

Mental health disorders and physical risk factors in children with cerebral palsy: a cross-sectional study

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ABBREVIATION

NSCH National Survey of Children's Health

AIM To examine the prevalence of mental health disorders among children with and without cerebral palsy (CP), and to examine how physical risk factors in children with CP might mitigate any elevated risk of mental health disorders in this population.

METHOD Children from 6 years to 17 years of age with ($n=111$) and without ($n=29\ 909$) CP from the 2016 National Survey of Children's Health were included in this cross-sectional study. Mental health disorders included depression, anxiety, behavior/conduct problems, and attention deficit disorder/attention-deficit/hyperactivity disorder (ADHD). Physical risk factors included physical activity (number of active days ≥ 60 min), sleep duration, and pain.

RESULTS Adjusting for sociodemographics, children with CP had higher odds of mental health disorders (odds ratio [OR]=2.7–7.1, $p<0.05$) except for attention deficit disorder/ADHD (OR=2.5; 95% confidence interval [CI]=0.9–7.1). Further adjusting for physical factors, the odds of depression were no longer increased (i.e. attenuated) in children with CP (OR=1.0; 95% CI=0.3–3.3); however, the odds of anxiety (OR=3.8; 95% CI=1.9–7.8) and behavior/conduct problems (OR=3.8; 95% CI=1.3–11.1) remained elevated. Assessed individually, low physical activity and pain attenuated the odds of depression in children with CP (OR=1.9; 95% CI=0.7–5.3; OR=1.4; 95% CI=0.6–3.8 respectively).

INTERPRETATION Children with CP have an elevated prevalence of mental health disorders even after accounting for physical risk factors. Low physical activity and pain partially accounts for the association between CP and depression.

Mental health disorders account for a substantial portion of the overall global burden of disease.¹ Importantly, a considerable proportion of the overall global burden of disease is associated with disability.² Therefore, better understanding of the development of mental health disorders is of significant public health interest, especially as it pertains to the intersection between mental health and disability.

Cerebral palsy (CP) is the most common physical disability of childhood³ and represents a heterogeneous group of movement disorders with a range of motor impairments. Individuals with CP are at a heightened risk for mental health disorders because of a variety of social and physical risk factors. In the general population, physical risk factors, such as low levels of physical activity,⁴ sleep disorders,⁵ and pain,⁶ increase the risk of developing mental health disorders. These physical risk factors for mental health disorders are often comorbid and are commonly reported symptoms in those with CP. Specifically, individuals with CP have low levels of physical activity regardless of the level of motor impairment.⁷ Children with CP also have more issues with sleep disturbances than typically developing children, which is associated with behavioral issues and quality of life.^{8,9} Individuals with CP consistently report higher pain prevalence, ranging from 33% to 75%,

compared to the general population.^{10–13} Further, pain is associated with mental health disorders in children,¹¹ but not adults,¹⁰ with CP.

Better understanding of the interrelationships between physical risk factors and mental health in individuals with CP is especially important during development, because the proportion of the global disease burden of mental health disorders is highest among children, adolescents, and young adults.¹ Knowledge of mental health disorder profiles and risk factors in children and adolescents with CP would benefit the development of early rehabilitation and treatment strategies to reduce the burden of adverse mental health through the lifespan. Thus, the primary objective of this study was to examine the prevalence of mental health disorders in children with and without CP. We hypothesized that children with CP would have a higher prevalence of mental health disorders compared to children without CP. The secondary objective was to examine how physical activity, sleep duration, and pain in children with CP associate with the elevated prevalence of mental health disorders in this population. We hypothesized that physical activity, sleep duration, and pain would individually account for some of the elevated mental health disorder prevalence in children with CP.

