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Association of Stimulation and Sleep Duration with Developmental Outcomes in Children Aged 12–36 Months

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Abstract
Introduction*: Early childhood development during the golden years is crucial for future quality of life, yet developmental disorders remain a significant challenge. In Surabaya, Gundih Health Center showed the lowest coverage of developmental monitoring services.* ***Objective:*** *This study aimed to analyze the relationship between stimulation provision and sleep duration with developmental outcomes in children aged 12-36 months at Gundih Health Center, Surabaya.* ***Method:*** *A quantitative analytical study with cross-sectional design was conducted from April to September 2025. Using purposive sampling, 110 children aged 12-36 months were selected. Data were collected through questionnaires adapted from the Maternal and Child Health Book for stimulation assessment, Brief Infant Sleep Questionnaire for sleep duration, and Developmental Pre-Screening Questionnaire for developmental assessment. Data analysis employed univariate and bivariate analysis using Spearman rank correlation test.* ***Result and Discussion****: Results showed that 48.2% of children had age-appropriate development, while 51.8% demonstrated questionable development or possible deviations. Statistical analysis revealed a significant relationship between developmental stimulation and child development (p=0.034, r=0.202), indicating that better stimulation correlated with appropriate developmental outcomes. However, no significant relationship was found between sleep duration and child development (p=0.323, r=0.095).* ***Conclusions:*** *Developmental stimulation significantly influences child development outcomes, while sleep duration does not show a direct significant relationship with developmental progress in children aged 12-36.*

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Introduction

Early childhood development represents a critical phase often referred to as the golden years, during which children experience a sensitive period for receiving various stimuli that profoundly influence their future quality of life (Jaoza et al., 2024). This period serves as a crucial foundation for the formation of cognitive, motor, language, and social-emotional abilities. However, developmental issues in children remain a significant global challenge. The World Health Organization (WHO, 2018) reported that the prevalence of toddlers with developmental disorders reached 28.7% globally. In Indonesia, the prevalence of developmental deviations in children under five years old reached 7.51%, with an estimated 1-3% of children under 5 years experiencing general developmental delays (Aswan & Ridwan, 2023). Data from the Basic Health Research (Riskesdas, 2018) indicated that East Java Province still faced developmental disorder problems in toddlers with a percentage of 10%.

This situation is exacerbated by the low monitoring of child growth and development. The Indonesian Ministry of Health (2022) noted that out of 22 million toddlers in Indonesia, approximately 6.5 million were not monitored for their growth and development. In Surabaya City, although all Health Centers have implemented the Stimulation, Detection, and Early Intervention for Growth and Development (SDIDTK) program, service coverage has not reached 100% (Dinkes Surabaya, 2024). Preliminary study data from the Surabaya City Health Office revealed 125 cases of child developmental disorders in 2024. Gundih Health Center in Bubutan District was recorded as having the lowest SDIDTK service coverage (80.65%) as well as the lowest coverage of toddlers monitored for growth and development (82.71%).

Developmental delays in children have serious consequences across various aspects of life. Susilowati et al. (2022) stated that these delays could affect gross motor development, fine motor skills, language abilities, and social and independence aspects, potentially reducing an individual's quality of life in the future. Karim et al. (2021) added that developmental problems in children could lead to impaired brain development, decreased immune system function, excessive anxiety, emotional instability, and cognitive dysfunction. Child development is influenced by complex interactions between internal factors (genetics, race, age, gender, chromosomal abnormalities) and external factors (nutritional intake, environment, culture, socioeconomic conditions, climate, and physical activity) (Suhartanti et al., 2019).

Among the various factors influencing child development, stimulation plays a fundamental role. Stimulation refers to activities that encourage children's abilities to develop optimally, which need to be provided routinely from an early age and adjusted to developmental stages (Neherta et al., 2023). Empirical evidence demonstrates that children who receive targeted and regular stimulation from an early age have 30% larger brain development compared to children who receive less stimulation (Aminah, 2019; Utaminingtyas, 2019). A study by Onyango et al. (2023) in Kenya and Zambia proved a significant relationship between stimulation activities and child development outcomes in rural areas. These findings were reinforced by research from Basid et al. (2025), which showed that children with good stimulation had age-appropriate development (63.3%), questionable development (6.7%), and deviant development (3.3%). The negative impacts of inadequate stimulation have been well documented, with research in Europe showing that 70% of toddlers experienced language development disorders and

socialization difficulties, while 15% experienced thinking difficulties due to insufficient cognitive, language, and social stimulation (Saputri et al., 2020).

