canonical R^2=.42) and the third function explained 1.1% of the variance (canonical R^2=.14). The first discriminant function significantly differentiated the groups (Λ=.33, $X^2(12)$=41.31, p<.01). Neither the second (Λ=.81, $X^2(6)$=7.67, p=.26) nor the third (Λ=.98, $X^2(2)$=.69, p=.71) function discriminated significantly. To interpret the contribution of each variable to each discriminant function, a structure matrix was computed (table 7). The structure matrix shows that the correlation between school type and the significant discriminant function showed high scores for BSID-II-NL mental scale, GMFCS and BSID-II-NL motor scale. The BSID-II-NL behaviour observation scale was part of the function but with less influence. The discriminant function can be described as *severity of limitation* on motor and cognitive level. The discriminant function plot in figure 3 shows that *severity of limitation* discriminated regular schools from schools for special education and day-care centres most clearly, but also discriminated schools for special education from day-care centres.

All 76 children were classified according to the discriminant function model, based on 42 children. Results showed that 69.7% of the children were classified correctly on the basis of this function: respectively 64.7% of the regular group, 8.3% of the regular group with SNSS, 90.5% of the special education group and 60% of the day-care centre group. This means that 23 children were classified incorrectly: respectively 6 children for the regular group, 11 children for the regular group with SNSS, 4 children for the special education group and 2 children for the day-care group (table 8).

Table 7. *Structure matrix*

	Discriminant function		
	1	2	3
BSID-II Mental scale	.78*	-.29	.43
GMFCS Level	-.67*	.40	.62
BSID-II Motor scale	.54*	.50	-.52
BSID-II Behaviour scale	.50	.40	.57

* Largest absolute correlation between each variable and any discriminant function.

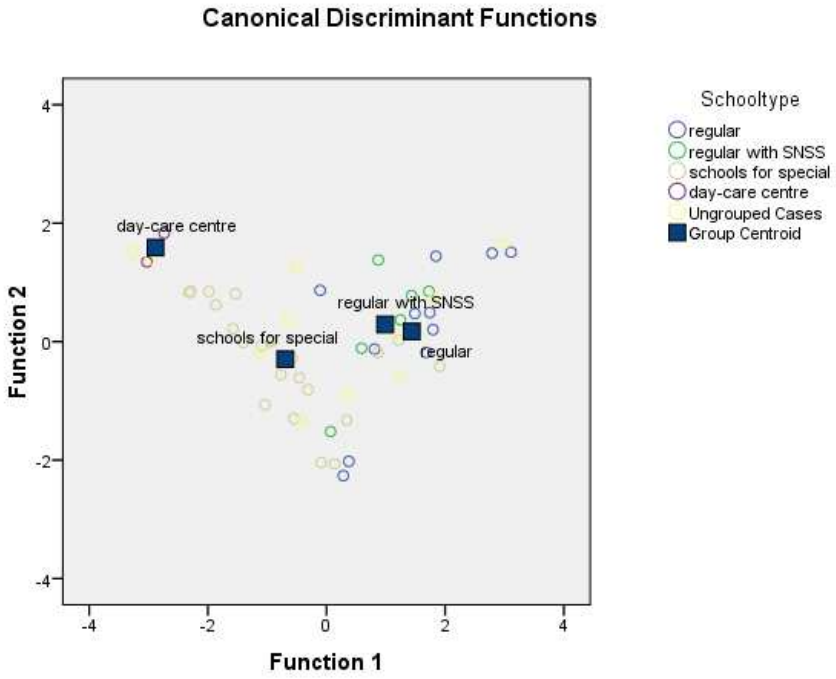

Figure 3. Discriminant function plot.

Qualitative analysis

Out of the total PERRIN-CP 5-9 Utrecht cohort of 67 children, 3 children showed a relapse in school type and 6 children showed a relapse in school level within a certain school type (table 9). When interviewing the parents about their children's relapse, frequently occurring themes were emotional functioning, cognitive functioning and motor functioning as discussed below.

