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Confirmatory Factor Analysis to Reduce the Knowledge and Economic Dimensions of the Behavior of Cerebral Palsy Parents

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ABSTRACT

This research is important to understand the behavior of parents of Cerebral Palsy (CP) children by reducing the complexity in understanding knowledge and economic dimensions, thus providing a structured approach to identifying factors that influence the psychology of children with CP. This study aimed to identify and reduce the dimensions that influence the behavior of parents of children with CFA. A quantitative approach with a cross-sectional design was used in this study to comprehensively examine the behavior of parents of children with CP. Purposive sampling was used to select 200 participants from various backgrounds. The instrument used was a 28-item questionnaire which was distributed online to collect data. The questionnaire has gone through rigorous testing, including CFA, determinant KMO test, Bartlett test PCA, and grouping of variables based on identified factors. Research in Lampung shows that the number of boys with CP is slightly higher, with the majority aged 1-5 years. Factor analysis identified three main dimensions: parental knowledge about CP, family economic situation, and parental behavior. Better knowledge and a stable economic situation are positively correlated with better parental behavior in caring for children with CP. Many parents experience high levels of stress due to the physical, emotional, and financial burden of caring for a child with CP. The research conclusion shows that the 28 statement items were successfully reduced to three main dimensions (knowledge, economics, and behavior) which have a significant relationship in the care of children with CP. These findings suggest the need for interventions to increase parental knowledge about CP and family economic stability to increase parental participation in child care.

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A. INTRODUCTION

Cerebral Palsy (CP) is a disorder of motor and postural development caused by brain damage during development, often occurring during pregnancy or childbirth. Movement disorders associated with CP were categorized as spasticity, dyskinesia, ataxia, or mixed or other (Vitrikas et al., 2020). Children with CP have difficulty controlling body movements, speech, and coordination of movements. Children with cerebral palsy may experience a variety of problems including movement and posture disorders, feeding difficulties, malnutrition, and sleep problems (Dieleman et al., 2021). Risk factors for cerebral palsy include antenatal, perinatal, and postnatal causes such as maternal infections, difficult deliveries, and head trauma during early life (Duma et al., 2023; Von Graffenried et al., 2022). This condition affects

not only the children themselves, but also has a significant impact on the parents who care for them.

Parental behavior has a crucial role in child development, especially for children with special needs. The attitude of parents towards children with CP varies. Some parents have a positive attitude towards their children with CP, while others may have a negative attitude or have inadequate knowledge about the condition (Ghazy et al., 2023; Salih et al., 2022). The family's attitude towards children with CP not only has a direct impact on the child, but also increases the level of stress in the family and parents' attitudes are assumed to be related to the child's psychosocial development (Al-Dababneh & Al-Zboon, 2018; Shevchuk et al., 2022). The role of parents in supporting a child with CP is not an easy one, and it can be a significant emotional burden. Therefore, understanding deeply the behavior of parents of CP children becomes a very important step. Parental functioning can be influenced by aspects of the behavior of children with CP (Ketelaar et al., 2008). Thus, this study is expected to make a valuable contribution in the development of better interventions and support for parents caring for children with CP. Social support can influence parents' capacity to care for children with CP (Kalleson et al., 2022; Oti-Boadi et al., 2022). The social Stigma associated with this condition can put additional pressure on parents, while support from the surrounding environment can have a positive effect on parents.

Several studies related to the relationship between socio-economics and education on the behavior of parents with CP include the research conducted Dieleman et al. (2021), in this research resulted that parenting behavior every day fluctuates and is influenced by the psychological needs of parents and child behavior. Attentive parenting is associated with parenting that has lower psychological control and higher responsiveness. Other research was conducted by De Clercq et al. (2022), in his research concluded that CP children show changes in psychosocial development over time. The parent's behavior and the child's personality affect the child's psychosocial outcomes. Parental knowledge about a child's whereabouts, activities, and relationships is among the most important factors (Liu et al., 2020). Knowledge factors include understanding of CP, medical knowledge, understanding of Child Development, and Social and psychological knowledge. However, this research still does not reveal the economic dimensions of the family that influence parental behavior towards children with CP.

