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Correlation between Factors Influencing Severe Disability in Cerebral Palsy and Obtained Physiotherapy

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ABSTRACT

This study aims to determine what factors influence severe disability in children with cerebral palsy and their relationship to the therapeutic measures obtained. The research method is descriptive observational research to describe the factors that affect severe disabilities in children with cerebral palsy (CP) and correlated with the therapeutic measures obtained and statistical analysis used to test data correlation applying the Pearson product-moment. The results showed (1) factors that aggravate disability in persons with CP are comorbidities, severe degree of spasticity, primitive reflexes that have not been well integrated, (2) strong, positive, and significant correlation between the maturity of primitive reflexes and physiotherapy measures was obtained ($r = 0.762$, $\alpha = 0.000$), (3) perfect, positive and significant correlation between the degree of the weight of spasticity and physiotherapy measures was obtained ($r = 0.926$, $\alpha = 0.000$), and (4) strong, positive and significant correlation between levels of functional ability with physiotherapy measures was obtained ($r = 0.773$, $\alpha = 0.000$). This research concludes that there is a correlation between factors that influence severe disability in cerebral palsy and obtained physiotherapy.

GRAPHICAL ABSTRACT

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Introduction

Children experience a process of growth and development from the womb. This process can be hampered and caused by many factors [1]. Cerebral Palsy (CP) is the most common motor disability disorder that can be described as permanent disturbances of movement and posture development that can result in activity limitation [2]. To alleviate symptoms and resolve complications, a wide variety of CP drugs are used. To minimize movements, children who suffer seizures, spasticity, and involuntary or uncontrolled movements, such as athetosis and chorea, for instance, are often administered medications. To relax muscles, improve comfort and promote better posture, some drugs are used. CP is a non-progressive disorder in the brain development of a baby or foetus. Motor disturbances in CP are often accompanied by disturbances in cognition, sensation, communication, perception, epilepsy, behaviour, and secondary disorders of the musculoskeletal system [3–6]. Cerebral palsy is caused by premature development or damage to the brain that is developing. This damage can occur in early childhood, during pregnancy, childbirth, the first month of life, or less commonly. In 80 percent of cases, structural problems in the brain are seen, most often in white matter. It is thought that more than three-quarters of cases arise from complications that develop during pregnancy. Most kids who are born with cerebral palsy have more than one CP-related risk factor.

Primitive reflexes are highly automatic, stereotypical, and evoked patterns by certain sensory stimuli. Primitive reflexes begin at the twenty-fifth week of gestation, are fully present as the central nervous system matures and at birth in term infants [7,8]. In CP children, when voluntary motor activity inhibits cortical levels, it can result in motor impairment [9].

Children with CP have problems with movement and posture that hinder their functional activities so that an examination by a physiotherapist with a gross motor functional measurement (GMFCS) is required [10]. GMFCS is a tool for measuring the functional activities of children with CP, which consists of 88 items and is divided into 5 categories [11]. The incidence of so many CPs with various kinds of disabilities that accompany and the evolution of physiotherapy measures for CP has been known so far. It is necessary to study the factors that influence disabilities in children with CP and their relationship to the therapeutic measures that have been obtained.

Material and methods

This type of research is a descriptive observational study [12,13]. The study was conducted in 14 cerebral palsy communities in Java and Sumatra, namely from Aceh, Lampung, Padang, Yogyakarta, Bandung, Jakarta, and Cirebon Purwokerto, Bumiayu, Tegal, Jember, Ngawi, Ponorogo, and Madiun. Data collection was carried out in July-August 2020. Data was collected in a network using google form.

The research subjects were children with CP who were members of 14 CP communities. The inclusion criteria that must be met were children with a medical diagnosis of CP. Exclusion criteria were patients with CP over 18 years of age. The drop-out criterion was a subject that did not complete the data.

Primitive reflexes are brainstem mediated, complex, automatic movement patterns. Primitive reflex consists of plantar grasp, palmar grasp, asymmetric tonic neck reflex, gallant, crossed extensor, suprapubic extensor, heel, moro, rossolimo, and babinski [9].