Table 8. *Classification results*

	School type	Predicted group membership				Total
		Regular	Regular SNSS	Special	Day-care centre	
Amount	Regular	11	0	6	0	17
	Regular SNSS	4	1	7	0	12
	Special	4	0	38	0	42
	Day-care centre	0	0	2	3	5
	Ungrouped cases	4	0	9	3	16
Percentage	Regular	64.7	0	35.3	0	100
	Regular SNSS	33.3	8.3	58.3	0	100
	Special	9.5	0	90.5	0	100
	Day-care centre	0	0	40	60	100
	Ungrouped cases	25	0	56.2	18.8	100

Table 9. *Descriptives with regard to relapse in school type and level*

Participant	Age	School type/level	Age	School type/level	Classification
1.	7	Cluster 3 Mytyl M stream	9	Cluster 3 Mytyl A stream	Relapse in school level
2.	5	Cluster 3 Mytyl M stream	7	Cluster 3 Mytyl A stream	Relapse in school level
3.	5	Regular	7	Cluster 3 Mytyl Toddlers	Relapse in school type
4.	7	Cluster 2 special education	9	Cluster 3 Mytyl A stream	Relapse in school level
5.	5	Regular class 2	7	Regular class 2	Relapse in school level
6.	7	Cluster 3 special education	9	Cluster 3 Mytyl A stream	Relapse in school level
7.	5	Regular class 2	7	Regular class 2	Relapse in school level
8.	5	Regular	7	Regular with SNSS	Relapse in school type
9.	5	Regular	7	Regular with SNSS	Relapse in school type

Emotional functioning. Emotional functioning emerged as a frequently occurring theme in the process around a relapse in school type or school level for both children and parents. All respondents mentioned this theme as being involved and in seven of the nine cases this topic had a large amount of influence on this process. Emotional functioning referred firstly to psychological aspects of the child and concerned the way the children experienced attending a certain school. Respondents reported as important whether a child feels happy at a certain school. Being happy at school was experienced as essential to be motivated for learning on all aspects, even if functioning in certain areas was not going so well. Attention to individual needs in all areas helped a child to feel happy.

"What is important, is the attention to the total amount of individual needs, not just needs on educational level but also motor and emotional needs. In a regular school with SNSS he would not be able to persevere, which is why schools like the Mytylschool are so important." [1; Mytyl M – Mytyl A]

Other factors associated with the child's happiness at school were; for example the equality in educational level between the child and classmates, the degree of support needed in daily activities compared to classmates and the ability of the school to adapt to individual needs of a child on all levels of functioning.

All these factors influenced the process around a relapse. Some parents mentioned that the educational level in a certain class was too high for their child which made their child feel unhappy. However, parents mentioned that when a child is able to help other children, it can increase a child's happiness and stimulate the child in his/her development. Remarkable was

that this was mentioned especially in the interviews with parents of children who switched to or within schools for special education.

"He started in a class with children with a much higher educational level. He was very unhappy. After the switch, he now helps classmates regularly instead of always depending on others to help him." [2; Mytyl M – Mytyl A]

Furthermore, parents mentioned that a school had to be suited for the emotional functioning of a child. A school should motivate a child to do things on his or her own when the child has the necessary capacities for this. The feeling of doing something good and, as a consequence, receiving positive feedback, could increase a child's self-esteem. On the other hand, teacher assistance could be very important when a child lacks certain capabilities, in order to keep the child motivated.

As mentioned above, emotional functioning of the parents turned out to be of importance as well. Emotional functioning involved the way parents feel about a certain school, the other children attending that school and the way they feel how people in their surroundings view their child and its handicap. A lot of interviewees reported that it often takes time to get used to a certain school and the other children attending that school. At first, parents may feel that the level of cognitive and motor functioning of their child is 'too high' for a certain school.

"It was emotionally hard for me, because there are many children with severe (motor) limitations at the Mytylschool. But it is important to focus on the needs of the child, not your own. She is perfectly happy there." [6; 'Cluster 3' Special education – Mytyl A]

Furthermore, the way other people view their child and the handicap was considered to be important. As mentioned in the interviews, a new school could mean uncertainty for parents about the way people view their child. Some teachers, for example, may experience a child with a disability in their classroom as a problem and approach the child as such, while others make no difference in the way they view and approach the child compared to children without a disability.