Sleep duration is another critical factor in child development. Adequate sleep supports memory consolidation, learning processes, and brain plasticity, all of which are essential for cognitive development (Basile et al., 2021). The National Sleep Foundation (2015) recommends 11-14 hours/day for toddlers (aged 1-2 years) and 10-13 hours/day for preschool children (aged 3-5 years). However, previous research has produced inconsistent findings regarding the relationship between sleep duration and developmental outcomes. Smithson et al. (2018) found that short sleep duration was associated with low cognitive and language development in children aged 3-12 months, while Putri & Condro (2024) reported no significant relationship between sleep duration and development in children aged 0-5 years. These contradictory findings indicate a research gap that warrants further investigation, particularly in the Indonesian context where sleep problems in early childhood affect approximately 31% of children aged 0-36 months (Retnosari et al., 2021).

Beyond the direct effects of stimulation and sleep, parental knowledge about developmental stimulation represents an important contextual factor that may influence caregiving practices and child outcomes. Parents with adequate knowledge are better equipped to provide appropriate developmental support, while limited knowledge may result in suboptimal stimulation provision. Given that this study examines children from diverse family backgrounds, parental knowledge of developmental stimulation will be documented as a family characteristic that could inform the interpretation of findings regarding stimulation practices and their relationship with child development.

The inconsistency of previous research findings regarding sleep duration, coupled with the high prevalence of child developmental disorders and low SDIDTK service coverage in the Gundih Health Center working area, indicates the need for further research to examine the relationship between stimulation and sleep duration with child development. This study aimed to analyze the relationship between stimulation provision and sleep duration with the development of children aged 12-36 months in the Gundih Health Center working area, Surabaya City. The results of this study are expected to provide a more comprehensive understanding to parents, healthcare professionals, and policymakers regarding the importance of optimizing stimulation and sleep duration in supporting optimal early childhood development.

Method

This study employed a quantitative analytical research design with a cross-sectional approach to analyze the relationship between stimulation provision and sleep duration with child development in a specific period. The study was conducted at Gundih Health Center in Surabaya City from April to September 2025. The population in this study comprised children aged 12–36 months in the Gundih Health Center working area, totaling 1,381 children. The sampling technique used purposive sampling with a total of 110 children with the following inclusion criteria:

1. Children aged 12–36 months residing permanently in the Gundih Health Center working area
2. Parents or guardians willing to participate as respondent

Exclusion criteria:

1. Children aged 12–36 months with autism spectrum disorder, hearing impairment, or visual impairment
2. Children aged 12–36 months suffering from severe illness requiring long-term Therapy
3. Children aged 12–36 months with chronic diseases
4. Children aged 12–36 months with congenital abnormalities

Data were collected through questionnaires designed to measure stimulation provision adapted from the Maternal and Child Health (KIA) Book, sleep duration questionnaire adapted from the Brief Infant Sleep Questionnaire (BISQ), and the Developmental Pre-Screening Questionnaire (KPSP) to assess child development. Data analysis was carried out univariate and bivariate with the Spearman rank correlation test. This study received ethical clearance from the Faculty of Medicine, Airlangga University, with approval number 98/EC/KEPK/FKUA/2025. Prior to the study, the researcher provided parents and guardians with informed consent through a clear protocol, ensuring that ethical standards were met, and their participation was voluntary.

Result and Discussion

1. Result

Characteristics of Children

Table 1
Frequency distribution of children under five based on gender, age and history of exclusive breastfeeding

Distribution	Frequency	Percentage
Gender		
Male	47	42.7
Female	63	57.3
Total	**110**	**100**
Age of Children		
12 – 17 mounts	22	20.0
18 – 23 mounts	31	28.2
24 – 29 mounts	28	25.5
30 – 36 mounts	29	26.4
Total	**110**	**100**
History of Exclusive Breastfeeding		
Exclusive	65	59.1
Non-Exclusive	45	40.9
Total	**110**	**100**

Based on the above table, the distribution of children's characteristics (N=110) indicates that most children were female (57.3%), with ages predominantly distributed in the 18-23 months range (28.2%). Most children had a history of exclusive breastfeeding (59.1%).

