

IMMUNIZATION COMPLETENESS AMONG CHILDREN AGED 0-59 MONTHS IN INDONESIA

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Abstract

Immunization has effectively reduced the burden of infectious diseases, mortality, morbidity, and saved resources. This study aims to identify factors that are associated with the completeness of immunization among children aged 0-59 months in Indonesia. This research is a quantitative study with a cross-sectional design. The source data used secondary data from the 2018 Indonesia Basic Health Research. The sample of this study consisted of 64,455 women who had children aged 0-59 months. The data were analyzed using a logistic regression test. The results revealed only 10% respondents have a complete immunization status for their children aged 0-59 months. This study also showed that the mother's age, antenatal care visit, access to health care, residence and place of birth had a significant relationship with the completeness of immunization in children. Mother's age ≥ 21 is the most dominant variable related to immunization completeness in children with a PR value of 1.613 (95% CI: 1.269-2.052) after being controlled by other variables. Age, antenatal care visit, access to health service, residence, and place of birth were associated with completeness of immunization among children aged 0-59 months. Policy makers may take these factors into account to increase complete immunization coverage for this group.

Keywords: Basic Health Research, Immunization, Indonesia, Completeness

Introduction

The Sustainable Development Goals (SDG's) is a commitment among countries worldwide to a prosperous, socially inclusive, and environmentally sustainable future for all (1). One of the SDG's targets in 2030 was to reduce child mortality, namely the mortality rate of

neonates, infants, and toddlers. Indonesia is currently trying to achieve the SDG's target. Deaths of children under the age of 5 in low and middle-income nations can be attributed to various variables, one of which is a developing immune system in children (2). As many as 51% of under-5 deaths in China in 1996-2015 were caused by pneumonia (3). While in Africa, half of the child deaths were caused by diarrhea, pneumonia, and measles (4). Based on the World Health Organization (WHO) report 2020, there will be about 20 million children who are not fully immunized or not immunized at all. It causes diseases to paralysis and death that can be prevented by immunization to re-emerge in developing and developed countries (5). Giving immunizations to children under 5 years can save 2 to 3 million deaths each year from 1990 to 2018, reducing infant mortality rates globally by more than 50% (6).

In order to accelerate the reduction of child mortality, immunization was carried out. It is a form of health intervention that effectively reduces morbidity and mortality from diseases that can be prevented by Immunization (PD3I), namely polio, measles, hepatitis B, tetanus, pertussis (whooping cough), diphtheria, pneumonia, and meningitis. The implementation of immunization must reach all socio-economic groups so that the impact can be evenly distributed and the results are maximized (7). It is necessary to increase herd immunity or community immunity by providing routine immunizations for children, including basic immunizations and advanced immunizations. The WHO state that immunization has reduced the burden of infectious diseases, reduced mortality, morbidity, and saved resources (8). Measles is one of the biggest causes of death in children under 5 years of age (2). In addition, pneumonia is still the highest cause of death for newborns and toddlers in

Indonesia. Therefore, a routine immunization program is a strategy that can contribute to reducing morbidity and mortality due to Immunization Preventable Diseases (PD3I) (9).

The conceptual framework of the current study is based on Lawrence W. Green Theory. Green describes a model approach called the PRECEDE (Predisposing, Reinforcing, and enabling cause in educational diagnosis and evaluation) framework to do health planning and is widely known (10). This theory explains the steps taken in a health plan to identify problems from educational needs to development planning. According to some evidence, several factors can influence a person to get immunization services. A study of Mappadang et al. showed that education level, number of living children, and place of residence are determinants of the primary immunization status of children aged 12-59 months in Indonesia (11). Another study conducted by Pangaribuan explains that knowledge, family support, and support from health workers influence the completeness of advanced immunization for toddlers in the working area of the Sentosa Baru Health Center, Medan City (12). Research conducted in Pakistan states that the factors that affect the completeness of immunization are the age of the child, the number of children who are still alive, the health of the parents' family, sources of maternal and child health information, the number of ANC visits, and assistance during childbirth (13). Research conducted by Yohannes et al. stated that knowledge, consent, intention, parents' place of residence, and religious background were significantly related to the utilization of immunization services (14).

Study on completeness of immunization among children aged 0-59 months in Indonesia is still limited. It is important to know the completeness of immunization among children aged 0-59 months so that the government can expand the coverage. This study aimed to identify

factors that are associated with the completeness of immunization among children aged 0-59 months in Indonesia.

Materials and Methods

We used secondary data from 2018 Indonesia Basic Health Research (RISKESDAS). A cross-sectional approach was used in this study. Riskesdas was a national scale survey conducted in a cross sectional manner by the Ministry of Health Indonesia. The sample of the survey was carried out by multistage cluster random sampling. The sample for this study was women who have child aged 0–59 month. A sample of 64,455 women was obtained.