A more well-known tool used to measure resistance and flex in joints during passive motion is the Ashworth Scale. The score given is based on the classification and description shown in the form [14].

Gross motor functional measurement (GMFM) is a tool to assess motor function in children with CP, which has 88 items, each rated on a 4-point ordinal scale of 0 to 3. It has five dimensions are: (1) lying and rolling, (2) sitting, (3) crawling and kneeling, (4) standing, and (5) walking, running, and jumping [14].

The research implementation stage includes a literature study or data tabulation in the CP

community. The research is carried out online via a google form. The results of the data obtained during the examination were recorded and sorted according to the order of each subject from the highest to the lowest.

The data were analysed using frequency distribution tables and descriptive analysis using the SPSS-20 application. Statistical analysis was used to test the correlation of the data using the Pearson product-moment. It is a parametric increment that produces a correlation coefficient that functions to measure the linear relationship between two variables. It has a range of values from -1 to +1. If the correlation coefficient is -1 then the two variables studied have a negative linear relationship. If the correlation coefficient is +1 then the two variables studied have a positive perfect linear relationship. If the correlation coefficient shows the number 0, then there is no relationship between the two variables studied. Data were analysed with frequency distribution tables using the SPSS-20 application.

Result and Dissection

The research was conducted online via google form in a multi-flashlight manner in 14 Cerebral Palsy (CP) communities in Java and Sumatra. The island of Sumatra includes Aceh, Padang and Lampung. Meanwhile, Java Island includes: Bandung, Jakarta, Cirebon, Purwokerto, Tegal, Bumiayu, Yogyakarta, Ponorongo, Ngawi, Madiun, and Jember.

The research sample was the total population of children with CP in all communities that met the research criteria, namely children with a CP medical diagnosis, with total sampling method. Five hundred seventy-three (100%) children were sampled in this study by the 14 CP communities in Java and Sumatra. A total of 459 (80.1%) children met the inclusion criteria in the sample, while 114 (19.9%) children did not meet the criteria, who were divided into three categories, namely 77 (13.44%) samples with a medical diagnosis, not CP, 33 (5.76%) samples over 18 years (adult category), and 4 (0.70%) samples with a medical diagnosis, not CP and over 18 years.

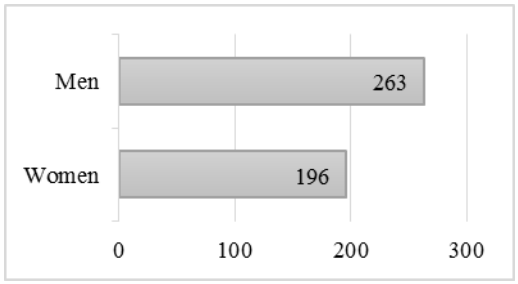

Figure 1: Distribution of subjects by gender

Based on Figure 1, the total subjects consisted of 459, most of whom were male, namely 263 children (57%), and a small proportion of women, namely 196 children (43%). Several epidemiological studies suggest that males are more at risk of developing CP than females due to the contribution of recessive X-linked chromosome variants, and males may be more susceptible to genetic mutations than females [15].

Research on children with boys with preterm birth shows that their brain tissue is more susceptible to damage to substantia alba and the occurrence of intraventricular bleeding. In addition, hormonal factors and neuroprotection factors in the nervous system show different responses in men and women, and the results of other studies provide information that there are differences in neurobiological system responses to nerve tissue injuries between men and women [16].

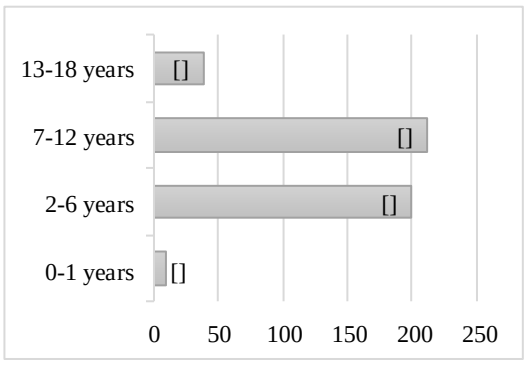

Figure 2: Distribution of subjects by age

Based on Figure 2, of the total subjects of 459, most were children with an age range of 7-12 years, namely 211 subjects (46%), followed by toddlers with an age range of 7-12 years, namely

199 subjects (43%), adolescents with a range of 13-18 years as many as 39 subjects (9%) and at least ten subjects (2%) were babies with an age range of 0-1 years. A study has shown that the onset of CP is most common from childhood in most countries around the world [1].

