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Validation of the Maternal and Child Health (MCH) handbook for assessing child developmental status in comparison to the Indonesian pre-screening developmental questionnaire (KPSP)

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Abstract

Objective: According to data from the Family and Nutrition Health Office of the Karanganyar Health Department in 2022, only 46.54% of health workers utilized instruments for Stimulation, Detection, and Early Intervention for Growth and Development (SDIDTK) to monitor developmental stages. This percentage is significantly lower than the national coverage targets of Stimulation, Detection, and Early Intervention for Growth and Development (SDIDTK) of 85%.

Materials and Methods: This research is a descriptive observational design with a cross-sectional approach, aiming to assess the validity of child developmental status evaluations using the Maternal and Child Health Handbook (MCH Handbook) compared to the Indonesian Indonesian Pre-Screening Developmental Questionnaire (KPSP) as the gold standard.

Results: The results showed that the MCH Handbook has a high sensitivity of 80% and excellent specificity of 96.2%, indicating that it accurately represents 96.2% of normal child developmental status compared to the KPSP as the gold standard. The Positive Predictive Value (PPV) of the MCH Handbook was 84.2%, meaning it correctly identifies 84.2% of children's developmental status. The Negative Predictive Value (NPV) was 95%, accurately reflecting 95% of normal developmental status.

Conclusions: The MCH Handbook is validated as a reliable instrument for assessing child development.

Keywords: Child Development; Human and Health; Maternal-Child Nursing; Pregnancy

1. Introduction

Child growth and developmental disorders remain a global health concern, associated with both short- and long-term consequences. According to WHO data, an estimated 5-25% of children worldwide experience developmental disorders [1]. In Indonesia, the Basic Health Research (Riskesdas) in 2018 reported that 11.7% of children aged 36 to 59 months had developmental delays [2].

To address these issues, the government has implemented the Stimulation, Detection, and Early Intervention for Growth and Development (SDIDTK) program. Early detection guidelines for developmental disorders in children utilize instruments outlined in the SDIDTK manual, such as the Developmental Pre-Screening Questionnaire (KPSP). KPSP screening is conducted at primary healthcare facilities, offering an initial overview of a child's developmental status and enabling prompt early intervention [3].

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A study by Entoh et al. (2020) demonstrated that early detection and intervention using KPSP effectively reduced the risk of long-term health issues. However, the study highlighted limitations, such as the requirement for trained healthcare professionals to administer the tool [3]. Additionally, Wahyuni et al. (2020) noted that conducting comprehensive KPSP screenings for all toddlers in community health posts (posyandu) can be time-consuming, leading to screenings often being limited to children suspected of having developmental delays [4].

Another tool for early detection is the Maternal and Child Health (MCH) Handbook, which includes developmental checklists based on age milestones. The MCH Handbook program has been in use since 1997 (JICA) and continues to be widely implemented. In 2022, 69.6% of toddlers in Indonesia owned an MCH Handbook [2]. Unlike KPSP, the MCH Handbook allows parents, caregivers, or family members to independently monitor a child's development at home. Home-based monitoring is considered more optimal as it takes place in a child's natural environment, fostering comfortable interactions and enhancing parental ability to detect developmental issues while preventing secondary disabilities caused by environmental differences during assessments.

According to the 2022 Indonesia Health Profile, 70.8% of toddlers had received SDIDTK services, and 76.8% of preschool-aged children in Central Java underwent early detection using KPSP [5]. Central Java also recorded the highest MCH Handbook ownership rate in Indonesia at 97%. However, in Karanganyar Regency, the coverage of KPSP detection services by healthcare workers was only 46.54%, significantly lower than the Ministry of Health's target of 85% [6].

To optimize early detection of developmental disorders, researchers believe it is essential to have a valid assessment tool that can be applied by family members in the child's natural environment. Such a tool must yield results consistent with the gold standard to ensure accuracy. Based on these considerations, this study aims to evaluate the feasibility of the MCH Handbook as a developmental assessment instrument compared to KPSP as the gold standard.

This research, titled "The Validity of the Maternal and Child Health Handbook in Relation to the Developmental Pre-Screening Questionnaire," will be conducted at Jaten Community Health Center, Karanganyar Regency, Central Java. The location was chosen due to the low coverage of SDIDTK services, despite Central Java having the highest MCH Handbook ownership rate in Indonesia.