Economic dimensions include sufficient family income to provide for CP children's needs, such as mobility aids, therapy equipment, therapy costs, special food, and sanitary conditions (Mohammed et al., 2024; Seroke & Mkhize, 2023). Adequate income allows parents to access necessary health services, including medical care and ongoing rehabilitation therapy. Economic constraints can limit access to these services, forcing families to choose between basic needs and optimal care for their child. Environmental aspects are also influenced by economic factors; a clean, safe, and supportive environment requires investment in sanitation, adaptive facilities, and a friendly environment for individuals with special needs.

This research is important and relevant because it aims to fill a gap in existing literature by systematically measuring and validating the economic dimensions that influence parental behavior towards children with CP. While previous studies provide insights into the psychosocial and knowledge aspects of parental behavior, they often overlook the significant impact of economic factors. By identifying and understanding these economic dimensions, this

study contributes to our understanding of the multifaceted factors that influence parental behavior. This understanding can inform the development of targeted interventions and support systems that address not only the psychological and social needs of parents but also the economic challenges they face.

Parents must understand the child's needs, provide support, and create an environment that facilitates optimal development. Parents play an important role in understanding their child's specific needs, providing support, and creating an environment that facilitates optimal development (Luby et al., 2022; McCleery & Burton, 2023). Several previous studies have provided an initial understanding of the parental behavioral aspects of CP children. However, no specific effort has been made to systematically measure and validate these dimensions using reliable measurement tools. Thus, this study specifically discusses the dimensions that have an impact on the behavior of parents of CP children using statistical methods of Confirmatory Factor Analysis (CFA). The CFA method has the advantage of understanding the conceptual structure of a variable or construct and measuring the validity of that construct. In addition, it can overcome the assumption of multicollinearity of many variables by carareducing variables and grouping them into a dimension or factor. Therefore, this study aimed to identify and reduce the dimensions that influence the behavior of parents of children with CFA.

B. METHODS

This study uses a quantitative approach with a cross-sectional design. Cross-sectional studies are a type of observational study that assess exposure, outcomes, and other variables at the same time (Spector, 2019). This approach is commonly used in the social sciences and behavioral sciences (Maier et al., 2023). This allows the simultaneous collection of data at a single point in time and makes it possible to analyze the relationships between the variables under study. The sample was selected using the purposive sampling method, with the selection of parents with children with CP from various socio-economic and educational backgrounds. The sample size was 200 respondents to ensure adequate representation of the population under study. The instrument used was a questionnaire using Google Form which was then shared with the link to the Lampung Cerebral Palsy Family Forum WhatsApp group, consisting of 28 statement items. The questionnaire was distributed during the data collection period, which lasted from January to February 2024. All Confirmatory Factor Analysis (CFA) processing was carried out with the help of R Studia 4.2.1 software. The steps in conducting CFA are as follows:

1. The first step is to describe the characteristics of the sample, such as age and gender.
2. Then, a determinant test of the correlation matrix is performed to determine the presence or absence of correlation between variables. According Baharum et al. (2023) and Jiang et al. (2023) state that the smaller the value of the determinant, the higher the degree of correlation. This test is decisive in that CFA can be used to confirm the variables studied. If the correlation is very high, singularities and multicollinearity can occur (Shrestha, 2021; Zhao et al., 2020). Therefore, it is necessary to reduce variables that have overlapping information.
3. Next, carry out the Kaiser-Meyer-Olkin (KMO) and Bartlett tests to determine the suitability of each variable for factor analysis (Şeyma & YAVUZ, 2022). The KMO test

measures the adequacy of sampling, with a value considered sufficient if it is more than 0.5. For example, if the KMO value is 0.75, this indicates good sampling adequacy, thus indicating that factor analysis is appropriate for the data. On the other hand, Bartlett's test checks the sphericity of variables, with a p value < 0.05 indicating that the variables are significantly correlated and suitable for factor analysis (Eze et al., 2021; Yayla et al., 2022). For example, if Bartlett's test produces a p value of 0.01, this confirms that the correlation between variables is large enough for factor analysis. This test is very important to ensure the validity and reliability of the factor analysis results.

