

Using a mobile application (“PrimaKu”) to promote childhood immunization in Indonesia: A cross-sectional study

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Nani Nurhaeni*^{ORCID}, Siti Chodidjah^{ORCID}, Robiyatul Adawiyah^{ORCID}, and Astuti^{ORCID}

Abstract

Background: Universal immunization coverage among children in Indonesia is low compared to the global target. Many children in Indonesia are not fully immunized as recommended by the government, which results in a high mortality rate. The government has developed a mobile application (PrimaKu) to provide information on vaccinations and reminder features. However, the successful use of the immunization features of the app has not been widely studied.

Objective: This study aimed to evaluate the use of PrimaKu on maternal attitudes toward immunization and complete basic immunizations status among Indonesian children aged 12 to 24 months.

Methods: A cross-sectional research was conducted at a public health center in West Java Province, Indonesia, from August to December 2020. Convenience sampling was used to select the respondents. Data were collected using validated questionnaires and analyzed using binomial logistic regression.

Results: A total of 119 mothers were included. About 44.5% of children had a complete basic immunization status. Mothers who had a supportive attitude toward immunization were 3.58 times (95% *CI* 1.49-8.57, *p* 0.003) more likely to complete the basic immunization, and those who used the mobile app were 3.23 times (95% *CI* 1.18-8.87, *p* 0.034) more likely to complete the immunization.

Conclusion: Using the PrimaKu mobile application could increase maternal attitudes toward immunization and complete basic immunization status. Therefore, public health nurses should provide comprehensive education and improve mothers' literacy to use the application.

Keywords

attitudes; immunization; child; mobile application; nursing; Indonesia

Immunization is one of the most economic preventive measures to date, preventing 2 and 3 million children each year (UNICEF, 2019), particularly in developing countries, where availability and access to vaccines and antenatal services are somewhat limited (World Health Organization [WHO], 2020). Unfortunately, many young children failed to get the immunizations they were supposed to. As a result, more children are at risk of measles, polio, and other vaccine-preventable diseases (UNICEF, 2019). The Diphtheria, Tetanus, and Pertussis vaccine (also known as DTaP) is frequently used as a general evaluation of

immunization due to its ability to indicate how easily routine immunization services can be accessed. It was estimated that 85 percent of people worldwide had received their third dose of diphtheria, tetanus, and pertussis vaccine (DTP3) in 2019. This is an increase from 72 percent in 2000 and only 20 percent in 1980 (WHO, 2019).

In Indonesia, children are required to receive immunizations through a program known as universal immunization coverage (Ministry of Health of Indonesia, 2018). About 57.9% of children are completely immunized as recommended by the government; this is much lower

Department of Pediatric Nursing, Faculty of Nursing, Universitas Indonesia, Indonesia

Corresponding author:

Dr. Nani Nurhaeni, S.Kp., MN

Department of Pediatric Nursing, Faculty of Nursing, Universitas Indonesia. Jl. Prof. Dr. Bahder Djohan, UI Depok Campus, West Java 16424 – Indonesia
Tel. (021) 78849120
E-mail: nani-n@ui.ac.id

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than the country target of 93% (Ministry of Health of Indonesia, 2018). The detail of universal immunization coverage for each immunization was 79.1% for HB-0, 87.6% for BCG, 75.6% for DPT-HB 3, 77% for Polio 4, and 82.1% for Measles. Therefore, the average universal immunization coverage was deficient (57.9%), far from the national target above 93% of universal immunization coverage (Ministry of Health of Indonesia, 2018). In addition, many provinces still have universal coverage under this percentage, including the Province of West Java, with low universal immunization coverage (89.27%) (Ministry of Health of Indonesia, 2018).

