

Original Article

Understanding the link between maternal knowledge and childhood immunization coverage in Indonesia

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Immunization is one of the most effective strategies to prevent infectious diseases in children. However, incomplete immunization coverage remains a public health issue in Indonesia. Maternal knowledge plays a vital role in ensuring adherence to the recommended immunization schedule. This study aimed to analyze the relationship between maternal knowledge and the completeness of basic childhood immunization in the working area of Genteng Kulon Community Health Center, Indonesia. A cross-sectional study was conducted among 90 mothers with children under five years old. Maternal knowledge was measured using a structured 20-item questionnaire adapted from the Indonesian Ministry of Health's Advanced Health Guidelines (Kemenkes RI, 2020), while immunization completeness was verified through children's immunization record cards. Data were analyzed using descriptive statistics and the chi-square test to examine the association between maternal knowledge and immunization completeness. Most respondents were high school graduates (71.1%), housewives (88.9%), and aged 26–35 years (48.9%). The majority demonstrated good knowledge (60%) and had fully immunized their children (89%). Chi-square analysis revealed a significant relationship between maternal knowledge and immunization completeness ($p = 0.000$; $p < 0.05$). Maternal knowledge strongly influences immunization adherence. Enhancing maternal education through nursing-led health promotion and community-based interventions is essential to improve vaccination coverage and support national child health goals.

Keywords:

child health, immunization completeness, maternal knowledge, nursing intervention

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INTRODUCTION

Childhood immunization remains one of the most cost-effective and impactful public health interventions globally, preventing an estimated 2–3 million deaths each year (WHO, 2023). Immunization not only protects children from vaccine-preventable diseases such as tuberculosis, diphtheria, tetanus, pertussis, poliomyelitis, hepatitis B, and measles but also significantly reduces under-five morbidity and mortality (Wetkos et al., 2022). The success of immunization programs relies heavily on adequate vaccine coverage, timely administration, and parental compliance,

particularly maternal awareness and participation, given that mothers are the primary decision-makers and caregivers responsible for children's health behaviors in most societies (Bbaale, 2022; Restrepo-Méndez et al., 2021).

Despite global progress, incomplete immunization remains a persistent challenge in many low- and middle-income countries, including Indonesia. According to the Indonesian Ministry of Health (Kemenkes RI, 2023), national coverage for basic immunization reached approximately 85%, which remains below the WHO-recommended target of 95% to achieve herd immunity. Regional disparities also exist, with several provinces reporting suboptimal coverage, especially in rural and low-resource settings. These gaps in immunization coverage expose children to the risk of outbreaks of preventable diseases such as measles and pertussis, which have re-emerged in several Indonesian districts over the past decade (Kemenkes RI, 2023; UNICEF, 2022).

One of the critical determinants of immunization coverage is maternal knowledge. Numerous studies have demonstrated that mothers' understanding of the importance, schedule, and benefits of immunization strongly influences their decision to complete their child's vaccination (Galadima et al., 2021; Asif & Akbar, 2022). Lack of awareness, misconceptions about vaccine safety, or inadequate health education often led to missed doses and incomplete schedules. Moreover, socio-demographic factors such as education, occupation, and access to health services also interact with maternal knowledge, shaping overall compliance with immunization programs (Islam et al., 2021; Putri et al., 2025).

From a theoretical standpoint, maternal knowledge aligns closely with constructs of health behavior models, particularly the Health Belief Model (HBM) and Orem's Self-Care Theory. According to these frameworks, individual health behaviors such as ensuring a child receives complete immunization depend on one's perception of susceptibility to disease, perceived benefits of action, and self-efficacy to carry out preventive measures (Orem, 1991; Rosenstock et al., 1988). Mothers with adequate knowledge are more likely to recognize the importance of immunization, understand the risks of incomplete vaccination, and feel empowered to seek timely immunization services for their children. Therefore, knowledge serves not merely as an informational component but as a catalyst that drives behavioral adherence to immunization schedules (Parsekar et al., 2024; Afandi et al., 2024).

In Indonesia, maternal knowledge about immunization varies widely across communities. Several studies have shown that mothers with higher levels of education tend to have a better understanding of vaccine benefits and demonstrate greater compliance (Andrianto et al., 2024; Rahmawati & Agustin, 2021). Conversely, limited health literacy, cultural beliefs, and misinformation, especially through social media, contribute to vaccine hesitancy and delay. A qualitative study by Machmud et al. (2022) found that some mothers perceive immunization as unnecessary once a child appears healthy, reflecting a lack of understanding of vaccination's preventive nature. These findings highlight the need for continuous health education and effective communication strategies targeting mothers at the community level.