4. Determine the number of factors using the Principal Components Analysis (PCA) method. This method forms a linear combination of observed indicators (D'Iorio et al., 2023). Choose an eigenvalue (λ) $\geqslant$ 1, which means it contains the most variance or information (Aghimien et al., 2023). In addition to referring to the λ, the number of factors can also be seen based on the scree plot.
5. Next is the grouping of variables by factors. It is seen from the value of the loadings of each variable. If the loading value is greater, then the variable is the factor.
6. The last step is the naming of factors or dimensions based on variables that have been grouped.

C. RESULT AND DISCUSSION

Based on the results of a questionnaire distributed to 200 respondents regarding the dimensions that influence the behavior of CP parents in Lampung Province as shown in Figure 1.

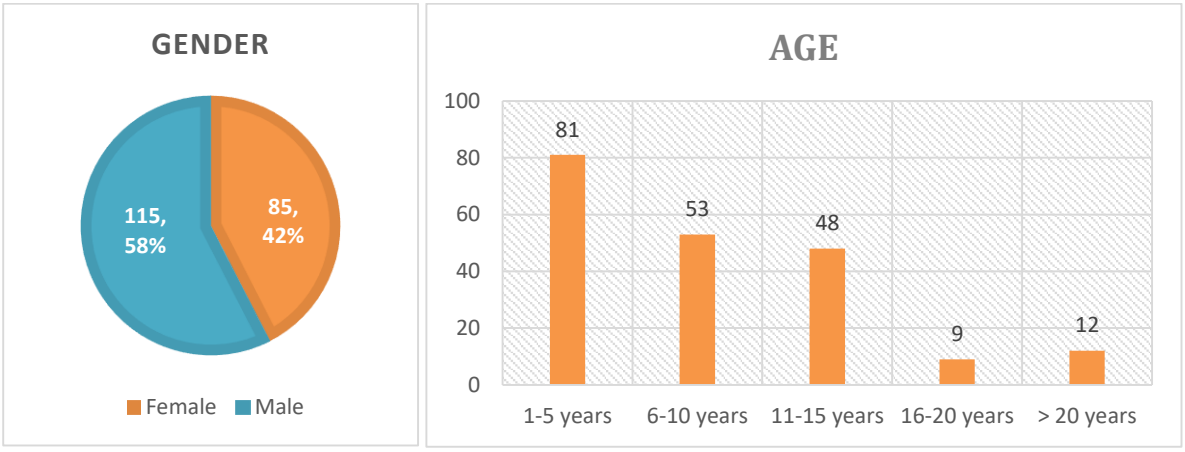

Figure 1. Sex and age of a child with Cerebral Palsy

Based on Figure 1 data on the number of children suffering from Cerebral Palsy in Lampung, namely 115 boys (58%) and 85 girls (42%). This gender distribution shows that there is a slight excess of boys in the population of Cerebral Palsy sufferers in the area. This is the opinion of Romeo et al. (2023) in their research this risk factor has the potential to affect brain development regardless of gender; however, some studies report a male bias in prevalence with a male-to-female ratio of 1.3-1.4:1. The Data is consistent across countries, and the incidence of CP in Europe is 30% higher in men.

In addition, Figure 1. also describes the age distribution of such children. Most CP children are in the age range of 1-5 years, followed by the age range of 6-10 years and 11-15 years. However, there is a significant decrease in numbers in the older age range, especially after age 15. This aligns with research conducted by Patel et al. (2020); in many infants and children, abnormal neuromotor findings tend to disappear in the first few years, especially during the first 2-5 years of life. Hence, the reported prevalence of CP tends to be higher in infancy. After understanding the gender and age distribution of children with cerebral palsy in Lampung, the next step is to conduct a factor analysis process to identify factors that may affect this condition in more depth.