Although access to vaccination is often a problem, acceptance is also a factor in vaccination uptake, influenced by social-economic factors and individuals' emotions, experiences, attitudes, and beliefs about vaccination (Wilson, Bakkabulindi, et al., 2016; Larson, 2018). There are three distinct poles of anti- and pro-vaccination: some people are pro-vaccination, while others only accept some, and those who do not at all (Larson et al., 2014). Individuals who express doubts and concerns about vaccination have been shown to have lower vaccination uptake (Damjanovic et al., 2018), which may have a significant impact on vaccination coverage and increase the risk of outbreaks (Smith et al., 2017). Unvaccinated people are at a higher risk of illness and negative health effects, but under-vaccinated people are at a higher risk of more serious outbreaks (Omer et al., 2008; Salathé & Bonhoeffer, 2008; Phadke et al., 2016).

Several mobile phone applications have been developed in low- and middle-income countries (LMICs) to address health problems, such as immunization, tuberculosis, and Malaria. In LMICs, mobile phones are used by 97 out of 1000 people (USAID, 2003), reaching out to rural communities that initially had very little engagement with public organizations and private companies (Stansfield et al., 2006). mHealth, including vaccine details portals and smartphone applications (hereinafter referred to as apps), has been researched by several private and public organizations to aid vaccination uptake. A systematic review published in 2015 on the design of vaccination reminder apps examined two studies on mobile reminder apps (Abahussin & Albarrak, 2016). These apps provide various features to assist health care professionals, caregivers, and, in some cases, children in accessing vaccine-related information, prescribed immunization schedules, storing vaccination records, and receiving appointment reminders. In many LMICs, the use of text messages and registrations to locate those who failed to receive immunization is being used to combat increasing levels of vaccine non-delivery (Bangure et al., 2015; Domek et al., 2016; Haji et al., 2016; Kazi et al., 2018). It has been proven that these interventions help complete vaccinations (Schlumberger et al., 2015; Haji et al., 2016; Uddin et al., 2016).

PrimaKu application is a health application intended for mothers to make it easier to monitor children's growth and development. One of its features is the immunization

schedule feature, which provides information related to immunization, compiles an immunization schedule, and provides a reminder system to carry out immunization according to an arranged plan (PrimaKu, 2018). Thus, the application can play a role in increasing coverage and fostering positive attitudes towards universal immunization coverage programs. However, the successful use of the immunization schedule feature of the application has not been studied in Indonesia.

Public health nurses have a critical role in ensuring all children have up-to-date immunizations as recommended by the World Health Organization (WHO) and ensuring that the children's growth and development are monitored. Therefore, assessing the utilization of this mobile application could provide useful information as a starting point for public health nurses to encourage all Indonesian women to utilize it. This study aimed to evaluate the use of the PrimaKu mobile application on maternal attitudes toward immunization and completed basic immunization status among Indonesian children aged 12 to 24 months.

Methods

Study Design and Setting

Cross-sectional research was conducted at a public health center in West Java Province, Indonesia, from August to December 2020. Public health centers are government-mandated community health clinics located across Indonesia. They are supervised by the Indonesian Ministry of Health and are responsible for providing healthcare at the sub-district level. West Java Province is located on Java Island that is close to the Capital city of Indonesia, Jakarta. West Java consists of 17 regencies and nine cities. This study was specially conducted in urban areas considering that smartphone use is more common among mothers who live in urban areas.

Participants

The inclusion criteria of the participants in this study were mothers who had a smartphone and children aged 12 to 24 months. The sampling method employed was convenience sampling. The sample size was calculated using G-Power Software version 3.1.6 (Faul et al., 2007) using the Z test assumed to be $\alpha = 0.05$, odds ratio = 2 (medium effect size), power level = 0.80. Therefore, the total minimum sample that should be recruited was 88. However, a total of 119 mothers agreed to join in this study.

PrimaKu application

The PrimaKu mobile application (<https://www.primaku.com/>) was developed by the government through the Indonesian Pediatric Association (IDAI). It is a health application designed specifically for parents. The purpose of this application is to enable all parents and physicians to take an active role in monitoring children's growth and development on a regular basis to detect growth and developmental disorders early. The features of PrimaKu are more engaging and user-friendly for parents. The following

are the most important features that are currently available: 1) growth (growth charts, nutrition recommendations); 2) development (developmental questionnaire); 3) vaccination (IDAI and PPI schedule); 4) at least 200 health-related articles; 5) integration of child health data from the PrimaKu

app into the “PrimaPro” app (Figure 1). The PrimaKu application is an open access app and can be downloaded freely for mobile phones and tablets via Google Play (Android) or the App Store (IOS) by searching for PrimaKu in the search field.