"How school was going to react to him and his handicap was one of my biggest fears when he entered primary school. Funny thing is that he now isn't seen as a problem child any more, which is also a disadvantage because he really needs special attention." [8; Regular – Regular with SNSS]

Cognitive functioning. Cognitive functioning emerged as another theme related to a relapse in school type or level. Cognitive functioning involved the intellectual capacities of a child in the classroom and the overall educational level. More than half of the participants reported problems in cognitive functioning as a reason for a change in school type or level. Further, parents mentioned that comparison of the educational level of a child with classmates influences the performance of their child in the classroom and the decision to switch schools. Some parents noticed that a low educational level of their child, compared to their classmates, resulted in poorer performances in the classroom.

"In his previous class, he experienced a lot of problems following all the lessons but his new class has a different level and he is doing well now!" [2; Mytyl M – Mytyl A]

Problems with concentration were reported to be an important factor in the decision for a certain school type or level as well. Parents reported that problems of their child to focus and concentrate in the classroom highly influenced their performance. It was mentioned that some children were not able to follow all the lessons or keeping up with the working rate. Parents expectations about future cognitive functioning were also mentioned as a factor in the process around a relapse. Some parents were not sure about the performance at this moment and were afraid of a further relapse in the future. They reported that concentration problems could be a factor to switch to a different school type or level in the future.

"She has problems with concentration. She needs more time for each task but her CITO score is average. At the moment it is okay but I'm not sure if she is staying at this school for years and years. They are going to learn a lot this year and I don't know if she will understand and learn all these things." [9; Regular – Regular with SNSS]

"*In learning skills he was definitely the one with the poorest performance. Furthermore, he has concentration problems and can not work on his own which was an important reason to go to a lower school level."* [1; Mytyl M – Mytyl A]

In spite of the importance of the theme of cognitive functioning in relation to a relapse in school type or level, it is important to note that there were also caregivers who reported intellectual capacities of their child as an indicator influencing school choice in a positive way. When a child has good cognitive capacities at school, this may influence the decision to stay at the same school. However, this did mark the overall importance of the cognitive theme in the choice for a certain school.

"*He is smart and he will perform well in the next class"* [2; Regular – Regular with SNSS]

Motor functioning. Motor functioning was mentioned as a theme involved in the choice for a switch to a certain school type or level by five of the parents. Motor functioning referred to the gross and fine motor functioning of a child at school and in the classroom in particular. This also involved whether a child can come along with classmates when it comes to the performance on fine and gross motor tasks. Caregivers reported a child's motor capacity compared to classmates of importance in the choice for a certain school; for example whether a child has better or worse motor capacities. Worse motor capacities may influence the decision to change school type or level. Furthermore, the possible presence of epilepsy and the level of physical energy was of great influence on motor functioning. These factors added to the reasons to switch in school type or level in some cases.

"Last year things were very bad with her epilepsy. She has been in hospital for a period of six weeks. Now we are very happy she is capable to persevere in school for a whole day." [4; 'Cluster 2' Special education – Mytyl A]

Other factors involved in the relapse concerning motor performance were whether a child is clumsy, was slow in performance on motor tasks and was (in)capable of participating on the playground. Future (uncertain) prospects were of importance as well.

"*We don't know yet how his motor skills are going to develop in the future, especially during puberty. In the future we may decide to switch in school type."* [8; Regular – Regular with SNSS]

Besides that, special aids such as a splint or absence due to hospitalization were of influence on the choice for a certain school as well. In regular schools, some children with a disability needed extra help during sport lessons. However, this was not considered to be a crucial point in determining the type of school a child attended. The possibility of a school to provide special care and help was considered to be important.

"We mentioned to the school that we find it very important that his fine-motor skills such as holding a pencil properly are being monitored." [5; Regular same class]

Discussion

Quantitative analysis

The first section of the present study was aimed to assess the relationship between several child factors and the choice for a certain school type at the beginning of primary school. Moreover, it was tested whether these child factors at age 2.5, predicted school type at age 4.5. The results showed a significant relationship between motor functioning and cognition at age 4.5 and school type at this age. At age 2.5 behaviour, motor functioning and cognition showed a significant relationship with school type at age 4.5. The Discriminant analysis revealed that the combination of cognition and motor functioning was the best predictor of school type at age 4.5. The variable behaviour was also part of the discriminant function, but did not contribute as much as motor functioning and cognition. The total combination of this factor predicted 86.7% of the total variance in school type and can be interpreted as severity of limitation in motor and cognitive function. A more severe limitation referred to a lower cognition and a lower motor ability. As a consequence, it is possible to classify children into different school types on the basis of these factors. The severity of limitation best discriminated regular schools from schools for special education and day-care centres, but also discriminated schools for special education from day-care centres.