The completeness of childhood immunization also depends on the effectiveness of healthcare delivery systems, including the role of community health centers (Puskesmas) and integrated service posts (Posyandu). These primary healthcare units serve as the frontline for immunization programs in Indonesia, where nurses and community health volunteers play essential roles in counseling,

administering vaccines, and maintaining immunization records (Della et al., 2022; Loftus et al., 2021). However, logistical barriers such as distance, vaccine stock-outs, and inconsistent outreach activities can further hinder full coverage (Masemola et al., 2025). Consequently, improving maternal knowledge must go hand in hand with strengthening service accessibility to ensure optimal immunization outcomes.

Previous studies across developing nations have consistently reported significant associations between maternal knowledge and immunization completeness. For example, Saika et al. (2023) in India and Hossain et al. (2021) in Bangladesh found that mothers with good immunization knowledge were more likely to have fully immunized children. Similarly, research conducted in India by Singh et al. (2022) demonstrated that maternal education and knowledge were among the strongest predictors of immunization compliance. In Indonesia, Maharani et al. (2018) observed that mothers who attended regular health counseling sessions at Posyandu were 2.5 times more likely to complete their children's basic immunization than those who did not. However, most of these studies were limited to specific regions or lacked standardized measurement tools aligned with national immunization guidelines. Therefore, further research is warranted to quantify the relationship between maternal knowledge and immunization completeness using validated and standardized instruments.

Given this background, the current study aims to examine the relationship between maternal knowledge and completeness of basic childhood immunization among mothers with children under five years of age. By employing a structured, validated questionnaire aligned with the Ministry of Health's guidelines (Kemenkes RI, 2020) and verifying immunization status through official child health records, this study aims to generate evidence-based insights relevant to nursing and community health practices. Specifically, the findings are expected to strengthen nursing interventions in health education, support nurses' roles as health educators and advocates for maternal and child health promotion (Sinuraya et al., 2022).

This research is particularly relevant within the broader framework of Indonesia's commitment to achieving the Sustainable Development Goals (SDGs), especially Goal 3: "Ensure healthy lives and promote well-being for all at all ages." Increasing immunization coverage among children is a cornerstone of SDG 3.2, which targets the reduction of preventable deaths of newborns and children under five years of age (United Nations, 2015). Improving maternal knowledge is an actionable, cost-effective strategy to enhance immunization adherence and overall child survival rates. Furthermore, the study supports Indonesia's National Immunization Program by identifying key knowledge-related barriers and facilitators, thereby informing the design of targeted, culturally appropriate, evidence-based health education interventions.

Despite substantial progress in national immunization programs, the persistence of incomplete immunization coverage underscores the need to continue strengthening maternal understanding and participation. Mothers' knowledge is not merely a passive attribute but an active determinant influencing behavioral outcomes in child health. By exploring the link between maternal knowledge and immunization completeness, this study addresses an essential aspect of preventive health behavior that has direct implications for public health nursing, policy formulation, and community-based health promotion. The findings are expected to provide empirical evidence that can guide future strategies to improve vaccine uptake, enhance maternal empowerment, and ultimately reduce the burden of vaccine-preventable diseases in Indonesia and similar contexts worldwide.

METHOD

This study employed a quantitative analytical approach with a cross-sectional design to examine the relationship between maternal knowledge and childhood immunization completeness. The cross-sectional method was chosen because it allows for the simultaneous measurement of exposure (maternal knowledge) and outcome (immunization completeness) within a defined population, providing an efficient means of identifying associations between variables at a single point in time. This design has been widely applied in public health and nursing research to explore behavioral and knowledge-based determinants of healthcare utilization.

The study was conducted in Indonesia. This health center was selected based on its high population density and active implementation of the national immunization program (Program Imunisasi Dasar Lengkap). The target population consisted of all mothers with children aged 0–24 months who were registered as residents of the health center's coverage area. A total of 90 respondents participated in this study. The inclusion criteria were: (1) mothers who had children aged under two years, (2) those who possessed an immunization card or health record (KMS Buku Pink), and (3) were willing to participate voluntarily by providing informed consent. Mothers with serious illnesses or communication barriers were excluded from participation. The sample size was determined using the Slovin formula with a 95% confidence level and a 5% margin of error, yielding a minimum of 90 participants to achieve sufficient statistical power for the chi-square analysis.