The dependent variable in this study was completeness of immunization to children aged 0-59 month i.e. basic immunization and advanced. This variable was grouped into Complete and Incomplete. There are 8 independents used in this study. Mother's age was grouped into ≥ 21 years old and < 21 years old. Mother's education level, was grouped into (high, middle, low, and no education). The number of children aged 0-59 month was grouped into 1, 2-4, and ≥ 5 children. Antenatal care (ANC) visit was grouped into two namely, ≥ 10 and < 10 . Access to health services was grouped into ≤ 20 minutes and > 20 minutes. Residence was grouped into urban and rural. Place of birth was grouped into medical facility and non-medical facility, and birth attendant which was grouped into health workers, non-health workers, both and no helper.

Three step of data analysis were used in this study: univariate, bivariate, and multivariate analysis. The data result shown in frequency distribution with univariate analysis was performed. Association between the dependent and independent variables was analyzed

using Chi-Square test. Then, all variables that showed statistical significance in the bivariate analysis were included in the multivariate logistic. We used logistic regression test in multivariate analysis. The analyses were completed using the statistical package SPSS 23.

Results

The results were obtained from secondary data from Indonesia Basic Health Research 2018, where the subjects of this study were women who had children aged 0-59 months. The characteristics of respondents and the completeness of immunizations for children in Indonesia are shown in Table 1.

"INSERT TABLE 1 HERE"

Based on Table 1, the proportion of respondents with complete immunization status was 10%. The proportion of respondents based on age category is dominated by mothers who were < 21 years old. The majority of the mother's education level was at the middle education level. The majority of respondents have one child aged 0-59 months. The majority of respondents had < 10 antenatal care visit. Access to health services is dominated ≤ 20 minutes. Most respondents live in urban areas. The majority of respondents gave birth at a health facility and gave birth assisted by health workers.

"INSERT TABLE 2 HERE"

Table 2 shows that maternal age, access to health services, and place of birth have a significant relationship with the completeness of immunization of children with a p-value < 0.05.

"INSERT TABLE 3 HERE"

As shown in Table 3, this study showed that the mother's age, antenatal care visit, access to health care, residence and place of birth had a significant relationship with the completeness of immunization in children. The most associated variable with the completeness of childhood immunization is the mother's age, which is determined based on the largest prevalence ratio (PR) value. The results of multivariate analysis showed that the mother's age had a PR value of 1.613 (95% Confidence Interval (CI): 1.269-2.052). It means that respondents aged ≥ 21 years have a 1.6 times greater chance of getting a complete child immunization status compared to respondents aged < 21 years.

Discussion

The objective of this study was to identify factors that are associated with the completeness of immunization among children aged 0-59 months in Indonesia. The findings of this study reveal that the mother's age was associated with complete immunizations in children. Mothers aged ≥ 21 years have a 1.613 greater probability of completing immunizations than mothers aged < 21 years. The mother's increasing age corresponds to the growth of thinking and parenting to prevent disease in children, one of which is immunization, which will affect mothers' willingness to immunize their children completely. It is in line with research by Feyisetan et al. (15), which states that as mothers get older, they become more aware of diseases that can be avoided by immunizing their children compared to when they are younger. Likewise, similar findings are reported from research of Centers for Disease Control and Prevention (16). It is stated that increasing maternal age might boost mothers' experience caring for children, hence affecting disease prevention and control efforts.

Additionally, an increase in maternal health services such as ANC visits, hospital deliveries, and postnatal care visits is considered a factor favoring child immunization. If the mother routinely performs antenatal care (ANC) visit, then the level of exposure to information about routine immunization will be higher (17). The findings of this study show that age is associated with a person's level of exposure, experience with health problems or diseases, and decision-making, as in the study of Taiwo et al., reported that mothers who are older have a higher probability of getting information about routine immunizations (18). Mothers who have recently given birth are more attentive to their children's needs, particularly health concerns, including immunization. Meanwhile, mothers who are older and have had multiple children will have more experience and a better understanding of the dangers of disease, enabling them to take preventative action.

Access to health care is another factor that is associated with the completeness of immunization in children. The findings of this study indicated that the majority of mothers who needed ≤ 20 minutes to obtain health services had a 1.233 greater probability of completing immunizations for their children. This is in line with the research of Lei Cao et al. They reported that there is a relationship between distance to health facilities and the completeness of immunization status in children in China (9). In line with research of Nainggolan et al. (19), it was reported that short distances from home makes it easier to access health care. Mothers with infants would typically seek access to health services nearest to their homes, owing to the inconvenience of bringing children and the many other activities that must be accomplished as reported by Gualu et al. (20). It claims that responders who travel ≤ 20 minutes to the immunization site had a threefold more

significant chance of immunizing their children than those who travel more than > 20 minutes.