METHOD

The National Survey of Children's Health (NSCH) was developed to produce state-level and national-level data on physical and mental health of American children under 18 years of age, their families, and their communities. The survey utilized a two-phase, self-administered data collection design using Internet and mailed paper data collection instruments between June 2016 and February 2017. There were more than 360 000 sampled household addresses that were allocated within states based on relative sizes of households having children under 18 years with an oversampling ratio of 5:1 compared to households without children. One child per household was selected for the survey. In households with two or more children, children with special healthcare needs had a higher probability of being selected (oversampled) to allow for more robust data estimates. The respondent was a parent or guardian with knowledge of the health status of the surveyed child. The overall weighted response rate was 40.7% and the completion rate for households that initiated the survey was 69.7%. The United States Census Bureau conducted a nonresponse bias analysis for the 2016 NSCH.¹⁴ Although response was higher in geographical locations where income was higher, they concluded that there is no strong or consistent evidence of nonresponse bias. (Further information about the NSCH methodology is available online <http://www.childhealthdata.org/>).

Participants

Individuals were first considered for this cross-sectional study if a CP diagnosis was available. Respondents were asked, 'Has a doctor or other healthcare provider EVER told you that this child has cerebral palsy?' If respondents answered 'yes', they were then asked, 'If yes, does this child CURRENTLY have the condition?' Respondents reported 'yes' or 'no'. Of the 159 individuals who EVER had a diagnosis of CP in the 2016 NSCH, 24 did not have a CURRENT diagnosis at the time of the survey. These 24 individuals were excluded from the study because CP is a lifelong condition, so the placement of these individuals in the second response may have been because of an original misdiagnosis. Because the NSCH oversampled children with special healthcare needs and CP is less likely to be diagnosed under the age of 2 years, we calculated the weighted CP prevalence in children aged 2 years to 17 years. The weighted (unweighted) sample included 179 192 (133) children with CP and 65 190 274 (45 749) children who did not have CP. This resulted in a CP prevalence of 2.8 per 1000, which is consistent with a previous study that found CP prevalence estimates of 2.6 and 2.9 in two nationally representative surveys in the USA from 2011 to 2013.¹⁵

Criteria to classify CP characteristics, such as gross motor function and type and distribution of CP, were not available in the 2016 NSCH. However, the respondent's report of the child's severity of CP was available for all participants and included two responses: 'mild' or 'moderate or severe'.

What this paper adds

- Children with cerebral palsy (CP) have an elevated risk of developing mental health disorders.
- Physical factors do not fully account for higher mental health disorder prevalence.
- Physical activity partially accounts for the relationship between CP and depression.
- Pain partially accounts for the relationship between CP and depression.

Controls were children who never had CP or any of the following conditions available in the 2016 NSCH: seizure, epilepsy, blood disorders, genetic disorders, cystic fibrosis, Down syndrome, developmental delay, intellectual disability, autism, or severe difficulty walking. Several important variables were not administered to children younger than 6 years. Therefore, the final sample was restricted to 111 children with CP and 29 909 controls aged 6 years to 17 years. Since the data used in this investigation are publicly available and deidentified, approval from an Institutional Review Board was not necessary.

Outcomes measures

Children were considered to have a mental health disorder if the respondent reported a positive diagnosis of depression, anxiety, behavioral/conduct problems, or attention deficit disorder or attention-deficit/hyperactivity disorder (ADHD) to the following survey prompt, 'Has a doctor or other healthcare provider EVER told you that this child has [specified condition]'. Multimorbidity was defined as having two or more diagnosed mental health disorders.

Predictor variables

Physical activity was determined by the number of days that the child exercised, played a sport, or participated in physical activity for at least 60 minutes. The NSCH stratified physical activity participation categories as 0 days, 1 days to 3 days, 4 days to 6 days, and 7 days. Because of a low number of children with CP in the 7 days category (10.7%), we combined the latter two groups into one category of 4 days to 7 days.