However, results of the Discriminant analysis showed that 23 children out of 76 were classified incorrectly, which could be explained by several factors. First of all, it could be the result of a broad definition of categories of school type. The third school type, for instance, refers to ‘cluster 1’ to ‘cluster 4’ schools and consists of a diverse level of functioning in both motor and cognitive ability. Another explanation for the incorrect classification could be that children with a lower cognitive and/or motor function were still able to attend a certain school type, for instance a regular school, because of a large amount of support offered by parents, teachers and/or classmates. Furthermore, the data consisted of unequal groups. For example, there was a large difference in group size between school type ‘day-care centre’ and school type ‘cluster 1 – 4’ which make classification more difficult. Another reason for the incorrect classification could be the heterogeneous group of children with CP, which makes it difficult to classify these children correctly. Moreover, when children are 5 years of age, they are sometimes waiting for the SNSS placement. Even though these children need the extra help, they were still attending a regular school without SNSS. This could be an explanation for the fact that especially the children who attend regular schools with SNSS were classified incorrectly.

Contrary to the expectations, behaviour only showed a significant relationship with school type at age 2.5. This is possibly due to the fact that behaviour is a much more prominent theme for parents during preschool puberty around the age of 2 years. Nonetheless, behaviour at the age of 2.5 did not seem to be a strong predictor for school type at age 4.5. This is possible due to the fact that behaviour was measured with different instruments at age 2.5 and 4.5. Instruments have to be highly sensitive in order to detect behaviour problems in children of this age. However, McDermott and colleagues (1996) showed that the reliability and validity of the BSID-II-NL behaviour observation scale, used at age 2.5, is insufficient. Therefore, results must be interpreted with caution. Studies showed that children with CP have more behavioural problems and show more dependency compared with children without CP (Sigurdardottir et al., 2010) However, this study found no evidence for the predicted value of behaviour at age 2.5 for school type at age 4.5.

Qualitative analysis

The second part of this study was aimed to investigate factors involved in a relapse in school type or school level of children with CP during their school career. The data revealed that 3 children showed a relapse in school type and 6 children showed a relapse in school level within a certain school type. The qualitative analysis revealed emotional functioning as the most occurring theme involved in a relapse, followed by cognitive and motor functioning.

It was expected that circa 50% of the total PERRIN-CP 5-9 research group would show a relapse in school type or level. Contrary to this expectation, only circa 13% of the children in this research group showed a relapse. Possibly, this was due to the fact that children were measured at a relatively young age (5 and 7 or 7 and 9 years of age). Hendriksen and colleagues (2009) have noticed that deficits are often recognised when cognitive and social-emotional functions do not develop as expected. At a young age, children may develop as expected. However, as children grow older, development may stay behind, which is called ‘growing into deficit’ (Bouma et al., 2008). As a consequence, the current study, assessing children at a maximum age of 7 or 9 years, may not have been able to detect the expected percentage of relapses as those might only occur at a later age.

Another explanation for the relatively small amount of children showing a relapse might be the definition of relapse, which was defined in this study as an actual change in level or school type. This does not include subtle declines within a certain school type or level. This definition might not have been sensitive enough for small declines in the development of the children. The small amount of children showing a relapse does not mean that there is no

decline in the development of the children at all. It is possible that the children showed a relapse in their performance on scholastic tasks in the classroom but have not changed to a different school type or level due to extra help and guidance offered by teachers and educational psychologists.

Moreover, the smaller amount of children showing a relapse might be explained by a methodological matter concerning the interviews with the parents. Since the relapse was not the focus of the interviews, some small declines in the school development of the children might not have been identified. This might especially be true for a possible relapse in school level, since it takes more than one simple question to gain knowledge about this relapse.