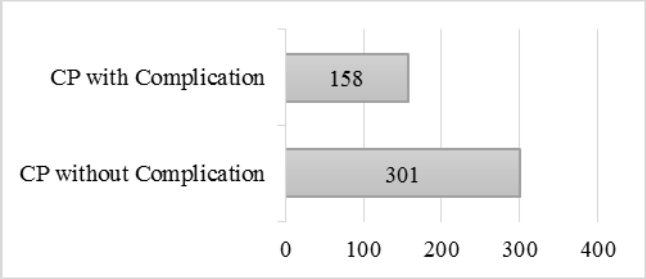

Figure 3: Distribution of subjects based on comorbidities

Based on Figure 3, of a total of 459 subjects, 301 subjects (66%) had uncomplicated CP and 158 subjects (34%) with comorbidities.

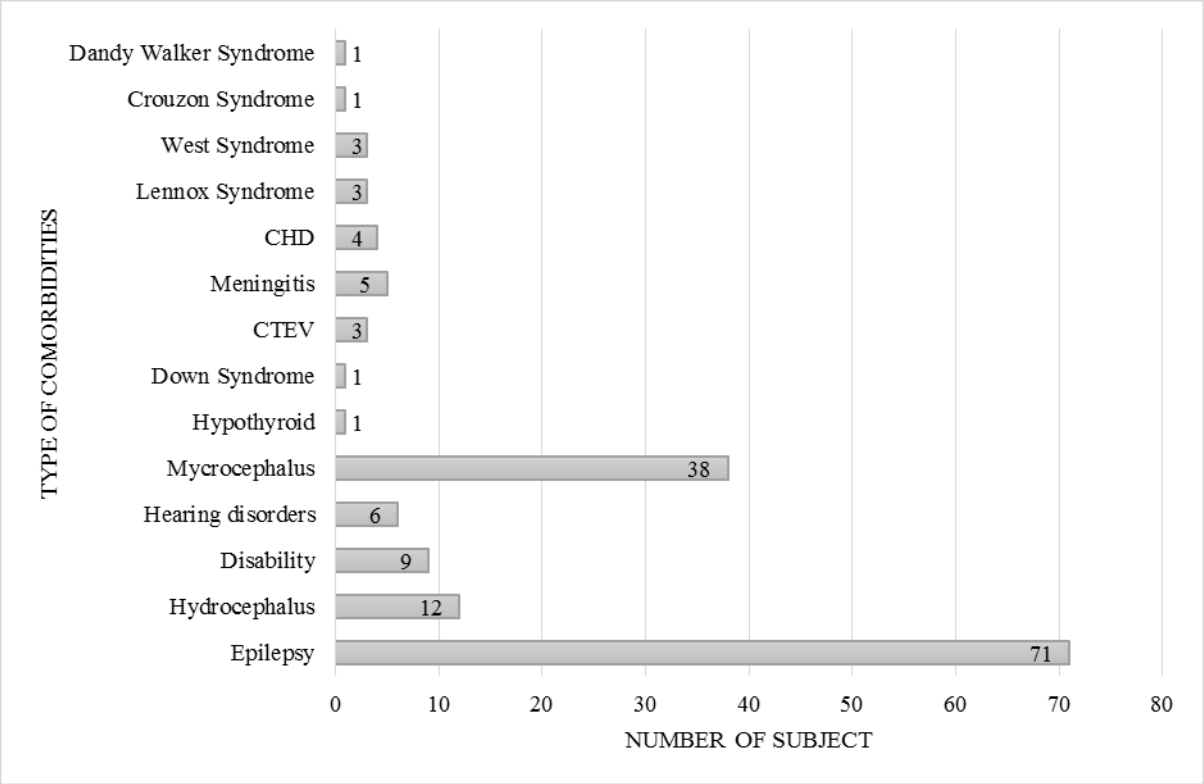

Figure 4: Subject distribution with comorbidities

Based on Figure 4, of the total subjects with comorbidities, as many as 158 subjects (34%) were divided into 14 categories of comorbidities, including 71 subjects (15.46%) with epilepsy, 12 subjects (2.6%) with hydrocephalus, 9 subjects (1.96%) with multiple tuna, six subjects (1.3%) with behaviour disorders, 38 subjects (8.27%) with microcephaly, 1 subject (0.2%) with hypothyroidism, 1 subject (0.2 %) with down syndrome, 3 subjects (0.65%) with congenital talipes equinovarus (CTEV), five subjects (1%) with meningitis, 4 subjects (0.87%) with congenital heart disease (CHD), three subjects (0.65%) with Lennox syndrome, 3 subjects (0.65%) with west syndrome, 1 subject (0.2%) with Crouzon syndrome, and 1 subject (0.2%) with dandy walker syndrome.

Comorbidity that accompanies people with CP will certainly aggravate the disability that occurs. Studies have reported that 35% of CP cases are in seizures [17]. Motor disorders in CP often experience disturbances in perception, sensation, cognition, behaviour, communication, epilepsy, and secondary disorders of the musculoskeletal system [18].