Characteristic of Family

Table 2
Frequency distribution of family under five based on parental age, education lever of parental, employment of mother, family income and knowledge developmental stimulation

Distribution	Frequency	Percentage
Age of Mother		
< 25 years	6	5.5
25 – 30 years	44	40.0
31 – 35 years	34	31.0
36 – 40 years	17	15.5
>40 years	9	8.0
Total	**110**	**100**
Age of Father		
< 25 years	5	4.5
25 – 30 years	33	30.0
31 – 35 years	22	20.0
36 – 40 years	28	25.5
>40 years	22	20.0
Total	**110**	**100**
Education Level of Mother		
Primary School	3	3.0
Junior High School	16	14.5
Senior High School	64	58.0
Diploma	4	3.6
Bachelor's Degree	22	20.0
Master's Degree	1	0.9
Total	**110**	**100**
Education Level of Father		
Primary School	7	6.4
Junior High School	9	8.2
Senior High School	81	73.6
Diploma	4	3.6
Bachelor's Degree	9	8.2
Master's Degree	0	0
Total	**110**	**100**
Employment of Mother		
Homemaker	68	62.0
Working	42	38.0
Total	**110**	**100**
Family Income		
Below the Surabaya Minimum Wage	83	75.5
Above the Surabaya Minimum Wage	27	24.5
Total	**110**	**100**
Knowledge Developmental Stimulation		
Yes	52	47.3
No	58	52.7
Total	**110**	**100**

Table 2 shows that among 110 families, the majority of mothers (40.0%) and fathers (30.0%) were aged 25-30 years. Most parents had a senior high school education level, with 58.0% of mothers and 73.6% of fathers. The majority of mothers were homemakers (62.0%), and most families (75.5%) had an income below the Surabaya Minimum Wage.

Notably, more than half of the parents (52.7%) lacked adequate knowledge about developmental stimulation.

Characteristic Variable

Table 3
Frequency distribution based on the variable of child development, developmental stimulation, and sleep duration

Distribution	Frequency	Percentage
Child Development		
Possible Deviation	21	19.1
Questionable	36	32.7
Appropriate	53	48.2
Total	**110**	**100**
Developmental Stimulation		
Poor	35	22.7
Good	85	77.3
Total	**110**	**100**
Sleep Duration		
Insufficient	9	8.2
Adequate	90	81.8
Excessive	11	10.0
Total	**110**	**100**

Based on Table 3, the results indicate that out of the total sample of 110 children, most fell into the appropriate category (48.2%). Most of the developmental stimulation was good (77.3%). In terms of sleep duration, most children had optimal sleep duration (81.8%).

Bivariate Analysis

Table 4
Bivariate Analysis of Developmental Stimulation and Child Development in Children Aged 12-36 Months

Developmental Stimulation	Child Development								Spearman Rank	
	Possible Deviation		Questionable		Appropriate		Total			
	n	%	n	%	n	%	n	%	*Coefficient*	*Sig. (2-tailed)*
Poor	8	32.0	9	36.0	8	32.0	25	100		
Good	13	15.3	27	31.8	45	52.9	85	100	0.202	0.034
Total	**21**	**19.1**	**36**	**32.7**	**53**	**48.2**	**110**	**100**		

Table 3 shows the relationship between developmental stimulation and child development. Notably, the proportion of children with appropriate development was markedly higher among those receiving good stimulation (52.9%) compared to poor stimulation (32.0%). Based on the statistical analysis test, Spearman's rank correlation shows that the p-value of 0.034 (less than α=0.05) indicates that developmental stimulation has a significant influence on child development. The coefficient correlation value of 0.202 located between 0.00-0.39 is a weak positive correlation category.

Table 5
Bivariate Analysis of Sleep Duration and Child Development in Children Aged 12-36 Months

Sleep Duration	Child Development								Spearman Rank	
	Possible Deviation		Questionable		Appropriate		Total			
	n	%	n	%	n	%	n	%	*Coefficient*	*Sig. (2-tailed)*
Insufficient	3	33.3	2	22.2	4	44.5	9	100		
Adequate	16	17.8	32	35.6	42	46.6	90	100	0.095	0.323
Excessive	2	18.2	2	18.2	7	63.6	11	100		
Total	**21**	**19.1**	**36**	**32.7**	**53**	**48.2**	**110**	**100**		

Table 5 presents the relationship between sleep duration and child development. The distribution of developmental outcomes showed relatively similar patterns across different sleep duration categories. Based on the statistical analysis test, Spearman's rank correlation shows that the p-value of 0.323 (greater than α=0.05) indicates that sleep duration does not have a significant influence on child development in children aged 12-36 months. The coefficient correlation value of 0.095 located between 0.00-0.19 is a very weak positive correlation category.

2. Discussion

Children's Characteristic

Based on the results of the study, the majority of children aged 12–36 months were female (61.8%), and most of them were in the age range of 18–23 months (28.8%). This finding is consistent with previous studies which indicate that developmental disorders occur more frequently in boys than in girls. This condition is associated with differences in brain function, where the development of the left hemisphere in girls is generally better, while boys show greater development of the right hemisphere, which is more suited for abstract tasks and skills (Suhadi & Istanti, 2019).

