



## Original Article

## Trajectories of psychiatric disorders in a cohort of children with cerebral palsy across four years

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## ABSTRACT

**Background:** Risk of psychiatric disorders has been reported for children and adolescents with cerebral palsy (CP) at different ages, however little is known regarding the long-term trajectories of these disorders.

**Objective:** The aim of this study was to assess the trajectories of psychiatric disorders in children with CP, and to explore their association to risk factors.

**Methods:** We assessed a cohort of children with CP at age seven and again at age eleven with a child psychiatric diagnostic instrument, and parents were informants. We assessed type of CP, Gross Motor Function Classification System (GMFCS) levels, and co-occurring medical conditions in a medical examination, through the medical records, and in an interview with the parents at the onset of the study.

**Results:** We found a significant increase in the prevalence of emotional disorders from seven to eleven years of age ( $p < 0.01$ ), whereas the prevalence of behavioral disorders was stable. Half of the cohort met criteria for a psychiatric disorder at both assessment points. Type of CP, spastic bilateral or unilateral, dyskinetic or ataxic, and co-occurring medical conditions were non-significant predictors of psychiatric disorders. Subthreshold psychiatric disorders at age seven were predictive of psychiatric disorders at age eleven.

**Conclusions:** We found a persistently elevated prevalence of psychiatric disorders in children with CP. Prevalence of behavioral disorders was stable, whereas we found a significant four-fold increase in emotional disorders. Sub-threshold psychiatric disorders predicted later psychiatric disorders. Increased focus on early mental health symptoms as well as more knowledge regarding emotional disorders in children with CP seems warranted.

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## Introduction

Children with Cerebral Palsy (CP) often experience a complexity of co-occurring disorders,<sup>1</sup> with impact on several areas of life, including mental health. Even if the CP diagnosis is based on motor impairment,<sup>2</sup> co-occurring conditions such as epilepsy, intellectual disability (ID), sensory impairment, pain and mental health problems are highly prevalent.<sup>1</sup> In fact a five-fold increased prevalence of psychiatric disorders in children with CP and other brain-related conditions has been known for more than 50 years,<sup>3</sup> and the last

decade has seen an increase in research on mental health in children with CP. A high prevalence of mental health problems has been described across the life-span in persons with CP,<sup>4–9</sup> and a recent meta-analysis estimated mental health problems in one in three children with CP,<sup>10</sup> underscoring the need for more studies to understand the trajectories of these disorders into adolescence. A 57% prevalence of psychiatric disorders was found in children with CP at school starting age, increasing to 79% at pre-adolescence in studies assessing mental health according to stringent diagnostic criteria.<sup>11,12</sup> Still, we lack knowledge regarding stability in the prevalence of psychiatric disorders, and in the presentation of these disorders across childhood and adolescence, suggesting longitudinal studies with repeated assessments.<sup>13</sup> Further, we do not know if early sub-threshold psychiatric disorders develop into psychiatric disorders according to diagnostic criteria, nor if they develop into

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the same type of psychiatric disorders. Knowledge regarding the role of risk factors on the trajectories of psychiatric disorders is also lacking. Although some studies have found a correlation between factors such as perinatal conditions, pain, ID, type and severity of CP, as well as communication problems,<sup>11,14</sup> other studies did not find any association to medical parameters.<sup>12,15</sup> Identifying risk factors for poor mental health therefore seem of importance to understand the trajectories of psychiatric disorders, and to address these disorders in the follow-up programs for children with CP in an attempt to prevent long-term mental health problems.

The aim of this study was to assess the trajectories of psychiatric disorders and sub-threshold psychiatric disorders in a cohort of children with CP from age seven to eleven.

## Methods

### Population

All children with CP born 2001–2003 and living in the Western Health Region of Norway were invited to take part in the assessment of mental health at age seven. Eligible for participation at age seven were 98, of whom 67 took part in the study. Of these children, 56 had GMFCS levels I-IV and were assessed using the child psychiatric diagnostic instrument Kiddie-SADS.<sup>11</sup> The same cohort of 56 was invited for assessment again at age eleven.<sup>12</sup> In this paper, only the 47 children who took part at school starting age, and again at pre-adolescence were included.