Specific descriptions of the study results were the distribution of subjects based on disability weighting factors and the therapeutic measures given to 459 samples. The following is the research data in disability weighting factors in children with CP (Figure 5).

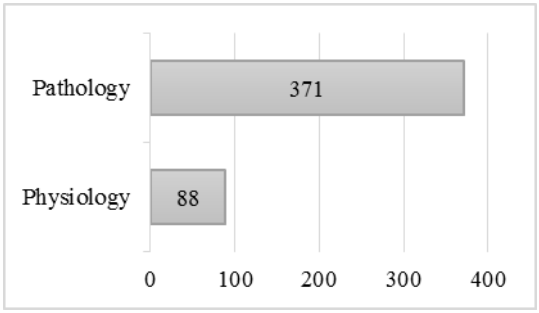

Figure 5: Distribution of primitive reflex maturity

Based on Figure 5, out of a total of 459 subjects, there were 371 subjects (81%) with primitive reflexes that had not been integrated so that they were called pathological reflexes, while in 88 subjects (19%) primitive reflexes had been integrated so that they were called physiological reflexes.

Manifestations of motor or posture disturbances can be the absence of primitive reflexes present in the early stages of growth or persistent primitive reflexes that will be present in later stages of growth [1]. Primitive reflexes are highly stereotyped patterns and are evoked by certain sensory stimuli. Primitive reflexes are complex, brainstem mediated, and automatic movement patterns. When voluntary motor activity blocks the cortical and takes over, this process sometimes hampers the process in children with CP, resulting in motor problems [9].

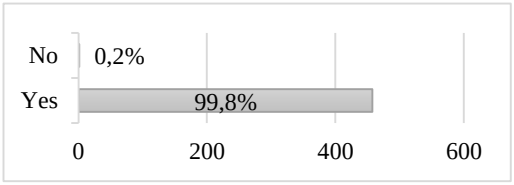

Figure 6: Distribution of spasticity

Based on Figure 6, out of a total of 459 subjects, there are 398 subjects (99.8%) who have problems with spasticity, while the one who does not have problems with spasticity is one subject (0.2%).