1. Determinant Test of Correlation Matrix

One way to evaluate the quality of the correlation matrix before performing further analysis, such as factor analysis, is to use the determinant of the correlation matrix test. A very small determinant value, close to zero, indicates that the correlation matrix has a very high correlation between several variables in the dataset. The calculation results of this study show that the value of the determinant of the correlation matrix is equal to 5.579895e-10 or less than 0.000000001. This indicates a value very close to zero.

In the context of a determinant test of a correlation matrix, this signifies that the correlation matrix has a very small determinant, indicating a very high correlation between several variables in the dataset. As a result, correlation matrices approach singularities, which can complicate the interpretation and use of such matrices in some analyses. In order to overcome these problems, data processing with dimensional reduction techniques was carried out in this study. The dimension reduction technique chosen is factor analysis. Using this technique, highly correlated variables are combined into smaller factors or major components that account for most of the variability in the data.

2. KMO Test and Bartlett Test

After collecting data from several parents, the second assumption is made by performing the Kaiser-Meyer-Olkin test (KMO). The KMO test is an important step in the CFA to ensure the feasibility of the data before further analysis is carried out. The following kmo values are presented in Table 1.

Table 1. KMO Test dan Bartlett's

Statistic test		**Value**
Kaiser Meyer Olkin Measure of Sampling Adequacy		0,77
Bartlett's test of Sphericity	Approx. Chi-Square	4023,412
	Degree of freedom	378
	p-value	0,00

Table 1 shows that KMO's to value is 0.7777, which means that the sum of the squares of the partial correlation coefficients among all pairs of variables is small compared to the sum of the squares of the correlation coefficients. The KMO figure of 0.77,77 indicates that the data are feasible for factor analysis. This indicates that the variables used in the study have a fairly strong relationship with each other, so it is worth doing a factor analysis.

The next assumption is Bartlett's test, where this test requires a significant correlation between at least some variables. Based On Table 1 the value of the resulting chi-square value (4023.412) is much larger than the critical value of chi-square at the same degree of freedom, and the resulting p-value is also significant (less than 0.05); we can conclude that there is a significant relationship between the variables that affect the behavior of parents of children with cerebral palsy. That is, the correlation matrix used for factor analysis is not identical to the identity matrix, indicating that the existing data is varied enough for factor analysis to be carried out. Therefore, it is possible to conduct further factor analysis to identify the main factors that influence parents' behavior toward a child with cerebral palsy.

3. Determining the Number of Factors

Before determining the number of factors, in this study, the Principal Components Analysis (PCA) method was chosen to reduce data from several indicators. This can result in fewer factors explaining the observed indicators' correlation. The reduction method used is Principal Components Analysis (PCA). This method forms a linear combination of observed indicators. After the PCA through R software analysis, eigenvalues are obtained for each of the factors presented in Table 2.

Table 2. Eigenvalues for Each Factor

	Initial Eigenvalue		
Component	**Total**	**% Variance**	**Cumulative %**
1	8,275	29,675	29,675
2	5,097	18,235	47,91
3	4,438	15,850	63,76
4	0,945	10,889	74,649
5	0,931	5,082	79,731
6	0,915	4,388	84,119
7	0,906	3,235	87,354
8	0,828	2,926	90,28
9	0,603	2,198	92,478
10	0,453	1,618	94,096
11	0,428	1,529	95,625
12	0,244	0,874	96,499
13	0,236	0,843	97,342
14	0,164	0,589	97,931
15	0,149	0,565	98,496
16	0,117	0,418	98,914
17	0,080	0,287	99,201
18	0,076	0,285	99,486
19	0,060	0,214	99,7
20	0,049	0,177	99,877
21	0,029	0,103	99,98
22	0,020	0,007	99,987
23	0,019	0,006	99,993
24	0,012	0,004	99,997
25	0,009	0,003	100
26	0,002	0,000	100
27	0,001	0,000	100
28	0,0001	0,000	100

Based on the criteria set, namely using components with eigenvalue $\geqslant 1$ as the main indicator of variance, the factor analysis results indicate the presence of 3 components with the eigenvalue value that meet these requirements. Table 2 shows that the data was successfully extracted into three factors or groups of significant variables, which are labeled as factor-1, factor-2, and factor-3. Factor 1 plays an important role by revealing the percentage of variance, 67 of 29.67%. This indicates that the variables incorporated into this factor contribute substantially to the total variation in the data. Meanwhile, factor 2 also had a significant effect with a percentage variance of 18.23,23%, followed by factor 3 with a percentage variance of 15.85%. Thus, the three factors together explain most of the variation in the original data, which reached 63.76,76%. In addition, the above results are supported by a graph on the scree plot in Figure 2. This plot displays the eigenvalues of each factor in descending order. A significant turning point in the plot, the point at which the graph decreases sharply, indicates the number of factors that are most relevant to include in the analysis, as shown in Figure 2.