2. Materials and methods

2.1. Experimental Design

This research is a descriptive observational design with a cross-sectional approach, aiming to assess the validity of child developmental status evaluations using the Maternal and Child Health Handbook (MCH Handbook) compared to the Developmental Pre-Screening Questionnaire Handbook (KPSP) as the gold standard. The ethical clearance approved by Health Research Ethics Committee, Faculty of Medicine, Airlangga University, Indonesia (No.120/EC/KEPK/FKUA/2024).

2.2. Collecting Data

This study was conducted at toddler community health posts (posyandu) within the Jaten Community Health Center, Karanganyar Regency, Central Java, from January 2023 to December 2024. The research process involved planning, proposal drafting, proposal testing, obtaining research permits, data collection, result reporting, and publication. The study population included all children attending posyandu in the Jaten Community Health Center area. The sample consisted of children aged 3–72 months, accompanied by caregivers and meeting the inclusion criteria: being present at the posyandu during the developmental assessment and having guardians who provided consent for participation. The sampling method used was total sampling, involving all eligible children who met the inclusion criteria and agreed to participate. The minimum sample size was calculated using Lemeshow's formula (1991), as the exact prevalence of developmental disorders in Indonesia is unknown, yielding a minimum of 96.04 respondents, rounded to 100 to minimize data error.

The independent variables in the study were developmental status assessed using the Maternal and Child Health (MCH) Handbook and the Developmental Pre-Screening Questionnaire (KPSP). The dependent variable was the developmental status of children aged 3–72 months at posyandu in the Jaten Community Health Center area. Data collection involved both primary and secondary sources. Primary data were collected by assessing the developmental status of children using both the MCH Handbook and KPSP. The MCH Handbook assessment was performed directly by the researchers, while KPSP data were obtained from healthcare workers at the posyandu. Secondary data were collected through

interviews with parents, healthcare workers, and posyandu cadres, as well as medical records in the MCH Handbook. Each child underwent two assessments: one using the MCH Handbook and another using KPSP.

After coding, editing, entry, and cleaning, diagnostic tests were performed to evaluate the sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and kappa statistic for the MCH Handbook compared to KPSP as the gold standard. The results were presented in a 2x2 contingency table, with developmental status categorized as either "potentially delayed" or "normal."

Table 1 Contingency table

Maternal and Child Health (MCH) Handbook	Developmental Pre-Screening Questionnaire (KPSP)			
		Possibility of deviating	Normal	Total
	Possibility of deviating	a	b	a+b
	Normal	c	d	c+d
Total	a+c	b+d	a+b+c+d	

a is the true positive, which represents the number of potentially delayed cases in both the MCH Handbook and KPSP assessments; b) b is the false positive, which represents the number of potentially delayed cases in the MCH Handbook but normal cases in KPSP; c is the false negative, which represents the number of normal cases in the MCH Handbook but potentially delayed cases in KPSP; d is the true negative, which represents the number of normal cases in both the MCH Handbook and KPSP assessments; e) a+b is the total number of samples classified as normal or potentially delayed based on the MCH Handbook; f) a+c is the total number of samples classified as normal or potentially delayed based on KPSP; g) c+d is the total number of normal assessments in the MCH Handbook; h) b+d is the total number of normal assessments in KPSP; i) a+b+c+d is the total number of samples in the study.

2.3. Statistical Analysis

In the data processing stage, several steps are undertaken to ensure the accuracy and efficiency of the research. First, coding is performed, where data is grouped to simplify and accelerate both the entry and analysis processes. Afterward, the editing phase takes place, where the completeness, accuracy, consistency, and relevance of each respondent's input are carefully reviewed to ensure the data aligns with the researcher's expectations. Following this, data entry is conducted, where the gathered data is systematically entered into tables and graphs for further analysis. Finally, during the cleaning process, the data is re-examined to correct any potential errors or discrepancies, ensuring that the dataset is accurate and reliable for analysis.

3. Result

The assessment of development using the MCH Handbook and KPSP showed similarities in age grouping and developmental aspects evaluated. Before the assessment, respondents were categorized into 16 age groups ranging from 3 months to 72 months, based on developmental stages. If a child's age did not align precisely with the 16 age groups, the child was categorized into the younger age group closest to their age. The mode age group among the respondents was 36 months, while the least represented age group was 15 months. There was variability in age group distribution among the 100 child respondents included in the study.