*Classification of cerebral palsy* given in the medical record was obtained. If this information was not available in the records, we classified type of CP during the medical examination at the onset of the study. The CP condition was classified according to ICD-10 criteria G80.0-G80.9 (International Classification of Diseases 10th edition), with the following subgroups: Spastic bilateral and spastic unilateral CP, dyskinetic CP, ataxic or not further classified. Functional level was classified by the Gross Motor Function Classification System (GMFCS),<sup>16</sup> distinguishing five groups. Classification for gross motor function was based on self-initiated movement, functional limitations, and the use of mobility devices in everyday life. Classification was grouped as follows: mild disability (GMFCS I and II), moderate (GMFCS III and IV), and severe disability (GMFCS V). For the present study, children with GMFCS levels V were omitted as a previous study had found the Kiddie-SADS inappropriate for the most severe cases of CP.<sup>11</sup> For the present study, mild and moderate disability were included and GMFCS levels were dichotomized for the analysis.

### Mental health assessment – Kiddie-SADS

The Kiddie-SADS is a semi structured child and adolescent psychiatric diagnostic instrument used to ascertain psychiatric disorders according to DSM IV criteria (Diagnostic and Statistical Manual of Mental Disorders IV). Parents of children with CP were interviewed using the Kiddie-SADS (PL) 2009 version for ages 6–18<sup>17</sup>, designed to assess psychiatric symptoms within the following groups of disorders: affective-, anxiety-, psychotic-, eating-, attention/hyperactivity-, oppositional defiant-, conduct-, tics-, substance abuse- and posttraumatic stress disorders, as well as encopresis and enuresis and autism spectrum disorders. Anxiety and affective disorders were grouped as emotional disorders, and conduct disorder, oppositional defiant disorder and hyperactivity/attention deficit disorders were grouped as behavioral disorders.

*Sub-threshold psychiatric disorders* were defined as meeting at least 75% of criteria for a psychiatric disorder, without meeting the full criteria for such a disorder. Likewise, subthreshold emotional disorders were defined as meeting 75% of criteria for any anxiety

disorder or affective disorder without meeting the full criteria for any of these disorders. Further, sub-threshold behavioral disorders were defined as meeting 75% of criteria for any conduct disorder, oppositional defiant disorder or hyperactivity/attention deficit disorder without meeting the full criteria for any of these disorders.

### Risk factors

*Intellectual Disability (ID)* was recorded when a clinical diagnosis under chapter F 70 in the ICD-10 diagnostic manual had been given in the medical records,<sup>18</sup> and the parents were given the opportunity to elaborate the child's functioning in daily activities.

*Communication problems* were defined as having no speech, difficulties with pronunciation, or slow speech. Information on communication difficulties was recorded through information gathered in the medical records, and through the medical examination performed at the onset of the study.

### Statistical analysis

We used Mc Nemars test to examine significance of differences in the prevalence of psychiatric disorders from seven to eleven years of age. Pearsons Chi Square Tests were used to examine risk factors such as type and severity of CP, as well as intellectual disability (ID), and communication problems in children meeting criteria for a psychiatric disorder compared to children not meeting criteria for a psychiatric disorder. Further, we selected four different trajectories of psychiatric disorders from age seven to eleven. For each of these trajectories, we used logistic regression analyses to examine the predictive value of the following parameters; gender, type and severity of CP, functional level, ID and communication problems. We used Pearsons Chi Square Tests to examine the predictive value of sub-threshold psychiatric disorders at age seven in developing psychiatric disorders at age eleven.

## Results

### Population

In the present study, a longitudinal sample consisting of 47 children with CP, GMFCS levels.

I-IV, who had been assessed at both ages seven and eleven were included.<sup>11,12</sup> Of these children, two thirds were boys, half of the children had bilateral CP, and 77% were GMFCS levels I-II. One in three had an intellectual disability (ID) (Table 1).

**Table 1**  
Demographic and medical characteristics of cohort of children with Cerebral Palsy Gross Motor Function Classification System Levels I-IV.

N = 47	N
Gender	
Male	28
CP <sup>a</sup> subtype	
Spastic bilateral	26
Spastic unilateral	16
Ataxia/Dyskinesia	5
GMFCS <sup>b</sup> level	
I+II	36
III+IV	11
Intellectual Disability	16
Communication problems	21

<sup>a</sup> Cerebral Palsy.