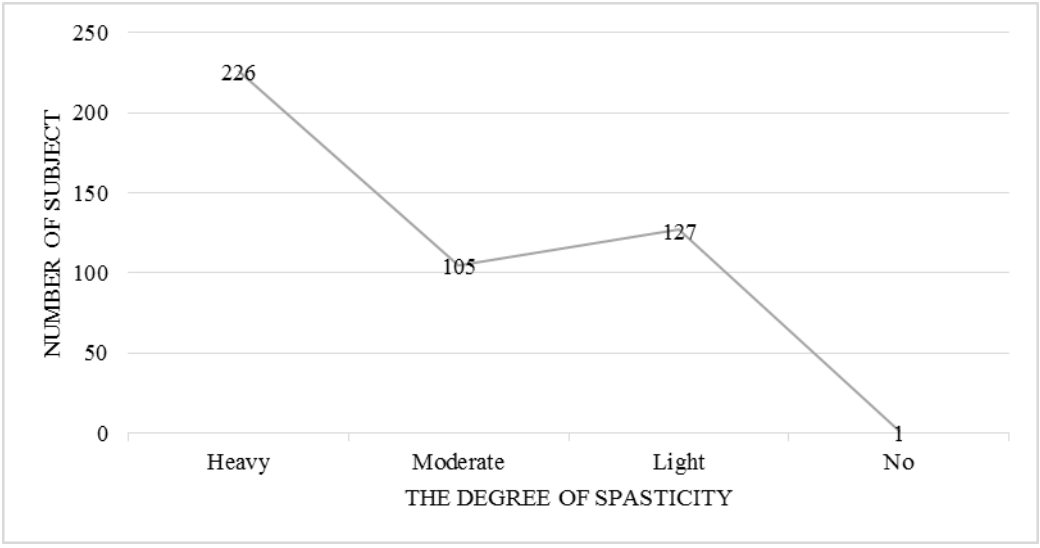

Figure 7: Distribution of weight of spasticity

Based on Figure 7, out of 398 subjects (87%) who have problems with spasticity, there are 226 subjects (49.2%) with severe spasticity category, 105 subjects (22.87%) with moderate spasticity category, 127 subjects (27.66 %) with mild

spasticity category, and 1 subject (0.2%) without spasticity.

In a literature review from 1965 - 2004 conducted in 2005, epidemiological data were obtained based on the type of CP, the most common type was the spastic group, namely between 72-91%, while the non-spastic group was 9-28% [19]. Manifestations of motor or posture disorders may include spasticity, rigidity, ataxia, tremors, atonic/hypotonic, dyskinesia, i.e. difficulty in doing voluntary movements. These symptoms can appear alone or as a combination of these symptoms [1,17].

Based on Figure 8, out of a total of 459 subjects, there are 311 subjects (68%) with delays in motor development, while 148 subjects (32%) have no problems with motor development.

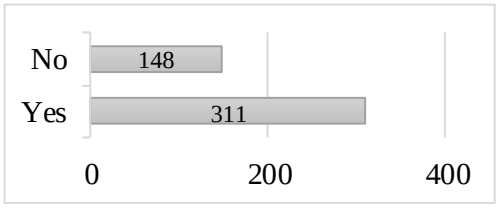

Figure 8: Distribution of delays in motor development

CP is the most common developmental and growth defect in children, with a prevalence of 2-3 per 1000 live births [20]. CP causes delayed and abnormal motor development, including poor movement control [1]. The following is the research data in the form of therapeutic measures, namely in the form of physiotherapy services obtained by children with CP (Figure 9).