A dichotomous variable for sleep duration was determined if the child slept age-appropriate hours or not. The American Academy of Sleep Medicine developed a guideline, which was utilized in the 2016 NSCH, that recommends children aged 6 years to 12 years should sleep 9 to 12 hours per 24 hours, and children aged 13 years to 18 years should sleep 8 hours to 10 hours per 24 hours.¹⁶

A dichotomous variable for pain (presence or absence) was determined if the child had 'FREQUENT or CHRONIC difficulty' with 'repeated or chronic physical pain, including headaches or other back or body pain.'

Covariates

Sociodemographic information was available for age, sex, ethnicity, and household poverty status. We used the predefined NSCH age grouping categories of 6 years to 11 years and 12 years to 17 years. Household poverty

status as a ratio of the federal poverty line was stratified into four groups in the 2016 NSCH (0%–199%, 200%–299%, 300%–399%, and ≥400%).

Statistical analysis

The 2016 NSCH uses a multistage and complex survey design to enhance the representativeness of the sample to the USA population. We therefore accounted for sampling strata and the primary sampling unit to obtain correct variance estimation, and weighted estimates to account for oversampling, survey nonresponse, and distribution of target population. All statistical analyses were performed using SAS 9.3 (SAS Institute, Cary, NC, USA) with 2-sided confidence intervals (CI) to determine significance. Unweighted sample sizes and weighted estimates of descriptive characteristics and outcome measures are presented. Descriptive characteristics and prevalence estimates are presented as percentages (95% CI). Group differences were tested for all categorical variables using χ^2 tests. Logistic regression analyses were performed with the presence/absence of mental health disorders as the response variable and group (CP or not) as the primary exposure variable. In alignment with the study aims and to examine main effects, covariates and predictors were added to the logistic regression models in the following order:

- Model 1 – CP indicator variable, covariate unadjusted.
- Model 2 – CP indicator variable, sociodemographics: age, sex, ethnic group, and household poverty status.
- Full model – CP indicator variable, sociodemographics + physical activity + sleep duration + pain.
- Physical activity model – CP indicator variable, sociodemographics+physical activity (ref: 4–7d).
- Sleep model – CP indicator variable, sociodemographics+sleep duration (ref: less than age-appropriate hours).
- Pain model – CP indicator variable, sociodemographics +pain (ref: no pain).

Interpretations will be made based on the structure of the logistic regression models; that is, the predictors being physical risk factors and the response variable being individual mental health disorders. Individuals that had missing data for any variables in the logistic regression models were included in analyses, which represented less than 4% for CP and controls.

RESULTS

Descriptive characteristics of study participants are presented in Table I. In children with CP, 56.6% had moderate or severe disabilities. There were no group differences in age, sex, household poverty status, or sleep duration. There were group differences in ethnic group distribution, and children with CP had a higher prevalence of 0 days of physical activity and a lower prevalence of 4 days to 7 days of physical activity compared to controls. Children with CP also had a higher prevalence of pain compared to controls.

Table I: Descriptive characteristics of children with cerebral palsy (CP) and controls

	CP (n=111) % (95% CI)	Controls (n=29 909) % (95% CI)	p
CP severity			
Mild	43.4 (25.3, 61.6)		
Moderate or severe	56.6 (38.4, 74.8)		
Age			
6–11y	40.4 (21.9, 58.9)	50.2 (48.9, 51.6)	0.31
12–17y	59.6 (41.1, 78.1)	49.8 (48.4, 51.1)	
Male	62.8 (46.4, 79.2)	49.3 (48.0, 50.6)	0.11
Ethnic group			
White	60.7 (41.7, 79.7)	51.5 (50.1, 52.8)	<0.01
Black	27.1 (8.1, 46.0)	12.5 (11.6, 13.5)	
Hispanic	10.8 (0.0, 22.0)	25.7 (24.2, 27.2)	
Other	1.4 (0.2, 2.7)	10.3 (9.6, 11.0)	
BMI category			
Underweight	10.9 (1.3, 20.5)	6.1 (5.4, 6.8)	0.55
Normal weight	66.3 (47.4, 85.2)	63.7 (62.1, 65.2)	
Overweight	11.1 (0.0, 22.3)	15.1 (13.9, 16.2)	
Obese	11.8 (2.3, 21.3)	15.2 (13.8, 16.5)	
Household poverty status			
0%–199%	50.6 (32.3, 68.9)	43.7 (42.3, 45.1)	0.67
200%–299%	9.7 (2.8, 16.5)	15.0 (14.1, 15.9)	
300%–399%	13.2 (3.5, 22.9)	11.0 (10.4, 11.6)	
≥400%	26.6 (9.6, 43.5)	30.3 (29.3, 31.3)	
Physical activity ≥60min			
0d	37.6 (17.7, 57.5)	7.8 (7.0, 8.5)	<0.01
1–3d	27.7 (12.4, 43.1)	38.3 (37.0, 39.6)	
4–7d	34.7 (17.9, 51.4)	53.9 (52.6, 55.3)	
Sleeps age-appropriate hours	56.4 (37.6, 75.2)	65.9 (64.6, 67.2)	0.29
Pain	39.0 (20.6, 57.3)	7.6 (6.9, 8.3)	<0.01