<sup>b</sup> Gross Motor Function Classification System

### Mental health trajectories

The prevalence of psychiatric disorders in the study cohort at ages seven and eleven is presented in Table 2. There was a significant increase in emotional disorders across the study period, however there were no significant difference in the prevalence of psychiatric disorder overall, nor in the prevalence of behavioral disorders across the assessment period (Table 2). We found a considerable overlap of subtypes of emotional disorders within the cohort, and in the whole cohort, co-occurring emotional and behavioral disorders were found in 13 children (28%) at age eleven. Depressive disorders increased from two to eleven percent during the four-year interval, and increased odds for emotional disorders were 5.1 (CI: 95% 0.5–53.0) at age eleven compared to age seven.

Four different trajectories of psychiatric disorders were described

- 1) Participants who did not meet criteria for a psychiatric disorder at any assessment point, consisting of six children (13%).
- 2) Participants who met criteria for at least one disorder at both assessment points, consisting of 25 children (53%).
- 3) Four children (9%) who met criteria for a psychiatric disorder at age seven only.
- 4) Twelve children (26%) who met criteria for a disorder at age eleven only.

Eight children had only sub-threshold psychiatric disorder at age seven. Of these, six children developed one or more psychiatric disorders by age eleven (three emotional disorders and five behavioral disorders).

### Risk factors for psychiatric disorder

In a logistic regression, each of the specific trajectories were assessed separately against exposure to the following dichotomized outcome variables; gender, type and severity of CP, ID and communication problems with the rest of the cohort as reference. None of these variables were statistically significant for any of the four trajectories.

### Sub-threshold psychiatric disorders

Using logistic regression, we found a significant association between the prevalence of any type of psychiatric disorder at age eleven with the rest of the cohort as reference group, and the following parameters; behavioral disorders at age seven, any type of sub-threshold psychiatric disorders at age seven, and sub-threshold emotional disorders at age seven (Table 3.).

3.4.2 There were increased odds for emotional disorder at age eleven in children who had any sub-threshold disorder or sub-threshold behavioral disorder at age seven (Table 3.)

### Discussion

In the present cohort of children with Cerebral Palsy (CP), we found a significant increase in the prevalence of emotional disorders from age seven to eleven. Behavioral disorders however, were stable across the study period. More than half of the cohort met criteria for a psychiatric disorder both at age seven and eleven. Neither gender, type of CP, functional level, ID, nor communication problems were predictive of psychiatric disorders at both assessment points compared to the whole cohort, however sub-threshold psychiatric disorders at age seven were significant predictors of psychiatric disorders at age eleven.

### Emotional disorders

In otherwise healthy peers, an increase in the prevalence of emotional disorders has been found as children approach adolescence,<sup>19</sup> with a 15% cumulative prevalence of emotional disorders by age 16, and an increase in the trajectory of serious emotional disorders after age twelve.<sup>19</sup> In our study however, the increase in the prevalence of emotional disorders from 19 to 40% started even earlier than in otherwise healthy peers, and with a higher prevalence than in controls. Further, changes in the presentation of emotional disorders in the course of time have been reported in previous studies,<sup>19,20</sup> and both heterotypic and homotypic continuity for emotional disorders have been described. Despite having found a considerable overlap of subtypes of emotional disorders within the cohort, and depressive disorders increasing from two to eleven percent during the four-year interval, we still lack knowledge regarding the exact reasons for a significant increase in emotional disorders. An accumulation of negative life events and experiences of shortcomings could be related to the increase, as many of these children often experience pain, hospitalizations and surgery, which could add to an elevated level of anxiety and depressive disorders.<sup>21</sup> In adults with CP, a recent study reported a high prevalence of depression, pain and fatigue on one hand, and emotional support enhancing satisfaction with life on the other.<sup>6</sup> Perhaps therefore, pain and negative life events should be included in future studies to gain an understanding of their impact on the trajectories of psychiatric disorders. Further, some of these children may undergo a grief process as they come to realize the permanence of the CP condition, and depressive symptoms could also be related to repeated losses and changes due to a frequent turnover of assistants or helpers both at home and at school. We

**Table 2**  
Psychiatric disorders in a cohort of children with Cerebral Palsy at age 7 and 11.

N = 47	Psychiatric disorders at age 7		Psychiatric disorders at age 11	
	N		N	Mc Nemar p-value
Any psychiatric disorders	29		37	0.077
Behavioral disorders	27		31	0.424
ADHD/ADD <sup>a</sup>	26		27	
ODD <sup>b</sup>	5		9	
Emotional disorders	4		19	0.001
Affective	1			5
Anxiety	4		16	
Tic disorders	0		2	
<sup>c</sup> Autism spectrum disorders	–		–	6

<sup>a</sup> Attention Deficit Hyperactivity Disorder/Attention Deficit Disorder.