The sampling method used was simple random sampling. A list of eligible mothers was obtained from the Health Center immunization register. Each mother was assigned a number, and the sample was selected using a random number table until the required number of participants was achieved. This approach minimized selection bias and ensured that every eligible participant had an equal chance of being included in the study. It investigated two primary variables: the independent variable, maternal knowledge about basic childhood immunization, and the dependent variable, completeness of childhood immunization. Each variable was carefully operationalized and measured using validated instruments and standardized national guidelines to ensure reliability and accuracy of data collection.

The independent variable, maternal knowledge of basic childhood immunization, referred to the extent to which mothers understood the essential concepts of immunization. This included their comprehension of immunization's importance in disease prevention, awareness of the recommended immunization schedule, knowledge of vaccines' benefits and possible side effects, and understanding of the overall goal of immunization programs for child health. The operational definition was aligned with the Maternal and Child Health Guidelines issued by the Ministry of Health of the Republic of Indonesia (Kemenkes RI, 2020), ensuring consistency with national public health standards.

Maternal knowledge was measured using a structured questionnaire consisting of 20 multiple-choice items. Each item was developed based on the thematic components outlined in the Kemenkes RI guidelines, encompassing four main domains: (1) definition and purpose of immunization, (2) immunization schedule and timing, (3) benefits and protection provided by each vaccine, and (4) management and understanding of potential side effects or adverse events following immunization. The instrument had undergone prior validation through expert review by professionals

in maternal and child health nursing, as well as pilot testing on a small subset of respondents to confirm its clarity, relevance, and internal consistency.

Each item was scored dichotomously: 1 for each correct answer and 0 for each incorrect response. The cumulative score, ranging from 0 to 20, reflected the respondent's overall knowledge level. The total scores were subsequently converted to percentages and categorized into three levels based on predetermined criteria: Good knowledge ($\geq 76\%$ correct answers), Fair knowledge (56–75% correct answers), and Poor knowledge ($\leq 55\%$ correct answers). This classification system followed the standard scoring interpretation used in community health research in Indonesia, thereby maintaining methodological comparability with previous studies. A higher score represented a greater level of understanding, indicating a more adequate comprehension of immunization practices and schedules.

Meanwhile, the dependent variable, completeness of childhood immunization, was defined as the fulfillment of the entire basic immunization schedule recommended by the Indonesian Ministry of Health. This included administering the Bacillus Calmette–Guérin (BCG), Diphtheria–Pertussis–Tetanus–Hepatitis B–Haemophilus influenzae type b (DPT-HB-Hib), Oral Polio, and Measles–Rubella (MR) vaccines. These vaccines constitute the core immunization program in Indonesia, designed to protect children from severe infectious diseases that pose significant public health challenges. The operational definition emphasized both the timeliness and completeness of vaccine doses appropriate for the child's age, in accordance with the national immunization schedule.

The measurement of immunization completeness was conducted through direct observation and verification of each child's immunization record card, known as the Kartu Menuju Sehat (KMS) or Buku Pink (Pink Health Book). This record served as official documentation maintained by healthcare providers and parents, detailing the types and dates of vaccines the child received. Using this record enabled an objective assessment and minimized recall bias that might occur if mothers were asked to self-report their immunization history. Data collectors reviewed the records and categorized each respondent's child as either "Complete" or "Incomplete." The immunization status was classified as Complete if all recommended basic vaccines had been administered according to the age-appropriate schedule at the time of data collection. Conversely, a child was considered Incomplete if one or more doses of the recommended vaccines had not yet been given.

This binary classification (complete vs. incomplete) provided a clear and measurable outcome variable suitable for statistical correlation analysis with maternal knowledge scores. The assessment framework aligned with the existing monitoring indicators used by the Indonesian Ministry of Health and the World Health Organization (WHO) to evaluate immunization program coverage and parental compliance. Furthermore, to ensure accuracy and consistency during data collection, trained research assistants were instructed to follow a standardized verification protocol. They were required to cross-check the information in the KMS Buku Pink against the respondents' statements, ensuring that no discrepancies existed between the reported and recorded data. When documentation was unclear or incomplete, the data collectors consulted local community health workers (kader posyandu) to confirm immunization records. This step enhanced data validity and minimized classification errors in the dependent variable.

The combination of a structured knowledge assessment tool and objective verification of immunization records enabled a robust examination of the relationship between mothers' cognitive

understanding and their behavioral outcomes in ensuring their children's complete immunization. By operationalizing the variables in this systematic manner, the study provided a scientifically sound framework for analyzing the influence of maternal knowledge on immunization adherence within a community health context. Moreover, aligning operational definitions with national and international standards reinforced the study's relevance for comparative research in maternal and child health.