Another factor that is associated with the completeness of immunization in children is the place of birth. According to the findings of this study, mothers who give birth in health facilities had a 1.186 times higher chance of their children receiving a complete immunization status compared to mothers who give birth in non-health facilities. According to the study by Nour et al. (21), there was a significant relationship between the place of birth and immunization coverage in children aged 12 to 23 months. Immunization coverage is more significant for mothers who give birth in health facilities than mothers in non-health facilities. This is because immunization begins with the children's birth, and parents are educated about further immunizations. This is in line with the research of Gidado et al., who reported that mothers who gave birth in health facilities had a significant relationship with the completeness of immunization (22). Study by Tesfaye et al. (23) stated that birth at a health facility was revealed to be a factor that was significantly and positively associated with children's immunization status. If a mother gives birth in a place or health facility, her child's chances of receiving the initial basic immunizations, namely HB0, BCG, and polio, are significantly increased. Additionally, education from health care workers to new mother, particularly on immunization, will provide them with additional insight and decision-making power in providing health care for their children.

There was no relationship between the mother's education and the completeness of immunization of children in this study. This is because the knowledge and mindset of mothers toward immunization cannot be acquired solely through formal education. Currently, information can be easily obtained from a variety of media, both print and

electronic The influence of social media can shape a person's mindset, affecting every aspect of his life, one of which is regarding children's health, so that they can complete immunizations for their children and thus improve their health. This is in line with Safitri et al. (24), who stated that there was no relationship between a mother's education and the completeness of immunizations for children under 5. If someone has a low level of education, they can acquire information on immunization through health workers, advertisements in electronic media, mass media, and social media. This suggests that one of the main factors promoting information absorption and behavioral adjustments is not achieved solely through formal education. In line with research, Pangaribuan (12) stated that respondents with a low, medium, or high level of education could not be confident they would take appropriate immunization actions to ensure their child's immunization status was complete. Health knowledge, particularly immunization, could be obtained through formal education or health education and health promotion. Research conducted in Rwanda states that parental knowledge about vaccination is not an essential factor in vaccination coverage (25). The low level of public knowledge and understanding of the scientific basis of immunization does not affect immunization coverage due to a high level of belief that immunization is essential and a solid intention to give immunizations despite the lack of knowledge (26). Another important factor influencing the provision of immunization is the belief of parents that vaccination is suitable for children's health and can prevent disease, thus creating a willingness for parents to provide services to their children to get protection (27).

The findings of this study reveal that women with a child are more likely to complete their children's immunization. The result of multivariate analysis revealed no relationship

between the number of children under 5 and routine immunization completeness. This study corroborates previous studies conducted by Istriyati (28), states that there is no relationship between the mother's number of children and the completeness of the baby's immunizations. Mothers who wish to immunize their children are affected not by their number but by their level of knowledge and information on the completeness of immunization.

The findings of this study showed that mothers who have antenatal care visit ≥ 10 times are associated with complete routine immunization. This finding is in line with the study conducted by Etana and Deressa (29) which stated antenatal care follow-up is a factor significantly associated with complete immunization. Various factors can influence a person's decision to use maternal and child health services, particularly antenatal care. One such factor is motivation to check her pregnancy by antenatal care visit.

In this study, we found that residence had a significant link with the completeness of completeness immunization. This finding is in line with previous studies in some countries (13, 30, 31) that showed a significant relationship between urban dwelling and completeness of immunization. Immunization can be done at Integrated Healthcare Centers, public health centers, hospitals, doctors or midwife's offices, and even mobile public health centers. In urban areas, health service providers are extensively scattered so that people can quickly secure vaccination for their children. With this, the completeness of immunization for children in urban areas is higher than in the rural setting while in rural area, here is a tendency towards limited distribution of immunization because of geographical barrier.

There are some limitations in our study. This study is a cross sectional survey, therefore, it is difficult to identify the causal mechanism of routine immunization and its risk factor. Secondly, this study used secondary data so that only a limited number of variables are available such as age, education, number of children, antenatal care visit, access to health services, place of residence, place of birth, birth attendant. There are several variables that have not been included in the study. These are economic status, birth order, quality of training services, mother's knowledge and external factors (vaccine refusal). We do not use these variables due to limited data.

Conclusion

The findings of this study reported that immunization completeness is still low (10%). Mother's age, antenatal care visit, access to health care, residence and place of birth were all significantly associated with the completeness of routine immunization in children. Mothers aged ≤ 21 have a greater chance of obtaining a complete child immunization status than mothers < 21 . It is recommended that governments to improve the completeness of routine immunization for children. It could be by optimizing by providing assistance, supervision, and education regarding reproductive health education among women.