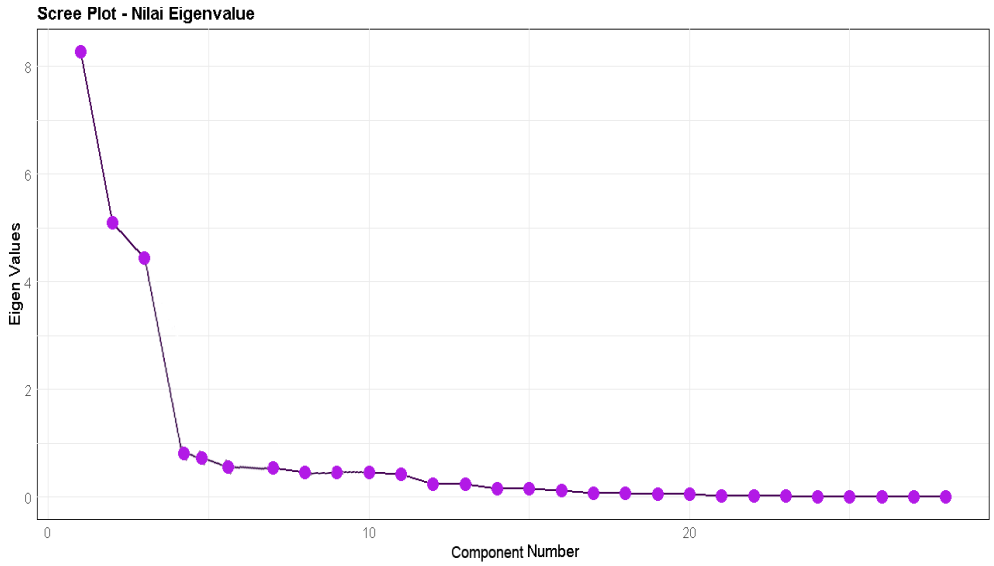

Figure 2. Scree Plot

Based on Figure 2, three main components with eigenvalues greater than 1 formed the figure shows that the point at which the graph sharply decreases indicates that the factors preceding the point are the most significant and considered in the model. Factors after such a turning point are stated to be less relevant or to have a lower contribution to variation in the data.

4. Grouping variables by factors

Relating to grouping variables based on factors used loadings value. High Loading indicates that the variable has a strong relationship with the factor. Variables that have high loadings on a factor most likely represent the same concept or aspect as the factor. Conversely, variables with low loadings on all factors may not be relevant for analysis. To ensure that the variables fit into the right factor, perform rotation factor using Varimax rotation. The following results from the factor matrix that has been rotated with varimax are shown in Table 3.

Table 3. Matrix of factors in rotation

	Factor		
	1	**2**	**3**
X1	0,849	-0,021	0,287
X2	0,700	0,005	0,345
X3	0,909	0,031	0,265
X4	0,488	0,399	0,107
X5	0,524	0,228	0,324
X6	0,542	0,263	0,346
X7	0,527	0,168	0,179
X8	0,695	0,379	0,212
X9	0,536	0,316	0,392
X10	0,760	0,310	0,279
X11	-0,042	0,289	0,212
X12	0,836	0,354	0,158
X13	0,858	0,175	0,271
X14	0,909	0,153	0,220
X15	0,373	0,400	-0,265
X16	0,421	0,371	0,260
X17	0,147	0,266	0,031
X18	0,281	0,510	0,062
X19	0,506	-0,133	0,260
X20	0,003	0,098	0,273
X21	0,523	0,260	0,070
X22	0,356	0,377	-0,034
X23	0,188	-0,030	0,364
X24	0,132	-0,101	0,457
X25	0,032	0,340	0,405
X26	0,038	0,383	0,095
X27	0,342	0,083	0,405
X28	0,155	0,089	0,310

Based on Table 3 the formed factor is labeled, and each variable is inputted into the label. This is done by taking into account the loading value of each variable. Here's Table 4 the result of grouping with each label.