The study also showed that most children (59.1%) aged 12–36 months had a history of exclusive breastfeeding. Children who receive breast milk tend to have better developmental outcomes because the composition of breast milk strongly supports growth and development. Breast milk contains cellular and hormonal antibodies that help children become less susceptible to illness. In addition, breast milk contains hormones and enzymes that play an important role in brain development. The breastfeeding process also provides sensory stimulation such as tactile, olfactory, and visual stimuli. The warmth and affection given during breastfeeding make children feel secure and comfortable, which is essential for their development (Pratiwi et al., 2023).

Family's Characteristic

The findings indicate that most mothers (40.0%) and fathers (30.0%) are within the productive age range of 25 to 30 years. Parental age, particularly maternal age, plays an important role in child development. Parents who are too young, below 25 years, or older than 35 years are at higher risk for health complications and developmental issues in their children (Duncan et al., 2019). This factor is closely related to physical maturity, emotional readiness, and the quality of parenting provided. In terms of education, most mothers (58.2%) and fathers (73.6%) have a high school education. The educational level

of parents is an important determinant because it influences their ability to understand their child's needs, access health information, and identify early signs of developmental problems. Parents with higher education tend to provide more appropriate parenting, while lower education may hinder the fulfillment of developmental needs (Herlina, 2018).

The employment status of mothers also affects parenting patterns. Most mothers in this study are not employed (61.8%), which allows them to spend more time interacting with and stimulating their children. Mothers who work, especially those with heavy workloads, may have limited time and may experience physical fatigue that reduces the quality of developmental stimulation they provide (Utami et al., 2023; Tiara and Zakiyah, 2021). From an economic perspective, most families (75.5%) have an income below the minimum wage of Surabaya. This socioeconomic condition affects the ability to fulfill nutritional needs and access health services. Families with better economic stability are more capable of providing nutritious food and adequate healthcare that support optimal child development (Rahmadani et al., 2023).

Regarding caregiving patterns, the majority of children are cared for directly by their mothers (75.5%), while some are cared for by grandparents or other relatives. Parental caregiving forms the foundation of child development. However, caregiving by grandparents is also common, particularly among working mothers. This type of caregiving may have positive or negative effects because the style of caregiving can differ from that of parents (Hartanto and Yuliani, 2019; Sumargi et al., 2020). Additionally, more than half of the respondents (52.7%) lack knowledge about developmental stimulation. This knowledge is essential because it influences how parents provide care, maintain health, and stimulate children appropriately according to their developmental stage (Rahayu et al., 2024).

Variable's Characteristic

The findings show that the development of children aged 12 to 36 months in the working area at Gundih Health Center still requires attention. Although 48.2% of children were categorized as having age-appropriate development, 51.8% showed questionable development or potential developmental deviations. This indicates that more than half of the children may be experiencing developmental concerns that are influenced by various factors such as genetics, prenatal and postnatal environments, parenting patterns, family psychosocial conditions, and the stimulation provided by parents (Sabur et al., 2020; Aisyah et al., 2010). Developmental delays can affect motor, language, social, and cognitive abilities. Early detection through KPSP and routine monitoring at the Integrated Service Post is therefore essential to ensure that children achieve optimal developmental progress (Susilowati et al., 2022; Karim et al., 2021; Kemenkes RI, 2022).

In terms of stimulation, most children (77.3%) received adequate developmental stimulation, although 22.7% still received insufficient stimulation. Parental stimulation plays an important role in shaping brain networks and supporting the development of physical, cognitive, language, and socio-emotional skills (Perdani et al., 2021; Dini & Deviana, 2022; Chamida, 2022). Insufficient stimulation can reduce brain function and hinder a child's ability to receive and process information, which makes developmental delays more difficult to overcome (Wajannah & Mariyani, 2024; Utaminingtyas, 2019). Factors that influence parental stimulation include parental knowledge, socioeconomic conditions, family support, and the availability of facilities that support child development (Misniarti & Haryani, 2022; Ramadia, 2021).

Most children in the working area at Gundih Health Center (81.8%) had sleep durations that met recommended guidelines. Sleep plays an essential role in memory consolidation, learning processes, brain plasticity, and overall physical health (Hirshkowitz et al., 2015; Castro et al., 2025). Inadequate or excessive sleep can affect behavior, cognition, emotional regulation, physical growth, and immune function (Kohyama et al., 2018; Kaliey et al., 2023). Sleep duration is influenced by genetic factors, parenting, medical conditions, sleep habits, sleep environment, and screen exposure. Establishing consistent sleep routines is an important practice for parents to support optimal sleep quality and promote healthy developmental outcomes (Fadzil, 2021; Chen et al., 2021).