Developmental assessments were conducted using the MCH Handbook, with each session lasting 5 to 10 minutes, accompanied by the child's parent. The researcher instructed the child to perform tasks from the MCH checklist, and if the child was uncooperative, the caregiver was asked about the child's behavior at home. The assessment was considered normal if all or only one task was incomplete. If more than one task was left undone, the child's development was classified as showing "possible deviations. The distribution of developmental status results for child respondents using the MCH Handbook, categorized by age groups, is shown in the following table:

Table 2 Distribution of Child Development Status Based on the MCH Handbook

Assessment Using the MCH Handbook					
Age (month)	Possibility of deviating		Normal		Total
	n	%	n	%	
3	0	0%	5	100%	5
6	0	0%	8	100%	8
9	0	0%	8	100%	8
12	3	30%	7	70%	10
15	2	66,6%	1	33,3%	3
18	3	50%	3	50%	6
21	0	0%	4	100%	4
24	2	25%	6	75%	8
30	1	11,1%	8	88,8%	9
36	1	0,9%	10	90,1%	11
42	2	33,3%	4	66,6%	6
48	3	37,5%	5	62,5%	8
54	1	1,1%	8	88,8%	9
60	1	2%	4	80%	5
66	0	0%	0	0%	0
72	0	0%	0	0%	0
Total	19	19%	81	81%	100

After age grouping and developmental assessment with the MCH Handbook, respondents were also assessed using the KPSP. The KPSP assessment, conducted by healthcare workers, took 5 to 15 minutes per respondent. Each child was asked 9-10 questions, or parents were asked if the child had performed the activity at least once at home. The KPSP status categories were "normal" (9-10 indicators), "questionable" (7-8 indicators), and "potential delay" (1-6 indicators). Respondents in the "questionable" category were classified as "potential delay" in the analysis.

Table 3 Distribution of Child Development Status Based on KPSP

Assessment Using the MCH Handbook					
Age (month)	Possibility of deviating		Normal		Total
	n	%	n	%	
3	0	0%	5	100%	5
6	0	0%	8	100%	8
9	0	0%	8	100%	8
12	2	20%	8	80%	10
15	2	66,6%	1	33,3%	3
18	4	66,6%	2	33,3%	6
21	2	50%	2	50%	4
24	3	37,5%	5	62,5%	8

30	0	0%	9	100%	9
36	1	0,9%	10	90,1%	11
42	2	33,3%	4	66,6%	6
48	2	25%	6	75%	8
54	1	1,1%	8	88,8%	9
60	1	2%	4	80%	5
66	0	0%	0	0%	0
72	0	0%	0	0%	0
Total	20	20%	80	80%	100

Diagnostic tests were performed to evaluate the accuracy of the MCH Handbook in assessing children's developmental status. The validity test compared developmental assessment results based on the MCH Handbook with the KPSP as the gold standard. The developmental status assessments of 100 child respondents were analyzed using bivariate analysis, specifically the Chi-Square test (2x2 table).

Table 4 Diagnostic Test Analysis

Maternal and Child Health (MCH) Handbook	Developmental Pre-Screening Questionnaire (KPSP)			
		Possibility of deviating	Normal	Total
	Possibility of deviating	16 (true positive)	3 (false positive)	19
	Normal	4 (true negative)	77 (false negative)	81
Total	20	80	100	

The results showed that the MCH Handbook has a high sensitivity of 80% and excellent specificity of 96.2%, indicating that it accurately represents 96.2% of normal child developmental status compared to the KPSP as the gold standard. The Positive Predictive Value (PPV) of the MCH Handbook was 84.2%, meaning it correctly identifies 84.2% of children's developmental status. The Negative Predictive Value (NPV) was 95%, accurately reflecting 95% of normal developmental status.

4. Discussion

Early detection and intervention for developmental delays in children are conducted at various levels, from the family and community to professional healthcare providers [7]. Monitoring a child's development is essential to track progress across areas such as gross motor skills, fine motor skills, socialization, independence, and language development. These assessments are done every three months for children aged 3 to 24 months and every six months for children aged up to 72 months, based on the SDIDTK guidelines [2].