Ethical Consents

The Research Ethics Committee has passed this study. The ethics research number: 083/UN9.FKM/TU.KKE/2021 by Public Health Faculty, Sriwijaya University.

Acknowledgment

We want to extend our gratitude to the Indonesian Ministry of Health Research and Development Agency for using data from the 2018 Basic Health Research.

Financial support

The study received no funding for this research.

Competing Interests

The authors declare that they have no competing interests.

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Table 1: Characteristics of respondents (N= 64.455)

Variable	n	%
Immunization completeness		
Complete	6,433	10.0
Incomplete	58,022	90.0

Age		
< 21	61,503	95.4
≥ 21	2,952	4.6
Education		
High	8,235	12.8
Middle	39,224	60.9
Low	16,232	25.2
No education	762	1.2
Number of children aged 0-59 month		
1	56,257	87.3
2-4	8,185	12.7
≥ 5	13	0.02
Antenatal care visit (times)		
≥ 10	8,650	13.4
< 10	55,805	86.6
Access to Health Services (minutes)		
≤ 20	41,062	63.7
> 20	23,393	36.3
Residence		
Urban	35,764	55.5
Rural	28,691	44.5
Place of birth		
Medical facility	55,460	86.0
Non-Medical facility	8,995	14.0
Birth attendant		
Health workers	58,216	90.3
Non-Health workers	2,901	4.5
Both	3,280	5.1
No Helper	58	0.1

Table 2: Association of independent variable and immunization completeness

Variable	Immunization Completeness				<i>p-value</i>	95% CI
	Complete		Incomplete			
	n	%	n	%		

Age						
< 21	6,242	10.1	55,262	89.9	<0.001	1.604 (1.261-2.039)
≥ 21	191	6.5	2,760	93.5	<i>Ref</i>	
Education						
High	761	9.2	7,475	90.8	0.601	1.100 (0.769-1.575)
Middle	4,200	10.7	35,025	89.3	0.139	1.294 (0.919-1.821)
Low	1,412	8.7	14,820	91.3	0.592	1.100 (0.777-1.557)
No education	60	7.8	702	92.2	<i>Ref</i>	
Number of children aged 0-59 month						
1	6,158	10.9	50,099	89.1	0.198	3.555 (3.004-4.207)
2-4	274	3.3	7,911	96.7	0.903	0.876 (0.103-7.426)
≥ 5	1	2.7	12	97.3	<i>Ref</i>	
Antenatal care visit (times)						
≥ 10	944	10.8	7,716	89.2	0.063	1.221 (1.033-1.286)
< 10	5,499	9.9	50,306	90.1	<i>Ref</i>	
Access to Health Services (minutes)						
≤ 20	4,406	10.7	36,656	89.3	<0.001	1.221 (1.113-1.339)
> 20	2,027	8.7	21,366	91.3	<i>Ref</i>	
Residence						
Urban	3,637	10.2	32,127	89.8	0.235	0.916 (0.837-1.002)
Rural	2,795	9.7	25,896	90.3	<i>Ref</i>	
Place of birth						
Medical facility	5,783	10.4	49,677	89.6	<0.001	1.152 (1.003-1.323)
Non-Medical facility	650	7.2	8,345	92.8	<i>Ref</i>	
Birth attendant						
Health workers	6,035	10.4	52,181	89.6	0.356	1.676 (0.560-5.015)
Non-Health workers	123	4.3	2,777	95.7	0.704	0.804 (0.261-2.475)
Both	272	8.3	3,009	91.7	0.519	1.438 (0.477-4.334)
No Helper	3	4.9	55	95.1	<i>Ref</i>	

Table 3: Final model determinant of immunization completeness

Variable	<i>p-value</i>	<i>PR Adjusted</i>	CI
Age			
≥ 21	<0.001	1.613	1.269-2.052
< 21			ref
Education			
High	0.509	1.128	0.798-1.614
Middle	0.108	1.323	0.940-1.861
Low	0.581	1.103	0.779-1.562
No Education			ref
Number of children aged 0-59 month			
1	0.196	4.076	0.483-3.442
2-4	0.901	1.145	0.135-9.715
≥ 5			ref
Antenatal care visit (times)			
≥ 10	0.011	1.152	1.032-1.285
< 10			ref
Access to Health Services (minutes)			
≤ 20	<0.001	1.233	1.124-1.351
> 20			ref
Residence			
Urban	0.042	0.910	0.832-0.997
Rural			ref
Place of birth			
Medical facility	0.009	1.186	1.043-1.348
Non-Medical facility			ref