Overall, this operationalization strategy ensured that both variables were measured precisely, objectively, and consistently across all respondents. It also established a solid basis for the subsequent analytical procedures, enabling a valid interpretation of the statistical relationship between maternal knowledge and immunization completeness. This methodological rigor enhances the study's contribution to evidence-based nursing practice and supports the development of targeted health education interventions to improve immunization coverage among children in Indonesia and comparable settings.

RESULT

This study examined the relationship between maternal knowledge and childhood immunization completeness among 90 mothers residing in Indonesia. Table 1 revealed that most respondents were high school graduates (71.1%), primarily housewives (88.9%), and predominantly aged 26–35 years (48.9%). This demographic profile indicates that most participants were within the productive age range and had sufficient time to supervise their children's immunization schedules.

Table 1. Distribution of Respondents (n=90)

Characteristic	Category	Frequency (n)	Percentage (%)
Education	Elementary School	4	4.4
	Junior High School	14	15.6
	Senior High School	64	71.1
	College (Diploma/Bachelor)	8	8.9
Occupation	Housewife	80	88.9
	Private Employee	10	11.1
Age (years)	17 – 25	32	35.6
	26 – 35	44	48.9
	36 – 40	8	8.9
	>40	6	6.6

Table 2. Maternal Knowledge of Basic Immunization

Knowledge Level	Frequency (n)	Percentage (%)
Good	54	60%
Fair	22	24.4%
Poor	14	15.6%

Most mothers (60%) demonstrated a good level of knowledge regarding basic immunization, showing awareness of immunization schedules and benefits (Table 2).

Table 3. Distribution of Respondents by Immunization Completeness

Immunization Status	Frequency (n)	Percentage (%)
Complete	80	88.9%
Incomplete	10	11.1%

Table 4. Maternal knowledge and immunization cross-tabulation

Knowledge Level	Immunization Complete (n, %)	Immunization Incomplete (n, %)	Total (%)	p-value
Good	54 (100%)	0 (0%)	54 (100%)	0.000
Fair	20 (90.9%)	2 (9.1%)	22 (100%)	
Poor	6 (42.9%)	8 (57.1%)	14 (100%)	

Table 3 showed that most children (88.9%) received complete basic immunizations, reflecting good participation in the immunization program. From Table 4, the chi-square test result ($p = 0.000$) indicates a significant relationship between maternal knowledge and the completeness of childhood immunization. Mothers with higher levels of knowledge tend to have children with complete immunization records.

DISCUSSION

The findings revealed that most respondents were high school graduates (71.1%), housewives (88.9%), and predominantly in the 26–35-year age group (48.9%). Most respondents demonstrated a good level of knowledge regarding basic immunization (60%), and 88.9% of children had completed their basic immunization schedule. A chi-square analysis showed a significant relationship between maternal knowledge and immunization completeness ($p < 0.05$), indicating that higher levels of maternal knowledge are associated with greater adherence to child immunization schedules.

Education plays a crucial role in shaping knowledge and behavior related to health care practices. In this study, most mothers had attained secondary-level education (senior high school). Similar results have been reported by Olufadewa et al. (2024) and Alabi et al. (2022), who found that higher maternal education levels were associated with improved understanding and compliance with childhood immunization programs. Educated mothers are more likely to access, process, and evaluate health information disseminated by health workers, mass media, or community programs (Nurprastiwi et al., 2024). Furthermore, Setiasari et al. (2021) emphasized that mothers with higher education tend to value preventive healthcare services and communicate more effectively with healthcare professionals. They understand immunization schedules, recognize vaccine-preventable diseases, and appreciate the long-term benefits of vaccination. Conversely, low educational attainment often leads to misconceptions, fear, or vaccine hesitancy (Amoah et al., 2023). Thus, the dominance of high school-educated respondents in this study may explain why most participants demonstrated strong knowledge and ensured their children were fully immunized.

Most respondents in this study were housewives (88.9%), suggesting they had more available time to engage in childcare, including attending immunization sessions. This finding aligns with Nwachukwu et al. (2023), who found that unemployed mothers or housewives showed greater adherence to immunization schedules than those working full-time. Employment, particularly in the informal or private sectors, often limits time availability, making it difficult for mothers to visit health centers during operational hours (Strong et al., 2021). However, several studies have also shown that working mothers tend to have better access to health information through digital media and workplace social interactions (Aplin-Houtz et al., 2025). Despite this, logistical challenges such as distance, scheduling conflicts, and lack of childcare support can reduce their ability to attend vaccination sessions. Hence, while occupation influences time management, knowledge, and perceived importance of immunization remain the decisive factors that determine actual behavior. In the current study, mothers' predominant role as caregivers may have contributed to the high immunization completion rate (88.9%). This underscores the importance of supporting mothers' engagement in community-based education programs that reinforce the value of timely immunization.