Weighted data and analyses are presented. CI, confidence interval; BMI, body mass index.

Mental health disorder profiles in children with CP

The prevalence and odds of mental health disorders and their severity are presented in Table II. Children with CP had higher prevalence and unadjusted odds of all mental health disorders examined in the present study and multimorbidity compared to controls. After adjusting for sociodemographic variables (Model 2), the odds of all mental health disorders and multimorbidity remained significantly increased in children with CP, except for attention deficit disorder/ADHD.

Mental health disorder profiles and physical risk factors in children with CP

When physical activity, sleep duration, and pain were added to Model 2 (Full model; Table III), the odds of depression and multimorbidity were no longer significantly increased for children with CP. The odds of anxiety and behavior/conduct problems remained significantly increased in children with CP; however, the odds of anxiety and behavior/conduct problems for CP were reduced, suggesting that these physical risk factors account for some of the association between CP and these mental health disorders.

We then examined the extent to which each of these physical risk factors individually modified the association between CP and mental health disorders after adjusting for

Table II: Mental health disorders in children with cerebral palsy (CP) and controls

	CP (n=111)	Controls (n=29 909)	Unadjusted OR (95% CI)	Model 2 ^a OR (95% CI)
Depression	7.8 (0.8, 14.8)	2.7 (2.4, 3.1)	3.0 (1.2, 7.9)	2.7 (1.1, 6.7)
Anxiety	30.2 (12.2, 48.3)	6.2 (5.5, 6.8)	6.6 (2.8, 15.4)	7.1 (3.3, 15.4)
Behavior/conduct problems	27.3 (8.9, 45.7)	4.9 (4.4, 5.4)	7.3 (3.0, 17.9)	6.3 (2.2, 17.9)
ADD/ADHD	19.5 (1.9, 37.1)	7.1 (6.6, 7.6)	3.2 (1.1, 9.5)	2.5 (0.9, 7.1)
Multimorbidity ≥2 mental health disorders	22.3 (4.4, 40.9)	5.2 (4.7, 5.7)	5.3 (1.9, 15.0)	4.7 (1.8, 12.7)

Significant odds ratios are in bold type. Weighted data and analyses are presented. ^aAdjusted for age, sex, ethnic group, and household poverty status. ADD, attention deficit disorder; ADHD, attention-deficit/hyperactivity disorder; CI, confidence interval; OR, odds ratio.