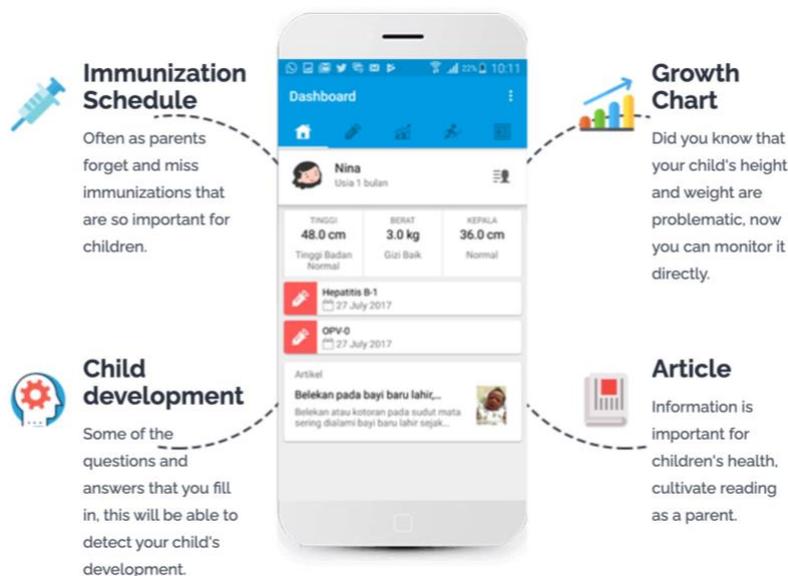


Figure 1 PrimaKu application (<https://www.primaku.com>)

Measures

The demographics questionnaire contained such questions as age, marital status, level of education, number of children, work status, and health-seeking facilities. The use of the PrimaKu mobile application was defined if they used the app for at least 12 months. Immunization status was categorized as complete or incomplete. Complete immunization was defined based on the WHO definition, “a child in the 12–23 months of the age group who has received a single dose of BCG vaccine, three doses of DPT, hepatitis B and Haemophilus type b, three doses of polio vaccine (excluding the dose given shortly after birth) and the first dose of measles” (WHO et al., 2009).

Attitudes toward immunization were adapted from Wilson, Atkinson, et al. (2016). Attitude is a parent's perspective that influences behavior in giving immunization to their children based on their stance and belief in immunization. The better the mother's attitude in supporting immunization, the greater the chance for the mother to comply with the process of giving child immunization. The questionnaire consisted of six items with a Likert scale to measure attitude in giving immunization to children based on their stance and belief in immunization. Permission to use the instrument was obtained prior to translation. This instrument has been translated from English to Bahasa Indonesia and then translated from Bahasa Indonesia to English. It consists of four stages: translation into a different language, back-translation by an expert panel, preliminary testing, and cognitive interviewing to follow (WHO, 2016).

This approach aims to produce final English translations of the Indonesian tool that are semantically identical across all target cultural backgrounds. Expert judgment was carried out by four experts (three Ph.D. in Nursing Community and one pediatric consultant) in the field of immunization in children in Universitas Indonesia. The content validity index ranged from 0.76 to 0.81. The reliability tested was carried out by distributing and analyzing the questionnaire to the 50 mothers not included in the study sample. In the current study, Cronbach's Alpha was 0.76.

Data Collection

A closed-ended, web-based survey was applied to collect the information on demographics, the use of the PrimaKu mobile application, complete coverage immunization status, and maternal attitude toward immunization. During the entire procedure, Google Form was developed by the authors. If the survey was already completed, the program automatically resolved the probability of double participants by denying two or more access permissions from the same e-mail address to the study. The survey took about five to ten minutes to complete on the internet.