Most mothers were aged 26–35 years, representing a period of maturity, stability, and reproductive responsibility. According to Karafilakis et al. (2020), maternal age influences decision-making power, confidence in dealing with healthcare workers, and trust in immunization programs. Younger mothers (under 25) often rely heavily on family or community advice, while older mothers tend to rely on their prior experience with older children. The current findings suggest that mothers within the 26–35 age group have optimal levels of awareness and autonomy, enabling them to make informed health decisions for their children. Dube et al. (2021) also reported that middle-aged mothers are more likely to complete immunization schedules compared to adolescent mothers, who may face limited support or lower health literacy. Thus, the age composition of this sample may explain the overall positive immunization coverage.

The key finding of this study was a statistically significant relationship between maternal knowledge and immunization completeness ($p = 0.000$). Mothers with good knowledge demonstrated 100% adherence to complete immunization, while those with poor knowledge had a high rate of incomplete immunization (57.1%). This finding is consistent with previous studies by Miller et al. (2021) and Chen et al. (2022), which demonstrated that knowledge serves as the foundation for positive health behavior in vaccination compliance.

Knowledge about immunization includes understanding vaccine schedules, benefits, potential side effects, and consequences of non-compliance. According to the Health Belief Model (Si et al., 1988), knowledge enhances perceived susceptibility and perceived benefits, which, in turn, motivate preventive actions, such as completing immunization. Mothers who understand that vaccines prevent serious diseases like measles, diphtheria, and polio are more likely to ensure their children receive all scheduled doses. Conversely, poor knowledge can lead to misconceptions, fears, and dependency on misinformation circulating within communities (Hemelka et al., 2020). Furthermore, the Theory of Planned Behavior (Syed et al., 2021) supports this finding, suggesting that knowledge influences attitudes and subjective norms, which, in turn, shape behavioral intentions. In the context of immunization, mothers with adequate information are more likely to perceive vaccination as a social norm and a moral responsibility. Therefore, educational interventions to improve maternal knowledge can have a substantial impact on immunization coverage rates.

The findings of this study align with national data and global trends. According to the Indonesian Health Profile (Ministry of Health, 2023), the average national coverage for complete basic immunization has reached 92.1%, but disparities remain between urban and rural regions. Studies by Marenny, R., et al (2021) in East Java and Qintharina et al. (2024) in Central Java similarly reported significant correlations between maternal knowledge and immunization status. At the global level, WHO and UNICEF (2023) reported that maternal education and awareness are among the most influential determinants of vaccine uptake, surpassing even geographic accessibility in some areas. In Nigeria, Okonko et al. (2023) found that knowledge deficits accounted for 43% of incomplete immunizations. Likewise, Budu et al. (2021) noted that mothers who received structured health education during antenatal visits were twice as likely to complete their children's immunization schedules compared to those who did not. These consistent findings emphasize that improving maternal health literacy is a universal strategy to enhance immunization outcomes. Therefore, community-based nursing programs and primary healthcare initiatives should focus on integrating educational interventions into routine maternal and child health services.

From a nursing perspective, the results highlight the essential role of nurses as educators, advocates, and community mobilizers in promoting immunization coverage. According to Orem's Self-Care Theory (Orem, 1991), nurses have a responsibility to enhance individuals' self-care agency through education and empowerment. In this context, educating mothers about immunization empowers them to practice self-care behaviors to maintain their children's health. Nurses at the community level can implement targeted education using home visits, health talks, and reminder systems through mobile health applications. Additionally, collaborative partnerships among nurses, midwives, and community health volunteers can increase outreach, especially to mothers with low levels of education or limited access to healthcare information. Moreover, the study suggests that health promotion programs should consider cultural and socioeconomic contexts. For example, local beliefs and misinformation regarding vaccines may persist in rural areas; therefore, culturally sensitive health education is required to address myths and misconceptions effectively.

CONCLUSION

The results of this study reaffirm that maternal knowledge significantly influences the completeness of childhood immunization. Mothers with a good understanding of immunization schedules and benefits are more likely to ensure their children receive complete vaccinations. Consequently, continuous health education led by nurses remains a cornerstone strategy in sustaining and improving immunization coverage across Indonesia.

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CONFLICT OF INTEREST

The authors declare that they have no known competing financial interests or personal relationships that could have influenced the work reported in this paper.

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