Table III: Multivariable logistic regression model for mental health disorders in children with cerebral palsy (CP) and controls

	Full model ^a OR (95% CI)
Depression	
CP	1.0 (0.3, 3.3)
Physical activity (ref: 4–7d)	
0d	3.5 (2.4, 5.2)
1–3d	1.8 (1.3, 2.3)
Sleeps <age-appropriate hours	1.0 (1.1, 1.8)
Pain	4.2 (3.1, 5.9)
Anxiety	
CP	3.8 (1.9, 7.8)
Physical activity (ref: 4–7d)	
0d	2.7 (2.0, 3.7)
1–3d	1.6 (1.2, 2.0)
Sleeps <age-appropriate hours	1.3 (1.0, 1.6)
Pain	3.3 (2.6, 4.3)
Behavior/conduct problems	
CP	3.8 (1.3, 11.1)
Physical activity (ref: 4–7d)	
0d	1.5 (1.1, 2.1)
1–3d	1.1 (0.9, 1.4)
Sleeps <age-appropriate hours	1.2 (0.9, 1.5)
Pain	3.0 (2.3, 4.1)
ADD/ADHD	
CP	1.5 (0.6, 4.1)
Physical activity (ref: 4–7d)	
0d	1.6 (1.2, 2.2)
1–3d	1.1 (0.9, 1.3)
Sleeps <age-appropriate hours	1.3 (1.1, 1.6)
Pain	2.1 (1.6, 2.7)
Multimorbidity	
CP	2.2 (0.9, 5.4)
Physical activity (ref: 4–7d)	
0d	2.5 (1.8, 3.5)
1–3d	1.2 (0.9, 1.5)
Sleeps <age-appropriate hours	1.3 (1.0, 1.6)
Pain	3.7 (2.8, 4.9)

Significant odds ratios are in bold type. Weighted data and analyses are presented. ^aAlso adjusted for age, sex, ethnic group, household poverty status. OR, odds ratio; CI, confidence interval; ADD, attention deficit disorder; ADHD, attention-deficit/hyperactivity disorder.

Model 2 (Table IV). When physical activity was added to Model 2, the odds of depression were no longer significantly increased in children with CP. The odds of anxiety, behavior/conduct problems, and multimorbidity remained significantly increased in children with CP; however, the

odds of anxiety and multimorbidity were reduced, suggesting that physical activity accounts for some of the association between CP and these mental health disorders. When sleep duration was added to Model 2, the odds of depression, anxiety, behavior/conduct problems, and multimorbidity remained significantly increased in children with CP. When pain was added to Model 2, the odds of depression were no longer significantly increased in children with CP, suggesting that pain accounts for the association between CP and depression. The odds of anxiety, behavior/conduct problems, and multimorbidity remained significantly increased in children with CP; however, these odds were reduced, suggesting that pain accounts for some of the association between CP and these mental health disorders.

DISCUSSION

The principal finding of this investigation is that in a nationally representative sample, children with CP had higher odds of mental health disorder profiles compared to children without CP. This was evident even after adjusting for physical activity, sleep duration, and pain. Moreover, physical activity and pain accounted, at least in part, for the association between CP and depression and accounted for a portion of the association between CP and other mental health disorders.

Mental health disorder profiles in children with CP

Children with CP are susceptible to mental health disorders because of a variety of physical risk factors and factors that affects social development, including communication problems, developmental comorbidities, and mobility restriction. We found a higher prevalence of all mental health disorders and multimorbidity in children with CP compared to children without CP. Although the odds of attention deficit disorder/ADHD were no longer significantly increased (i.e. attenuated) after accounting for socio-demographic variables, the elevated odds of other mental health disorders and multimorbidity in children with CP persisted. Mental health disorders lead to an increased overall disease burden.¹ Therefore, identifying associative risk factors is clinically necessary in this population to identify strategies to effectively reduce this burden.