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[JUMMEC] Submission Acknowledgement

1 pesan

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30 September 2021 08.58

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Discussion

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IMMUNIZATION COMPLETENESS AMONG CHILDREN AGED 0-59 MONTHS IN INDONESIA

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Abstract

Immunization has effectively reduced the burden of infectious diseases, mortality, morbidity, and saved resources. This study aims to identify factors that are associated with the completeness of immunization among children aged 0-59 months in Indonesia. This research is a quantitative study with a cross-sectional design. The source data used secondary data from the 2018 Indonesia Basic Health Research. The sample of this study consisted of 64,455 women who had children aged 0-59 months. The data were analyzed using a logistic regression test. The results revealed only 10% respondents have a complete immunization status for their children aged 0-59 months. This study also showed that the mother's age, antenatal care visit, access to health care, residence and place of birth had a significant relationship with the completeness of immunization in children. Mother's age ≥ 21 is the most dominant variable related to immunization completeness in children with a prevalence ratio (PR) value of 1.613 (95% confidence interval (CI): 1.269-2.052) after being controlled by other variables. Age, antenatal care visit, access to health service, residence, and place of birth were associated with completeness of immunization among children aged 0-59 months. Policy makers may take these factors into account to increase complete immunization coverage for this group.

Keywords: Basic Health Research, Immunization, Indonesia, Completeness

Introduction

The Sustainable Development Goals (SDG's) is a commitment among countries worldwide to a prosperous, socially inclusive, and environmentally sustainable future for all (1). One of the SDG's targets in 2030 was to reduce child mortality, namely the mortality rate of neonates, infants, and toddlers. Indonesia is currently trying to achieve the SDG's target. Deaths of children under the age of 5 in low and middle-income nations can be attributed to various variables, one of which is a developing immune system in children (2). As many as 51% of under-5 deaths in China in 1996-2015 were caused by pneumonia (3). While in Africa, half of the child deaths were caused by diarrhea, pneumonia, and measles (4). Based on the World Health Organization (WHO) report 2020, there will be about 20 million children who are not fully immunized or not immunized at all. It causes diseases to paralysis and death that can be prevented by immunization to re-emerge in developing and developed countries (5). Giving immunizations to children under 5 years can save 2 to 3 million deaths each year from 1990 to 2018, reducing infant mortality rates globally by more than 50% (6).

In order to accelerate the reduction of child mortality, immunization was carried out. It is a form of health intervention that effectively reduces morbidity and mortality from diseases that can be prevented by Immunization Preventable Diseases (PD3I), namely polio, measles, hepatitis B, tetanus, pertussis (whooping cough), diphtheria, pneumonia, and meningitis. The implementation of immunization must reach all socio-economic groups so that the impact can be evenly distributed and the results are maximized (7). It is necessary to increase herd immunity or community immunity by providing routine immunizations for children, including basic immunizations and advanced immunizations. The WHO state that immunization has reduced the burden of infectious diseases, reduced mortality, morbidity, and saved resources (8). Measles is one of the biggest causes of death in children under 5 years of age (2). In addition, pneumonia is still the highest cause of death for newborns and toddlers in Indonesia. Therefore, a routine immunization program is a strategy that can contribute to reducing morbidity and mortality due to PD3I (9).

The conceptual framework of the current study is based on Lawrence W. Green Theory. Green describes a model approach called the PRECEDE (Predisposing, Reinforcing, and Enabling Cause in Educational Diagnosis and Evaluation) framework to do health planning and is widely known (10). This theory explains the steps taken in a health plan to identify problems from educational needs to development planning. According to some evidence, several factors can influence a person to get immunization services. A study of Mappadang et al. showed that education level, number of living children, and place of residence are determinants of the primary immunization status of children aged 12-59 months in Indonesia (11). Another study conducted by Pangaribuan explains that knowledge, family support, and support from health workers influence the completeness of advanced immunization for toddlers in the working area of the Sentosa Baru Health Center, Medan City (12). Research conducted in Pakistan states that the factors that affect the completeness of immunization are the age of the child, the number of children who are still alive, the health of the parents' family, sources of maternal and child health information, the number of Antenatal Care (ANC) visits, and assistance during childbirth (13). Research conducted by Ababu et al. stated that knowledge, consent, intention, parents' place of residence, and religious background were significantly related to the utilization of immunization services (14).

Study on completeness of immunization among children aged 0-59 months in Indonesia is still limited. It is important to know the completeness of immunization among children aged 0-59 months so that the government can expand the coverage. This study aimed to identify factors that are associated with the completeness of immunization among children aged 0-59 months in Indonesia.