Tabel 4. Results of grouping and labeling of factors

Label	Variable	Description
Knowledge (Factor 1)	X1-X10, X13, X14, X16, X19, X21	- Know Cerebral Palsy - Knowing the type of Cerebral Palsy child - Know the symptoms of Cerebral Palsy child - Know Cerebral Palsy affects the development of the child - Knowing how to care for a child with Cerebral Palsy with the right - Control routine to the doctor - Therapy for children - Looking for the latest information about the development of therapy and child care for Cerebral Palsy

		- Following educational programs/seminars about the Cerebral Palsy - education Program/seminar affects the knowledge and attitude of - Knowledge about Cerebral Palsy affects the attitude of parents toward children - Know about Physiotherapy Passive Mobilization Exercise as independent therapy for children with Cerebral Palsy - Understand the concept and benefits of Physiotherapy Passive Mobilization Exercise in caring for children with Cerebral Palsy - Determine the ease of health services for children with Cerebral Palsy - Accessibility of education for children with Cerebral Palsy easy
Behavior (Factor of 2)	X11, X12, X15, X17, X18, X22, X26	- Feel the weight of parenting a child with cerebral palsy - gracefully accept the conditions, children - Have hopes and dreams positive for the future of the children - Have high levels of stress - are Ready to face the challenges that may arise in caring for a child with Cerebral Palsy - Feel confident of having a child with Cerebral Palsy - struggling to take care of my child who has cerebral palsy for a better life
Economy (Factor 3)	X20, X23-X25, X27, X28	- Team parents - the Cost of the Needs of the child Cerebral Palsy High - House complete with sanitary facilities adequate for the child's Cerebral Palsy - Has mobility aids such as a corset, backslap, AFO, etc., to care for a child with Cerebral Palsy - Conditions of the cleanliness of the environment around the place of residence of the child Cerebral Palsy meet - Have health supplies, such as masks, gloves, and disinfectants, to care for a child with Cerebral Palsy

Parents' behavior of children with cerebral palsy can be influenced by factor knowledge and economic factors. The relationship between these variables is illustrated with a biplot in Figure 3.