Table IV: Multivariable logistic regression models for mental health disorders and physical risk factors in children with cerebral palsy (CP) and controls

	Physical activity and sociodemographics ^a OR (95% CI)	Sleep duration and sociodemographics ^a OR (95% CI)	Pain and sociodemographics ^a OR (95% CI)
Depression			
CP	1.9 (0.7, 5.3)	2.7 (1.1, 7.0)	1.4 (0.6, 3.8)
Physical activity (ref: 4–7d)			
0d	3.8 (2.6, 5.6)		
1–3d	1.8 (1.4, 2.4)		
Sleeps <age-appropriate hours		1.6 (1.2, 2.1)	
Pain			4.6 (3.4, 6.3)
Anxiety			
CP	6.1 (3.0, 12.7)	7.1 (3.2, 15.6)	4.4 (2.1, 9.0)
Physical activity (ref: 4–7d)			
0d	2.8 (2.1, 3.8)		
1–3d	1.6 (1.2, 2.0)		
Sleeps <age-appropriate hours		1.4 (1.1, 1.7)	
Pain			3.4 (2.7, 4.5)
Behavior/conduct problems			
CP	6.1 (2.1, 17.5)	6.1 (2.1, 18.1)	3.9 (1.4, 11.3)
Physical activity (ref: 4–7d)			
0d	1.6 (1.1, 2.2)		
1–3d	1.1 (0.9, 1.4)		
Sleeps <age-appropriate hours		1.2 (0.9, 1.5)	
Pain			3.1 (2.3, 4.1)
ADD/ADHD			
CP	2.3 (0.9, 6.1)	2.5 (0.9, 7.2)	1.7 (0.6, 4.6)
Physical activity (ref: 4–7d)			
0d	1.7 (1.3, 2.3)		
1–3d	1.1 (0.9, 1.3)		
Sleeps <age-appropriate hours		1.4 (1.2, 1.7)	
Pain			2.2 (1.7, 2.8)
Multimorbidity			
CP	3.9 (1.5, 9.7)	4.7 (1.9, 11.8)	3.0 (1.3, 6.8)
Physical activity (ref: 4–7d)			
0d	2.6 (1.9, 3.7)		
1–3d	1.2 (1.0, 1.6)		
Sleeps <age-appropriate hours		1.3 (1.1, 1.6)	
Pain			3.5 (2.7, 4.6)

Significant odds ratios are in bold type. Weighted data and analyses are presented. ^aAdjusted for age, sex, ethnic group, and household poverty status. ADD, attention deficit disorder; ADHD, attention-deficit/hyperactivity disorder; CI, confidence interval; OR, odds ratio.

Mental health disorder profiles and physical risk factors in children with CP

Low physical activity,⁴ sleep disorders,⁵ and pain⁶ increase the risk of developing mental health disorders in the general population, and are often comorbid. Importantly, these physical risk factors are hallmark symptoms in those with CP and could potentially be modified through rehabilitation and treatment strategies.

Our findings of lower levels of physical activity and a higher prevalence of pain in children with CP compared to controls is consistent with previous studies. Neuromuscular dysfunction, weak muscles,¹⁷ and elevated ambulatory oxygen consumption¹⁸ may help to partially explain why children with CP have low levels of physical activity across the gross motor function spectrum.⁷ In the current study, 39% of children with CP reported pain, which is consistent with the range of 33% to 75% previously reported in individuals with CP.^{10–13} Pain has been shown to interfere with physical activity¹³ and sleep¹⁹ in this pediatric population. After adjusting for the sociodemographic model for the physical risk factors, the increased odds of depression and

multimorbidity were attenuated and no longer statistically different between children with CP and controls (Table III). Although the odds of anxiety and behavior/conduct problems remained elevated in children with CP, the odds were substantially reduced. This suggests that the combination of these three modifiable risk factors accounts for the CP-depression association, but only partially accounts for the CP-anxiety and CP-behavior/conduct problems associations.

When we assessed the entire cohort using the Full model, low physical activity, sleep duration, and pain were independently associated with all mental health disorders, except for the association between sleep duration and behavior/conduct problems (Table III). We therefore examined separately the extent to which each physical risk factor, in combination with sociodemographic variables, modified the association between CP and mental health disorders (Table IV).