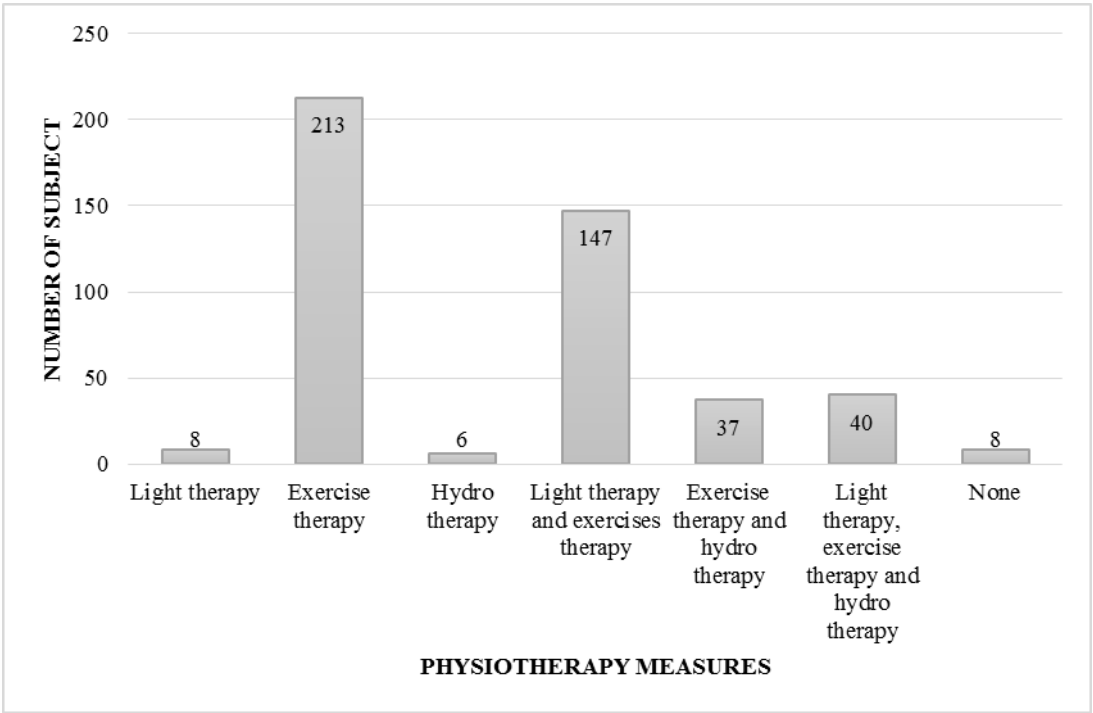

Figure 9: Distribution of physiotherapy services

Based on Figure 9, out of a total of 459 subjects, there were 8 subjects (1.7%) who received physiotherapy services in the form of light therapy alone, x213 subjects (46.4%) who received exercise therapy alone, 6 subjects (1.3%) who received therapy, water alone, 147 subjects (32.1%) who received light therapy and exercise therapy, 37 subjects (8.1%) who received exercise therapy and water therapy, 40 subjects (8.7%) who received light therapy, exercise therapy and water therapy, and 8 subjects (1.7%) who did not receive physiotherapy services.

Given the hallmark of cerebral palsy is a motor disability, physiotherapy is the clinical management of children with this disorder. Physiotherapy plays a central role in managing

this condition, focusing on optimal function and movement. Physiotherapy uses a physical approach to promote, maintain and restore physical, and motor skills and functional mobility management for motor deficits in children with CP [1,21,22].

Table 1: Primitive reflex correlation of maths by physiotherapy measures

		Primitive Reflex	Physiotherapy measures
Primitive Reflex	*Pearson Correlation*	1	0.762**
	Sig. (2-tailed)		0.000
	N	459	459
Physiotherapy measures	*Pearson Correlation*	0.762**	1
	Sig. (2-tailed)	0.000	
	N	459	459

*** Correlation is significant at the 0.01 level (2-tailed)*

Based on Table 1, the maturity of primitive reflexes is related to the strong category, and positively on the physiotherapy intervention obtained is 0.762 (r = 0.762). The r-value of the relationship between primitive reflex maturity and physiotherapy measures obtained is α = 0.000. This means that 0.000 <0.05, and thus the correlation between the two variables is significant. Research shows a strong correlation between the maturity level of primitive reflexes and physiotherapy, as described in Table 1. This illustrates the important role of physiotherapy in helping to increase the maturity of primitive reflexes in people with CP. A study has provided evidence that a specific reflex integration approach by physiotherapy can help integrate primitive reflexes in people with CP [23].