Materials and Methods

We used secondary data from 2018 Indonesia Basic Health Research (RISKESDAS). A cross-sectional approach was used in this study. RISKESDAS was a national scale survey conducted in a cross sectional manner by the Ministry of Health Indonesia. The sample of the survey was carried out by multistage cluster random sampling. The sample for this study was women who have child aged 0-59 month. A sample of 64,455 women was obtained.

The dependent variable in this study was completeness of immunization to children aged 0-59 month i.e. basic immunization and advanced. This variable was grouped into Complete and Incomplete. There are 8 independents used in this study. Mother's age was grouped into ≥ 21 years old and < 21 years old. Mother's education level, was grouped into (high, middle, low, and no education). The number of children aged 0-59 month was grouped into 1, 2-4, and ≥ 5 children. ANC visit was grouped into two namely, ≥ 10 and < 10 . Access to health services was grouped into ≤ 20 minutes and > 20 minutes. Residence was grouped into urban and rural. Place of birth was grouped into medical facility and non-medical facility, and birth

attendant which was grouped into health workers, non-health workers, both and no helper.

Three step of data analysis were used in this study: univariate, bivariate, and multivariate analysis. The data result shown in frequency distribution with univariate analysis was performed. Association between the dependent and independent variables was analyzed using Chi-Square test. Then, all variables that showed statistical significance in the bivariate analysis were included in the multivariate logistic. We used logistic regression test in multivariate analysis. The analyses were completed using the statistical package SPSS 23.

Results

The results were obtained from secondary data from Indonesia Basic Health Research 2018, where the subjects of this study were women who had children aged 0-59 months. The characteristics of respondents and the completeness of immunizations for children in Indonesia are shown in Table 1.

Table 1: Characteristics of respondents (N= 64.455)

Variable	n	%
Immunization completeness		
Complete	6,433	10.0
Incomplete	58,022	90.0
Age		
< 21	61,503	95.4
≥ 21	2,952	4.6
Education		
High	8,235	12.8
Middle	39,224	60.9
Low	16,232	25.2
No education	762	1.2
Number of children aged 0-59 month		
1	56,257	87.3
2-4	8,185	12.7
≥ 5	13	0.02
Antenatal care visit (times)		
≥ 10	8,650	13.4
< 10	55,805	86.6
Access to Health Services (minutes)		
≤ 20	41,062	63.7
> 20	23,393	36.3
Residence		
Urban	35,764	55.5
Rural	28,691	44.5
Place of birth		
Medical facility	55,460	86.0
Non-Medical facility	8,995	14.0

Table 1: Characteristics of respondents (N= 64.455) (continued))

Variable	n	%
Birth attendant		
Health workers	58,216	90.3
Non-Health workers	2,901	4.5
Both	3,280	5.1
No Helper	58	0.1

Based on Table 1, the proportion of respondents with complete immunization status was 10%. The proportion of respondents based on age category is dominated by mothers who were < 21 years old. The majority of the mother's education level was at the middle education level. The majority of respondents have one child aged 0-59 months. The majority of respondents had < 10 antenatal care visit. Access to health services is dominated ≤ 20 minutes. Most respondents live in urban areas. The majority of respondents gave birth at a health facility and gave birth assisted by health workers.

Table 2: Association of independent variable and immunization completeness

Variable	Immunization Completeness				p-value	95% CI
	Complete		Incomplete			
	n	%	n	%		
Age						
< 21	6,242	10.1	55,262	89.9	<0.001	1.604 (1.261-2.039)
≥ 21	191	6.5	2,760	93.5	Ref	
Education						
High	761	9.2	7,475	90.8	0.601	1.100 (0.769-1.575)
Middle	4,200	10.7	35,025	89.3	0.139	1.294 (0.919-1.821)
Low	1,412	8.7	14,820	91.3	0.592	1.100 (0.777-1.557)
No education	60	7.8	702	92.2	Ref	
Number of children aged 0-59 month						
1	6,158	10.9	50,099	89.1	0.198	3.555 (3.004-4.207)
2-4	274	3.3	7,911	96.7	0.903	0.876 (0.103-7.426)
≥ 5	1	2.7	12	97.3	Ref	
Antenatal care visit (times)						
≥ 10	944	10.8	7,716	89.2	0.063	1.221 (1.033-1.286)
< 10	5,499	9.9	50,306	90.1	Ref	
Access to Health Services (minutes)						
≤ 20	4,406	10.7	36,656	89.3	<0.001	1.221 (1.113-1.339)
> 20	2,027	8.7	21,366	91.3	Ref	
Residence						
Urban	3,637	10.2	32,127	89.8	0.235	0.916 (0.837-1.002)
Rural	2,795	9.7	25,896	90.3	Ref	
Place of birth						
Medical facility	5,783	10.4	49,677	89.6	<0.001	1.152 (1.003-1.323)
Non-Medical facility	650	7.2	8,345	92.8	Ref	
Birth attendant						
Health workers	6,035	10.4	52,181	89.6	0.356	1.676 (0.560-5.015)
Non-Health workers	123	4.3	2,777	95.7	0.704	0.804 (0.261-2.475)
Both	272	8.3	3,009	91.7	0.519	1.438 (0.477-4.334)
No Helper	3	4.9	55	95.1	Ref	