<sup>b</sup> Oppositional Defiant Disorder.

<sup>c</sup> Assessment of autism was not available at age seven.

**Table 3**  
Predictors for psychiatric disorders at age 11 assessed against psychiatric disorders and sub-threshold psychiatric disorders at age seven in a cohort of children with Cerebral Palsy.

N = 47	Any psychiatric disorder age 11			Emotional disorder age 11			Behavioral disorder age 11		
	N	p	OR (95%CI)	N	p	OR (95%CI)	N	p	OR (95%CI)
Age 7									
Any psychiatric disorder <sup>b</sup>	25	p = 0.12	3.2 (0.7–13.2)	13	p = 0.40	1.6 (0.5–5.5)	22	p = 0.07	3.1 (0.9–11.0)
Behavioral disorders	24	p = 0.05 <sup>a</sup>	4.3 (1.0–19.5)	12	p = 0.50	1.5 (0.5–4.9)	22	p = 0.09	5.4 (1.4–20.0)
Any sub-threshold psychiatric disorder <sup>b</sup>									
Sub-threshold emotional disorders	25	p = 0.03 <sup>a</sup>	4.9 (1.1–22.2)	15	p = 0.03 <sup>a</sup>	4.3 (1.1–16.4)	21	p = 0.11	2.7 (0.8–9.3)
Sub-threshold behavioral disorders	20	p = 0.01 <sup>a</sup>	10.6 (1.2–92.3)	11	p = 0.13	2.5 (0.8–8.2)	16	p = 0.18	2.3 (0.7–8.4)
Sub-threshold behavioral disorders	16	p = 0.45	1.2 (0.4–8.0)	11	p = 0.04 <sup>a</sup>	3.4 (1.0–11.7)	14	p = 0.36	1.8 (0.5–6.5)

<sup>a</sup> Significance level at or below 0.05.

<sup>b</sup> Assessed against the whole cohort.

also know that mental health problems significantly impact participation for children with CP,<sup>22,23</sup> and that leisure participation is positively correlated to better psycho-social wellbeing,<sup>24</sup> suggesting interventions to improve both mental health and participation as these factors interact. Further, modifiable social factors have been described in relation to the high prevalence of mental health disorders in children with CP.<sup>8</sup> In this regard, both anxiety disorders as well as behavioral disorders have been associated with difficulties in relation to friends. Adaptations to ensure that children with CP experience congruence between their individual development and demands and expectations regarding social relations has been suggested.<sup>25</sup> Perhaps it would be helpful to focus on identifying the problems that some of these children experience in establishing lasting age-congruent friendships, in an attempt to develop interventions to improve long-term mental health. From a previous study, we know that peer problems are highly prevalent in the study cohort,<sup>26</sup> affecting nine in ten children at school starting age. This is in line with the conclusions in a study including children with CP hemiplegia, where these children had fewer friends, were more rejected, and more often victimized than their healthy peers.<sup>27</sup> The authors suggest explanations ranging from peer prejudices, to neurologically determined deficits in metalizing skills. The latter explanation has support in studies finding a higher prevalence of autism spectrum symptoms and even autism disorders in children with CP than in controls.<sup>28,29</sup>

### Behavioral disorders

Despite a significant increase in emotional disorders, the prevalence of behavioral disorders was stable across the study interval, and in this study, attention deficit disorders with and without hyperactivity (AD/HD) were the most common. Perhaps behavioral problems tend to become apparent earlier than emotional problems, and that these problems therefore were recognized already at the first assessment at age seven. An impact on executive functioning, affecting attention, planning and other higher order cognitive functions is common in children with CP,<sup>30–32</sup> supporting the notion that the early brain lesion causing the motor impairment of CP also could give rise to impairments in executive functioning. We also found an association between behavioral disorders at age seven and emotional disorders at age eleven, indicating that early behavioral disorders could pose a potential risk for later development of emotional problems. Behavioral disorders may be a barrier to developing lasting friendships, and could be related to problems in social functioning. Perhaps early interventions to modify the negative impact of behavioral problems could reduce the risk of developing emotional disorders at a later stage.