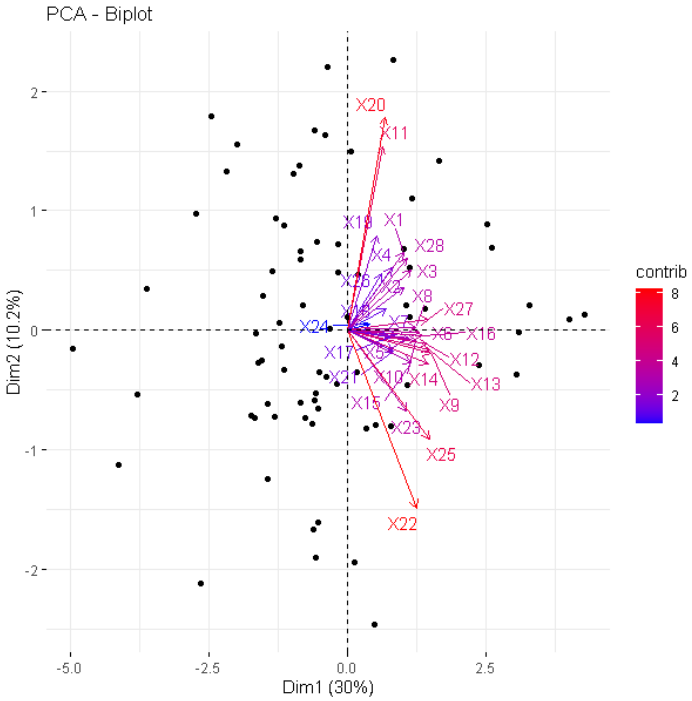

Figure 3. Plot the Relationship of Knowledge with Parental Behavior

Based on Figure 3 the biplot graph has a total diversity that can be explained by 42.2%. The first dimension or the first factor can explain the diversity of data by 30%%, while the second dimension or the second factor is only 10.2,2%. Regarding the closeness of the relationship between variables (correlation), the relationship between knowledge and parental behavior is a fairly large positive correlation. Parents with better and broader knowledge of CP tend to have greater access to information about Cerebral Palsy and effective treatment strategies. They may better understand their child's condition and cope with The Associated challenges. With better knowledge about cerebral palsy, they are less likely to use the health and rehabilitation services available to their child. They are more aware of the type of therapy needed and work to obtain it.

Parents who actively seek the latest information about CP therapy and treatment and attend educational programs or seminars about the condition tend to better understand how to care for their child and acquire additional skills in managing the associated challenges. Knowledge of the ease of access to health and education services for children with cerebral palsy will assist parents in accessing the resources needed to support their child's development and well-being. Then, it also studied the relationship between the economy and parents' behavior, illustrated in Figure 4.

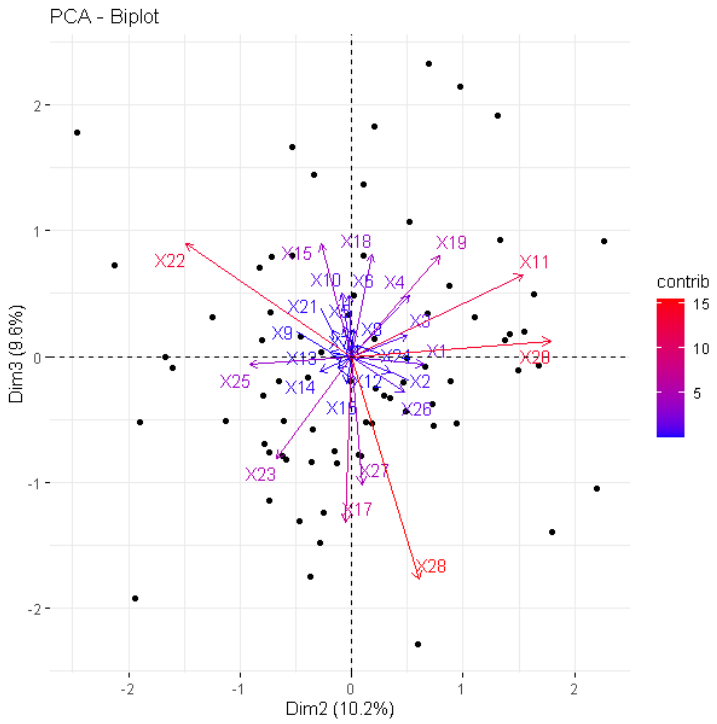

Figure 4. Biplot of economic relations with parental behavior

Based on Figure 4 the graphs on the plot spread in all directions indicate that there is no single pattern of relationship between economic factors and the behavior of the parents of the child. When there is a positive correlation between economic factors and parental behavior, parents with higher economic levels tend to show more positive behavior in caring for their children with cerebral palsy. This may include better access to medical care and therapy, the ability to meet the child's specific needs, and readiness to seek additional information and support. On the other hand, the negative correlation between economic factors and parental behavior suggests that parents with lower economic levels may have difficulty providing the necessary care for their child who has CP. This can be due to limited access to health and rehabilitation services, high financial stress, or constraints in meeting specific needs. The relationship between knowledge and the economy of parents of children with cerebral palsy is illustrated in Figure 5.