The Bivariate Analysis

Relationship Developmental Stimulation with Child Development

The results of the Spearman correlation test in this study indicate a significant relationship between developmental stimulation and the development of children aged 12–36 months in the working area of Gundih Health Center, Surabaya ($p = 0.034$; $p < 0.05$). This finding demonstrates that developmental stimulation has a direct influence on child development. Most respondents (52.9%) who provided good stimulation had children with age-appropriate development. However, some children were still found to have questionable development (31.8%) or a possible deviation (15.3%). This pattern suggests that the better the stimulation provided, the greater the likelihood that a child will achieve appropriate developmental progress, whereas inadequate stimulation increases the risk of developmental deviation.

These results align with the study by Saputri et al. (2020), which also reported a relationship between stimulation and child development. The findings are further supported by Jesika and Hayu (2023), who observed a significant association between parental stimulation and child development ($p = 0.022$). They noted that adequate stimulation supports normal developmental progression, while insufficient stimulation increases the likelihood of developmental problems. However, this study differs from the findings of Septiyanti and Seniwati (2025), who reported no significant relationship between stimulation and development. Although children receiving good stimulation still tended to experience normal development, a small number continued to show questionable outcomes.

This study also found that most children had received adequate developmental stimulation. The strong connection between stimulation and development is rooted in the concept of the golden period, a window of opportunity and a critical phase for brain formation, particularly between the ages of one and four years. During this period, the brain's plasticity is at its peak, enabling children to absorb learning processes more easily and respond well to stimulation. At the same time, this heightened plasticity makes children more sensitive to environmental factors such as nutritional status, stimulation quality, and overall health conditions (Utaminingtyas, 2019). Stimulation is a crucial factor influencing child development. Lack of environmental stimulation or insufficient stimulation in early childhood can lead to developmental delays and disorders. Conversely, optimal and continuous stimulation can enhance children's overall developmental progress. Parental knowledge and experience play a key role in determining their readiness to provide appropriate stimulation. Therefore, it is essential

for parents to continuously seek and access relevant information regarding child growth and development (Basid et al., 2025).

Relationship Sleep Duration with Child Development

Based on the results of the Spearman correlation test, this study shows that there is no significant relationship between sleep duration and developmental outcomes among children aged 12–36 months in the Working Area of Gundih Health Center, Surabaya ($p = 0.323$; $p > 0.05$). Although most children with adequate sleep duration demonstrated age-appropriate development, there were still children within this group who showed questionable development or possible developmental deviations. These findings indicate that sleep duration does not directly influence child development. This result is consistent with the findings of Putri and Chondro (2024), who also reported no statistically significant relationship between sleep duration and child development ($p = 0.293$). However, it differs from the study by Castro et al. (2024), which found that sleep has a significant impact on early childhood development. Adequate nighttime sleep was shown to positively affect cognitive, motor, and socio-emotional development, while prolonged wakefulness contributed to delays in these developmental domains.

The discrepancy in findings may be attributed to differences in research design. The present study used a cross-sectional design, whereas Castro et al. employed a cohort study design that allowed for long-term monitoring of sleep duration and clearer observation of its effects. In addition, sleep duration data in this study were obtained through open-ended questions posed to parents or caregivers, making the data subjective and potentially biased. Child development may also be influenced by other factors such as the home environment and gadget use (Budiyanto et al., 2024).

The home environment is one factor that may contribute to inadequate sleep among children. Those living in less favorable conditions, such as noisy surroundings, poor air quality, or uncomfortable housing conditions, are more likely to experience frequent awakenings and fail to achieve the recommended sleep duration for their age (Budiyanto et al., 2024). Beyond sleep, the home environment also plays an important role in child development, as environmental stimulation is essential for supporting growth and developmental processes (Nurainun & Putri, 2024). Additionally, children's sleep needs may be affected by gadget use. Excessive exposure to digital devices may lead to dependence, which can disrupt sleep patterns (Budiyanto et al., 2024). Prolonged gadget use has negative effects on children's social and emotional development (Varadarajan et al., 2021). Other adverse impacts of excessive gadget use include speech delays, limited vocabulary, and unclear articulation (Ilza & Karnila, 2019).

Conclusion

This study found that 51.8% of children aged 12–36 months in the Working Area of Gundih Health Center exhibited questionable development or possible deviations, indicating the need for greater developmental attention. Developmental stimulation showed a significant relationship with child development ($p = 0.034$). Sleep duration was not significantly associated with development ($p = 0.323$). These results highlight that stimulation is a key determinant of developmental outcomes, while sleep duration does not directly influence development.

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