Physical activity attenuated the CP-depression association, accounted for a portion of the CP-anxiety and CP-multimorbidity associations, and did not contribute to the

CP-behavior/conduct problems association. A systematic review of 30 prospective studies concluded that physical activity is preventative of depression onset,²⁰ with this causal relationship being shown to be bidirectional.⁴ Furthermore, reduction of physical activity elevates the risk of depression.²⁰ This is particularly important in children with CP, because they have low levels of physical activity and elevated mental health disorders, and are likely to experience exaggerated mobility decrements as they age into their adult years.²¹ Evidence suggests that increasing or maintaining physical activity is associated with a reduced risk of subsequent depression.²² Therefore, a continued focus on improving physical activity in those with CP could mitigate the risk of mental health burdens, especially as children with CP transition to adulthood.

Sleep duration did not account for the association between CP and mental health disorders with adjustment for sociodemographic variables. This was contrary to our hypothesis; however, we were only able to assess sleep quantity. Sleep problems in children with CP are often qualitative disturbances in initiating/maintaining sleep, sleep-wake transition, and sleep disordered breathing. A treatment focus on improving sleep quality is supported by previous studies that have shown that sleep disturbance is associated with behavioral issues and quality of life in children with CP.^{8,9}

Pain attenuated the CP-depression association and accounted for a portion of the CP-anxiety, CP-behavior/conduct problems, and CP-multimorbidity associations. Pain is related with a lower quality of life,¹³ behavior/emotional problems,^{11,19} and other mental health disorders, such as anxiety and depression,¹¹ in children with CP. Unfortunately, there are many challenges in pain assessment in this population. For example, pain is not necessarily correlated to the type, distribution, or severity of CP,^{10,19,23} and the efficacy of pain assessment is confounded by communication barriers and intellectual capacity in this population.²³ Notwithstanding, pain management as a clinical priority has been suggested,²³ and may have a substantial impact on the physical and mental health profiles in children with CP. However, this is only speculation. Prospective cohort studies examining pain and health outcomes are warranted.

Study limitations

There are several limitations of this study that have implications for interpretation. First, because of the cross-sectional design, we were unable to explore causality or directionality in association between exposures and outcomes. Second, we were unable to determine the association of mental health disorders and other comorbidities, such as intellectual disability, language disorders, and

epilepsy, which are prevalent in the CP population and are associated with risk factors for mental health disorders.²⁴ Future research in this area is certainly warranted. Third, the NSCH utilizes parent/guardian proxy reports. Studies have shown discrepancies between child-report and parent-reports of a child's quality of life.²⁵ Fourth, the definition of behavior/conduct problems is somewhat vague. There can be conflation of the emotional aspect of behavior/conduct problems and clinical diagnoses. However, presence of a condition reportedly was determined by a doctor or healthcare provider who then informed the respondent of a condition. Fifth, because the purpose of this investigation was to examine the association of physical risk factors and mental health disorders, we did not explore the association of social risk factors. Children with CP have low social participation and relationships,²⁶ and are at increased risk for being bullied,²⁷ all of which may contribute to poor mental health. Moreover, poor parental mental health is associated with adverse child mental health²⁸ and is a prevalent complication in parents of children with disabilities.²⁹ Future studies are needed to determine the interplay between social and physical risk factors, and their implication on the development of mental health disorders in children with CP.

In conclusion, children with CP have a concerning prevalence of mental health disorders, which is only partially accounted for by their low levels of physical activity, shorter sleep duration, and pain. Low physical activity and pain attenuated the odds of depression and partially accounted for the increased odds of other mental health disorders, including anxiety and multimorbidity, in children with CP. Prospective studies are needed to assess the efficacy of interventions on improving physical activity and managing or treating pain on mental health in those with CP.

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RESUMEN**TRASTORNOS DE SALUD MENTAL Y FACTORES DE RIESGO FÍSICO EN NIÑOS CON PARÁLISIS CEREBRAL: ESTUDIO TRANSVERSAL**

OBJETIVO Examinar la prevalencia de trastornos de salud mental en niños con y sin parálisis cerebral (PC), y examinar cómo los factores de riesgo físicos en niños con PC pueden mitigar cualquier riesgo elevado de trastornos de salud mental en esta población.