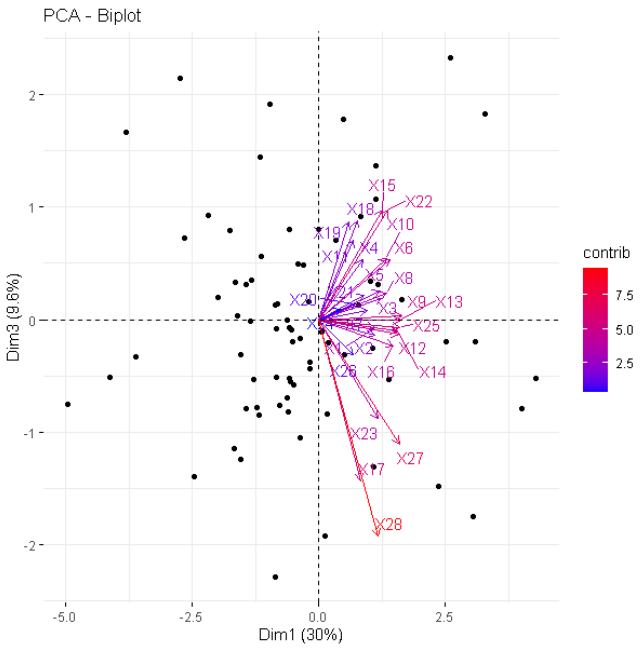

Figure 5. Biplot

Based on Figure 5 suppose the dots representing parents with a high level of knowledge tend to be at the top or right of the graph (high direction of the economic axis). In that case, this indicates a positive relationship between knowledge and the economy. That is, more educated parents tend to have a better economic level, and conversely, parents with a lower level of education tend to have less good economic conditions. The cost of special needs CP children, such as mobility aids, medical care, and therapy, can be a great financial burden for families with low economic levels that affect parents in knowing the symptoms of CP children. Many parents experience high levels of stress in caring for a child with CP because of the physical, emotional, and financial burden that the condition brings. Some parents feel a heavy burden in caring for a child with CP because of the intensive care demands and challenges of the child's condition. This was also conveyed by Fong & Ali (2023) in their research concluding that parental stress is classified as moderate for parents who have children with disabilities.. Factors that cause stress, namely family socio-economic, fatigue in managing daily routines, and children's health problems. This was strengthened by research by Guimarães et al. (2023) that caring for and educating children with CP is emotionally and physically demanding, thus showing that parents do feel a heavy burden in caring for CP children. Despite the severe challenges faced, many parents can accept their child's condition gracefully, accepting cerebral palsy as part of their lives.

Parents still have positive hopes and dreams for the future of children with CP, such as hopes for progress, happiness, and independence. Andromeda et al. (2023), parents' acceptance in this research was shown by the attitude of being at peace with reality and positive behaviors to change difficulties to be more easily tolerated. Adjustment will be easier to achieve when parents have resources that are proportional to the difficulties they experience. These resources include knowledge, finances, support from other family members, and extended family. The findings from this study have important implications for the development of better interventions and support for parents caring for children with CP. With a better understanding

of the factors that influence parental behavior, interventions can be designed to improve parents' well-being and support their children's optimal development. Interventions may include targeted educational programs to increase parental knowledge about CP, economic support initiatives to reduce financial stress, and community-based support networks to provide social and emotional support. These steps can help improve parents' well-being and support their children's optimal development, ensuring that families have the resources and information necessary to manage CP effectively.

D. CONCLUSION AND SUGGESTIONS

Based on the findings of this study, it can be concluded that 28 variables have been reduced to 3 dimensions, namely parental knowledge about CP, family economic situation, knowledge, and parental behavior, which are complexly interconnected. Research shows that better knowledge of the condition and a more stable economic situation positively correlate with better parental behavior in caring for a child with CP. Considering the complexity of the inter-variable relationships involved, these results provide important insights for developing interventions and supports that can improve parental well-being and support the optimal development of children with CP.

Findings suggest that targeted interventions to increase parental knowledge about CP and improve family economic stability can improve parental behavior in caring for children with CP. Health workers and the Government must implement inclusive education programs and economic support to help parents manage this condition more effectively and improve the quality of services. Future research could explore the most effective educational interventions to increase parental knowledge about CP and its long-term impact on parental behavior and child outcomes. Additionally, research could investigate the role of community and social support networks in reducing the economic challenges faced by families with children with CP.

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