### Trajectories of psychiatric disorders

More than half of the cohort met criteria for one or more psychiatric disorders at both assessment points, indicating persistently high levels of psychiatric disorders across childhood. This is in line with a longitudinal study of psychiatric disorders in low birth weight (LBW) adolescents,<sup>33</sup> in which psychiatric disorders described at adolescence lasted into young adulthood. Exposure to unfavorable perinatal events with early lesions in the developing brain is common both in children with LBW and in children with CP, increasing the likelihood of similar trajectories of psychiatric disorders. In children with LBW, a strong association was found to ADHD and reduced psychosocial functioning.<sup>34,35</sup> Further, autism spectrum disorders were associated with low Apgar scores at 1 min, and internalizing problems were associated to low Apgar scores at 5 min. This may suggest that multiple risk factors interact in a complex chain to develop psychiatric symptoms in children with LBW as well as in children with CP.<sup>34</sup> A previous study suggests more focus on the accumulation of several early risk factors, in an attempt to counteract the potential impact on the development of psychiatric disorders in these vulnerable children.<sup>36</sup>

### Risk factors

Despite having found a continuously elevated level of behavioral disorders, and a significantly higher prevalence of emotional disorders in the study population, we still lack knowledge regarding the nature of predisposing factors. In our study, none of the co-occurring medical conditions and functional parameters such as type or severity of CP, could predict the trajectories of psychiatric disorders in children with CP from age seven to eleven. However, numbers were small, and we should be cautious in our conclusions in this regard. Intellectual disability (ID) is a known predisposing factor for mental health problems.<sup>37</sup> There is however still a lack of comprehensive service structures designed for persons with ID and mental health problems, including awareness raising, the development of adapted assessment tools as well as training of professionals.<sup>38</sup> To mitigate these challenges, NICE guidelines have been developed,<sup>39</sup> offering guidance to preventing, assessing and managing mental health problems in persons with ID. The validity of a diagnostic instrument such as Kiddie-SADS used in children with ID could be discussed, however one could argue that it allows for comparison to otherwise healthy peers.<sup>40</sup>

Odds for psychiatric disorders at age eleven were 4.9 when presenting with sub-threshold psychiatric disorders at age seven, perhaps supporting the notion that early sub-threshold symptoms of psychiatric disorders may be predictive of later development of

psychiatric disorders. Likewise, for emotional disorders at age eleven, we found a significant association to any type of sub-threshold disorders at age seven as well as to sub-threshold behavioral disorders at age seven. This may indicate that emotional disorders could present with behavioral symptoms at an early age, before emotional disorders become more apparent. Early screening for emotional disorders has been suggested in a previous paper,<sup>6</sup> and results from the present study seem to suggest that attention should also be directed towards children with early behavioral symptoms, as these children may run a risk for developing both behavioral and emotional disorders later. Perhaps therefore, follow-up services for children with CP should be alerted to early symptoms of psychiatric disorders, and to develop preventive mental health strategies to take on the challenge of meeting the complex needs of children with CP.<sup>41,42</sup>

### Conclusions and clinical implications

A fourfold increase in emotional disorders during the study period gives reason to suggest more attention towards anxiety and depressive disorders during follow-up in children with CP. Further, addressing sub-threshold psychiatric disorders early seems indicated, as children with CP are vulnerable for long-lasting psychiatric disorders. Increasing mental health competence at all levels in the follow-up health care system for children with CP therefore seems warranted.

### Strengths and limitations

The study population was limited in numbers, and did not include children with GMFCS level V. Generalizing the results should therefore be done with caution. Despite the shortfalls of the study, we have gained insight into the trajectories of psychiatric disorders in children with CP, and the significant role of sub-threshold psychiatric disorders at an early age in these children. There is however a need to elaborate these findings, and to continue the assessment of mental health in children with CP as they approach adulthood.

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### Ethics

Written approval was given by parents of the participants, and the study was approved by the Regional Ethical Committee in the Western Health Region of Norway.

### Declaration of competing interest

The authors have no conflict of interest to declare.

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