Table 2: Correlation of the degree of spasticity with physiotherapy measures

		The Degree of Spasticity	Physiotherapy measures
The degree of spasticity	*Pearson Correlation*	1	0.926**
	Sig. (2-tailed)		0.000
	N	459	459
Physiotherapy measures	Pearson Correlation	0.926**	1
	Sig. (2-tailed)	0.000	
	N	459	459

*** Correlation is significant at the 0.01 level (2-tailed)*

Based on Table 2, the degree of spasticity is associated with the perfect category, and positively on the physiotherapy intervention obtained is 0.926 (r = 0.926). The r-value of the relationship between the degree of spasticity and physiotherapy measures obtained is α = 0.000. This means that 0.000 <0.05, and thus the correlation between the two variables is significant. Research shows a perfect correlation between the degree of spasticity and physiotherapy, as described in Table 2. This illustrates the important role of physiotherapy in helping to control spasticity in people with CP. Management of spasticity in children should be initiated as early as possible with the help of intensive physiotherapy to achieve this goal [24].

Table 3: Correlation of functional abilities level by physiotherapy measures

		Functional abilities level	Physiotherapy measures
Functional abilities level	*Pearson Correlation*	1	0.773**
	Sig. (2-tailed)		0.000
	N	459	459
Physiotherapy measures	*Pearson Correlation*	0.773**	1
	Sig. (2-tailed)	0.000	
	N	459	459

*** Correlation is significant at the 0.01 level (2-tailed)*

Based on Table 3, the level of functional ability is related to the strong category and positively on the physiotherapy intervention obtained, which is equal to 0.773 (r = 0.773). The r-value of the relationship between the level of functional ability and physiotherapy measures obtained is α = 0.000. This means that 0.000 <0.05, and thus the correlation between the two variables is significant.

Research shows that there is a strong correlation between the level of functional ability and physiotherapy, as described in Table 3. This illustrates the important role of physiotherapy in improving functional abilities in people with CP to carry out daily activities independently. A study has documented that physiotherapy and physical activity as early as possible play an important role in the lives of children with CP, namely to prevent a decline in functional abilities [25].

Cerebral palsy is not a disease but a clinical picture of children characterized by non-progressive brain injury or lesions acquired during the prenatal, perinatal, or postnatal period. The clinical manifestations are the type of movement disorder, the level of ability, and functional limitations. Clinical management of children with cerebral palsy is directed to minimize the influence of factors that can worsen the condition and maximize function and participation in activities. These management strategies include managing medical comorbidities, improving neurologic function during early development, using rehabilitation technology to improve motor function, weakness and hypertonia; and prevent secondary musculoskeletal problems [1].

In children with spastic CP, diplegia causes disturbances in motor function in the form of weakness and uncontrolled movements. The neurological and functional development of children with CP will be disrupted to varying degrees. The approach to rehabilitation of children with CP is comprehensive, in addition to medical and surgical applications, occupational therapy, physiotherapy, orthotic prosthetics, speech therapy, and other adaptive devices. Recreational activities, school and adaptation education, and psychosocial support are needed in the rehabilitation approach [21].

The clinical implication based on the results of this study is that people with CP have disability weighting factors in the form of spasticity, the maturity of primitive reflexes, and the inability of functional activities. Therapeutic measures are needed to minimize these factors so that the child's functional abilities can be achieved. The novelty of the research is 1) weighting factor in the form of spasticity, and 2) the form of therapy in accordance with the disability disorder possessed in the form of exercise therapy.

Conclusion

The research was carried out in 14 cerebral palsy (CP) communities in Java and Sumatra, including Aceh, Padang and Lampung, Bandung, Jakarta, Cirebon, Purwokerto, Tegal, Bumiayu, Yogyakarta, Ponorongo, Ngawi, Madiun, and Jember. 573 children were sampled in this study. A total of 459 children met the inclusion criteria as the sample, while 114 children were excluded. The results of the study showed (1) factors that aggravate

disability in persons with CP were comorbidities, severe degree of spasticity, primitive reflexes that have not been well-integrated, and (2) there was a positive relationship between factors affecting severe disability in children with CP and therapeutic measures found in Java and Sumatra.

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Authors' contributions

All authors contributed toward data analysis, drafting and revising the paper and agreed to be responsible for all the aspects of this work.

Conflict of Interest

We have no conflicts of interest to disclose.

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