Besides the amount of circa 50% expected to show a relapse in school type or level, it was expected that theme's involved in a relapse would be the feeling of being different, the need for extra care in the classroom with regard to motor and cognitive tasks and classroom abilities. This expectation was partly confirmed. As expected, emotional factors such as being unhappy in school and not feeling part of the group seemed to be important factors involved in a relapse. This can possibly be explained by the fact that children, as they get older, might experience a more intense awareness of shortcoming or being different. As this awareness grows, children might not feel as comfortable in a certain school or class as before and decide to change classes. Remarkable is that parents also reported their own emotions as part of the decision.

Cognitive functioning emerged as another theme related to a relapse, which is partly consistent with the expectation of need for extra care in the classroom with regard to cognitive tasks and classroom abilities. However, it was not the need for extra care in the classroom per se, but the comparison of the intellectual level of a child with classmates that determined a possible relapse. It is important to notice in this respect that the influence of the comparison of educational level with classmates on school performance can be interpreted as being part of the theme of emotional functioning as well. The finding that cognitive functioning emerged as the second most occurring theme is inconsistent with the literature where cognitive functioning as an important theme is mostly expressed as significant problems in reading and mathematics (Jenks et al., 2007). This is contrary to the findings in the current study, where cognitive functioning is mostly expressed as the comparison of educational performance to classmates.

When analysing the interviews, the expectation of the influence of motor functioning on the process around a relapse was partly confirmed. Within the theme motor functioning, parents mentioned that motor functioning at school, particular in the classroom, influenced the

choice for a certain school type. However, this was not the most important factor. It seems that, as with cognitive functioning, it is not the need for extra care in the classroom per se, but the feeling about this extra care that mostly influenced the choice. A change in school type or level is mostly considered when the child feels different from his or her classmates, as a consequence of the extra care required. As with cognitive functioning, it is important to notice that this can be interpreted as being part of the emotional theme as well.

It is remarkable that the results pointed to emotional functioning as the most occurring theme involved in a relapse when compared to the results of the quantitative analysis. Namely, the quantitative analysis showed a limited correlation between behaviour at age 2.5 and school type and/or level at age 4.5 and no correlation with behaviour at age 4.5. This child factor refers to externalising and internalising behaviour. Since internalising behaviour shows similarities with the emotional theme mentioned in the interviews, it could be expected that the child factor behaviour would show a stronger correlation than has currently been found.

Even though the quantitative and the qualitative part of this study show some different results, both have a relevant value in the understanding of the school career of children with CP. It seems to be that the choice for a certain school type is mostly based on the motor and cognitive capacities of a child as expressed in the quantitative part of this study. However, when a relapse in school type or level during the school career is necessary, it appears that other factors such as emotional functioning become much more important.

Recommendations/limitations

The current study contributes to the existing knowledge of the school functioning of children with CP. The relapse in school type or level was investigated in a relatively small amount of children and showed relevant and important insights. However, to be able to better understand which factors influence successful and satisfactorily school attendance for children with CP, more large-scale research is needed. Since the results of the qualitative part are a very valuable addition to this study, it would be recommended to combine a quantitative and qualitative design in further research.

Several limitations were encountered in this study. First of all, this study has some methodological limitations. Although not all variables showed a normal distribution and the assumption of equality of variances for the difference school type groups were not met, probably because of a small research group, it was decided to apply a Discriminant analysis. Furthermore, it has to be noted that differences in scoring between the measurements could

have occurred, as every measurement was scored by a different pair of researchers who could have interpreted the items differently. In performing the qualitative analysis however, the inter-rater reliability was found to be sufficient. However, it is recommended to perform a Discriminant analysis with a larger amount of participants, so that there is no violation of equality of variances.

It is difficult to generalise the results of this study because the sample was not random. All participants were seen intensively by paediatricians, child neurologists or rehabilitation physicians of medical centres, rehabilitation centres and clinics in the Netherlands. It could be that the children in this research group attending the best suited school type and level from the beginning, due to good guidance and advice from professionals. As a consequence, less children might show a relapse. Therefore, it would be useful to collect a more diverse group of children in further research.

All children included in the qualitative analysis were between 5 and 9 years old. As mentioned above, children with CP often show no problems in school functioning in the first period of primary school, but problems appear at a later age. In further research, it would be interesting to measure the children again at the age of circa 12 years to compare their development and investigate whether more children show a relapse at this age.

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