MÉTODO Los niños de 6 a 17 años de edad con ($n=111$) y sin ($n=29.909$) PC de la Encuesta nacional de salud infantil 2016 se incluyeron en este estudio transversal. Los trastornos de salud mental incluían depresión, ansiedad, problemas de conducta / comportamiento, y trastorno por déficit de atención / hiperactividad (TDAH). Los factores de riesgo físico incluían actividad física (número de días activos ≥ 60 min), duración del sueño y dolor.

RESULTADOS Al ajustarse a los datos sociodemográficos, los niños con PC tenían mayores probabilidades de trastornos de salud mental (razón de probabilidades [OR] = 2,7–7,1, $p<0,05$) excepto por el trastorno por déficit de atención / TDAH (OR=2,5; intervalo de confianza del 95% [IC]=0,9–7,1). Al ajustar aún más los factores físicos, las probabilidades de depresión ya no aumentaron (es decir, se atenuaron) en niños con PC (OR=1,0; 95% CI=0,3–3,3); sin embargo, las probabilidades de ansiedad (OR=3,8; IC 95% =1,9–7,8) y problemas de conducta/conducta (OR=3,8; IC 95%=1,3–11,1) se mantuvieron elevadas. Evaluados individualmente, la actividad física baja y el dolor atenuaron las probabilidades de depresión en niños con PC (OR=1,9; IC del 95%=0,7–5,3; OR=1,4; IC del 95%=0,6, –3,8 respectivamente).

INTERPRETACIÓN Los niños con PC tienen una prevalencia elevada de trastornos de salud mental incluso después de tener en cuenta los factores de riesgo físicos. La baja actividad física y el dolor explican parcialmente la asociación entre PC y depresión.

RESUMO**DESORDENS DA SAÚDE MENTAL E FATORES DE RISCO FÍSICOS PARA CRIANÇAS COM PARALISIA CEREBRAL: ESTUDO TRANSVERSAL**

OBJETIVO Examinar a prevalência de desordens da saúde mental entre crianças com e sem paralisia cerebral (PC), e examinar como fatores de risco físico em crianças com PC podem mitigar qualquer risco elevado de desordens da saúde mental nesta população.

MÉTODO Crianças de 6 a 17 anos de idade com ($n=111$) e sem ($n=29.909$) PC no Levantamento Nacional de Saúde da Criança de 2016 foram incluídas neste estudo transversal. Desordens da saúde mental incluíram depressão, ansiedade, problemas de comportamento/conduita, e transtorno do déficit de atenção/atenção e hiperatividade (TDAH). Fatores de risco físico incluíram atividade física (número de dias ativos ≥ 60 min), duração do sono e dor.

RESULTADOS Ajustando para variáveis sócio-demográficas, crianças com PC tiveram maior risco de desordens da saúde mental (odds ratio [OR]=2,7–7,1, $p<0,05$) exceto para transtorno de déficit de atenção/TDAH (OR=2,5; intervalo de confiança 95% [IC] =0,9–7,1). Ajustando para fatores físicos, os riscos de depressão não eram mais aumentados (ou seja, atenuados) em crianças com PC (OR=1,0; IC 95%=0,3–3,3); no entanto, os riscos de ansiedade (OR=3,8; IC 95%=1,9–7,8) e problemas de comportamento/conduita (OR=3,8; IC 95% =1,3–11,1) permaneceram elevados. Avaliando individualmente, baixos níveis de atividade física e dor atenuaram os riscos de depressão em crianças com PC (OR=1,9; IC 95% =0,7–5,3; OR=1,4; IC 95%=0,6, –3,8 respectivamente).

INTERPRETAÇÃO Crianças com PC tem prevalência aumentada de desordens da saúde mental, mesmo considerando fatores de risco físicos. Atividade física baixa e dor respondem parcialmente pela associação entre PC e depressão.