Table 3: Final model determinant of immunization completeness

Variable	p-value	PR Adjusted	CI
Age			
≥ 21	<0.001	1.613	1.269-2.052
< 21			ref
Education			
High	0.509	1.128	0.798-1.614
Middle	0.108	1.323	0.940-1.861
Low	0.581	1.103	0.779-1.562
No Education			ref
Number of children aged 0-59 month			
1	0.196	4.076	0.483-3.442
2-4	0.901	1.145	0.135-9.715
≥ 5			ref
Antenatal care visit (times)			
≥ 10	0.011	1.152	1.032-1.285
< 10			ref
Access to Health Services (minutes)			
≤ 20	<0.001	1.233	1.124-1.351
> 20			ref
Residence			
Urban	0.042	0.910	0.832-0.997
Rural			ref
Place of birth			
Medical facility	0.009	1.186	1.043-1.348
Non-Medical facility			ref

Table 2 shows that maternal age, access to health services, and place of birth have a significant relationship with the completeness of immunization of children with a p-value < 0.05.

As shown in Table 3, this study showed that the mother's age, antenatal care visit, access to health care, residence and place of birth had a significant relationship with the completeness of immunization in children. The most associated variable with the completeness of childhood immunization is the mother's age, which is determined based on the largest PR value. The results of multivariate analysis showed that the mother's age had a PR value of 1.613 (95% CI: 1.269-2.052). It means that respondents aged ≥ 21 years have a 1.6 times greater chance of getting a complete child immunization status compared to respondents aged < 21 years.

Discussion

The objective of this study was to identify factors that are associated with the completeness of immunization among children aged 0-59 months in Indonesia. The findings of this study reveal that the mother's age was associated with complete immunizations in children. Mothers aged ≥ 21 years have a 1.613 greater probability of completing immunizations than mothers aged < 21 years. The mother's increasing age corresponds to the growth of thinking and parenting to prevent disease in children, one of which is immunization, which will affect mothers' willingness to immunize their children completely. It is in line with research by Feyisetan et al. (15), which states that as mothers get older, they become more aware of diseases that can be avoided by immunizing their children compared to when they are younger. Likewise, similar findings are reported from research of Centers for Disease Control and Prevention (16). It is stated that increasing maternal age might boost mothers' experience caring for children, hence affecting disease prevention and control efforts.

Additionally, an increase in maternal health services such as ANC visits, hospital deliveries, and postnatal care visits is considered a factor favoring child immunization. If the mother routinely performs ANC visit, then the level of exposure to information about routine immunization will be higher (17). The findings of this study show that age is associated with a person's level of exposure, experience with health problems or diseases, and decision-making, as in the study of Taiwo et al., reported that mothers who are older have a higher probability of getting information about routine immunizations (18). Mothers who have recently given birth are more attentive to their children's needs, particularly health concerns, including immunization. Meanwhile, mothers who are older and have had multiple children will have more experience and a better understanding of the dangers of disease, enabling them to take preventative action.

Access to health care is another factor that is associated with the completeness of immunization in children. The findings of this study indicated that the majority of mothers who needed ≤ 20 minutes to obtain health services had a 1.233 greater probability of completing immunizations for their children. This is in line with the research of Cao et al. They reported that there is a relationship between distance to health facilities and the completeness of immunization status in children in China (9). In line with research of Nainggolan et al. (19), it was reported that short distances from home makes it easier to access health care. Mothers with infants would typically seek access to health services nearest to their homes, owing to the inconvenience of bringing children and the many other activities that must be accomplished as reported by Gualu et al. (20). It claims that responders who travel ≤ 20 minutes to the immunization site had a threefold more significant chance of immunizing their children than those who travel more than > 20 minutes.