Field observations revealed that children attending posyandu (integrated health posts) ranged from 3 to 60 months, with no children aged 60-72 months attending, as children over 60 months were considered to have "graduated" from posyandu services. Developmental assessments were performed on 100 child respondents with their parents or caregivers using the MCH Handbook. The characteristics of the respondents and caregivers varied, aiming to represent the population accurately. While children follow the same developmental patterns, their progress rates differ due to internal or external factors [8].

The results of the MCH Handbook assessment indicated that 81% of children had normal developmental status, while 19% showed potential developmental delays. These 19% of children also exhibited growth problems, with low weight, height, upper arm circumference, and head circumference compared to peers. Factors contributing to developmental issues included a history of health problems, low birth weight, congenital diseases, infections, and inadequate

caregiving. Additionally, some children with suspected developmental delays were diagnosed with infections due to missed immunizations and vaccinations. This was confirmed by local midwives, who reported that some families in the posyandu area refused immunizations due to personal beliefs [8].

The prevalence of developmental delays was highest in gross motor skills, followed by language development. Parents expressed concerns when their children could not walk by 18 months or speak a few words by 36 months. These findings highlight the importance of early detection and the need for continued monitoring to prevent long-term developmental issues [9].

Previous studies, such as Lutfiya (2018), reported that 17.5% of children in Surabaya were suspected of having developmental disorders, based on 400 subjects [10]. Erin (2015) found that 34.4% of children in Puskesmas Kota Metro, Bandar Lampung, were suspected of developmental delays [11]. The varying percentages of suspected developmental delays in these studies could be attributed to differences in research locations, education levels, income (which affects nutrition and a conducive environment), community conditions, sample sizes, and interpretation of assessment results.

The results of the developmental assessment using KPSP showed that 80% of child respondents were classified as having normal developmental status, while the remaining 20% were categorized as having doubtful developmental status or potential developmental delays, which, according to the operational definition, were classified as potentially delayed. Previous research by Artha et al. (2014) explained that KPSP had good agreement with the PEDS test and Denver II test. Another study by Erin (2016) found no significant difference in the developmental screening results of preschool-aged children between KPSP and Denver II. Therefore, KPSP is considered a valid gold standard for diagnostic testing in child development assessments using the MCH Handbook [11].

Development monitoring helps identify early signs of developmental issues in children [12]. The MCH Handbook, when completed correctly, improves mothers' knowledge to support maternal and child health. Research by Khuzaiyah (2018) in Pekalongan showed a readability score of 34.9% and a completion rate of 21.3%. A study by Lulianthy et al. (2020) in Pontianak found 72.34% ownership of the MCH Handbook, with 61.5% completion for record-keeping and 16% understanding. Differences between studies are attributed to location, timing, and respondent factors.

Frankenburg & Dodds (2004) explain that validity and reliability tests assess the quality of the KIA Book as a developmental assessment tool, while specificity and sensitivity are evaluated by comparing KIA Book results with KPSP as the gold standard. The sensitivity value for the KIA Book was found to be 80%, meaning it correctly detects developmental delays 80% of the time. This is due to the detailed questions in the KIA Book, which represent the child's developmental status before further diagnosis. Each question covers four developmental aspects—motor skills, speech and language, and social skills—based on SDIDTK guidelines. Additionally, the KIA Book has advantages such as simple, easy-to-understand questions, a short assessment time (around 5 minutes), and no special skills required for use. The general public can easily complete it. The specificity of the KIA Book, at 96.2%, indicates its accuracy in identifying children with normal development as per KPSP. The kappa test for agreement between the KIA Book and KPSP showed a high score of 0.89, indicating near-perfect agreement. These findings suggest that the KIA Book is a highly effective screening tool due to its high sensitivity, specificity, and ease of use.

5. Conclusion

The Maternal and Child Health Handbook is validated as a reliable instrument for assessing child development.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

Statement of ethical approval

The ethical clearance approved by Health Research Ethics Committee, Faculty of Medicine, Airlangga University, Indonesia (No.120/EC/KEPK/FKUA/2024)

Statement of Authorship

All authors participated in data collection and analysis, and approved the final versions submitted.

Author Disclosure

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Statement of informed consent

Informed consent was obtained and agreed by all individual participants included in the study.

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