Another factor that is associated with the completeness of immunization in children is the place of birth. According to the findings of this study, mothers who give birth in health facilities had a 1.186 times higher chance of their children receiving a complete immunization status compared to mothers who give birth in non-health facilities. According to the study by Nour et al. (21), there was a significant relationship between the place of birth and immunization coverage in children aged 12 to 23 months. Immunization coverage is more significant for mothers who give birth in health facilities than mothers in non-health facilities. This is because immunization begins with the children's birth, and parents are educated about further immunizations. This is in line with the research of Gidado et al., who reported that mothers who gave birth in health facilities had a significant relationship with the completeness of immunization (22). Study by Tesfaye et al. (23) stated that birth at a health facility was revealed to be a factor that was significantly and positively associated with children's immunization status. If a mother gives birth in a place or health facility, her child's chances of receiving the initial basic immunizations, namely HBO, BCG, and polio, are significantly increased. Additionally, education from health care workers to new mother, particularly on immunization, will provide them with additional insight and decision-making power in providing health care for their children.

There was no relationship between the mother's education and the completeness of immunization of children in this study. This is because the knowledge and mindset of mothers toward immunization cannot be acquired solely through formal education. Currently, information can be easily obtained from a variety of media, both print and electronic. The influence of social media can shape a person's mindset, affecting every aspect of his life, one of which is regarding children's health, so that they can complete immunizations for their children and thus improve their health. This is in line with Safitri et al. (24), who stated that there was no relationship between a mother's education and the completeness of immunizations for children under 5. If someone has a low level of education, they can acquire information on immunization through health workers, advertisements in electronic media, mass media, and social media. This suggests that one of the main factors promoting information absorption and behavioral adjustments is not achieved solely through formal education. In line with research, Pangaribuan (12) stated that respondents with a low, medium, or high level of education could not be confident they would take appropriate immunization actions to ensure their child's immunization status was complete. Health knowledge, particularly immunization, could be obtained through formal education or health education and health promotion. Research conducted in Rwanda states that parental knowledge about vaccination is not an essential factor in vaccination coverage (25). The low level of public knowledge and understanding of the scientific basis of immunization does not affect

immunization coverage due to a high level of belief that immunization is essential and a solid intention to give immunizations despite the lack of knowledge (26). Another important factor influencing the provision of immunization is the belief of parents that vaccination is suitable for children's health and can prevent disease, thus creating a willingness for parents to provide services to their children to get protection (27).

The findings of this study reveal that women with a child are more likely to complete their children's immunization. The result of multivariate analysis revealed no relationship between the number of children under 5 and routine immunization completeness. This study corroborates previous studies conducted by Istriyati (28), states that there is no relationship between the mother's number of children and the completeness of the baby's immunizations. Mothers who wish to immunize their children are affected not by their number but by their level of knowledge and information on the completeness of immunization.

The findings of this study showed that mothers who have antenatal care visit ≥ 10 times are associated with complete routine immunization. This finding is in line with the study conducted by Etana and Deressa (29) which stated antenatal care follow-up is a factor significantly associated with complete immunization. Various factors can influence a person's decision to use maternal and child health services, particularly antenatal care. One such factor is motivation to check her pregnancy by antenatal care visit.

In this study, we found that residence had a significant link with the completeness of immunization. This finding is in line with previous studies in some countries (13, 30, 31) that showed a significant relationship between urban dwelling and completeness of immunization. Immunization can be done at Integrated Healthcare Centers, public health centers, hospitals, doctors or midwife's offices, and even mobile public health centers. In urban areas, health service providers are extensively scattered so that people can quickly secure vaccination for their children. With this, the completeness of immunization for children in urban areas is higher than in the rural setting while in rural area, here is a tendency towards limited distribution of immunization because of geographical barrier.

There are some limitations in our study. This study is a cross sectional survey, therefore, it is difficult to identify the causal mechanism of routine immunization and its risk factor. Secondly, this study used secondary data so that only a limited number of variables are available such as age, education, number of children, antenatal care visit, access to health services, place of residence, place of birth, and birth attendant. There are several variables that have not been included in the study. These are economic status, birth order, quality of training services, mother's knowledge and external factors (vaccine refusal). We do not use these variables due to limited data.

Conclusion

The findings of this study reported that immunization completeness is still low (10%). Mother's age, antenatal care visit, access to health care, residence and place of birth were all significantly associated with the completeness of routine immunization in children. Mothers aged ≤ 21 have a greater chance of obtaining a complete child immunization status than mothers < 21 . It is recommended that governments to improve the completeness of routine immunization for children. It could be by providing assistance, supervision, and education regarding reproductive health education among women.

Ethical Consents

The Research Ethics Committee has passed this study. The ethics research number: 083/UN9.FKM/TU.KKE/2021 by Public Health Faculty, Sriwijaya University.

Acknowledgment

We want to extend our gratitude to the Indonesian Ministry of Health Research and Development Agency for using data from the 2018 Basic Health Research.

Financial support

The study received no funding for this research.

Competing Interests

The authors declare that they have no competing interests.

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