Data Analysis

The standard deviation of the mean (SD) was added for continuous data, while frequency and percentage were used for categorical variables. The non-significant test using Kolmogorov–Smirnov test showed that the data were distributed normally for maternal attitude. Chi-square and

student *t*-test were used to compare demographic characteristics, immunization status, and maternal attitude toward immunization between those who completed and not completed immunization recommendations. Binomial logistic regression to identify the relationship between the use of PrimaKu and attitude toward immunization with complete immunization status. It was considered significant if the *p*-value was less than 0.05. SPSS 20 version was used to record and evaluate the data.

Ethical Consideration

Ethical approval from the ethical committees of the Faculty of Nursing, University of Indonesia, was obtained prior to data collection (SK-246/UN2.F12. D1.2.1/ETIK 2020). In addition, a detailed consent form was given to the studied participants before collecting data. The information

collected was confidential and saved on a separate drive that only the management team could access.

Results

Participants were 119 mothers who have children aged 12 to 24 months from the public health center in West Java Province, Indonesia. About 44.5% of children had a complete basic immunization as recommended by the government, and 55.5% did not have a full basic immunization status. Those who had a complete basic immunization were more likely to have children more than 3. While, there were no significant differences between those who had complete or incomplete basic immunization status in terms of maternal age, marital status, education level, and working status (Table 1).

Table 1 Demographic characteristics comparison between those who used PrimaKu mobile app and those who did not use (*n* = 119)

Variable	Immunization status		<i>p</i> -value
	Complete, <i>n</i> = 53 (%)	Incomplete, <i>n</i> = 66 (%)	
Maternal age , mean±SD	30.97±4.48	32.57±4.96	0.107
Marital status			
Married	48 (90.6)	60 (90.9)	0.316
Divorce/Widow	5 (9.4)	6 (9.1)	
Education level			
Below senior high school	25 (47.2)	31(46.9)	0.285
Above senior high school	28 (52.8)	35 (53.1)	
Number of children			
1-2	40 (75.5)	59 (89.4)	0.022
More than 3	13 (24.5)	7 (10.6)	
Working status			
Employed	46 (86.8)	56 (84.8)	0.121
Unemployed	7 (14.2)	10 (16.2)	

Table 2 shows the relationship between the use of PrimaKu and maternal attitude on complete immunization status. Findings showed a significant relationship between maternal attitude and the use of the app on basic immunization status. Mothers who had a supportive attitude

toward immunization were 3.58 times (95% *CI* 1.49-8.57, *p* 0.003) more likely to complete basic immunization, and those who used the mobile app were 3.23 times (95% *CI* 1.18-8.87, *p* 0.034) more likely to complete basic immunization.

Table 2 The relationship between the use of PrimaKu and maternal attitude with complete immunization status (*n* = 119)

Variable	Immunization status		OR (95% <i>CI</i>)	<i>p</i> -value
	Complete, <i>n</i> = 53 (%)	Incomplete, <i>n</i> = 66 (%)		
Maternal attitude				
Supporting	48 (90.6)	60 (90.9)	3.58 (1.49-8.57)	0.003
Not supporting	5 (9.4)	6 (9.1)		
Using PrimaKu				
Yes	25 (47.2)	31 (46.9)	3.23 (1.18-8.87)	0.034
No	28 (52.8)	35 (53.1)		

Discussion

This study found that the achievement of basic immunization status for under-five-year-old children in West Java Province was 44.5% and 55.5% not covered by basic immunization status. This achievement has a slightly

lower difference from the 2018 immunization data, namely 57.9%. This can be due to the tendency of mothers who do not have an awareness of the importance of immunization and an understanding of information on the location and schedule of immunization their children need (Hailu et al., 2019). In addition, the high percentage of immunization

coverage could be due to participants were included in the Family Hope Program (FHP) monitored by the Indonesian Ministry of Social Affairs. They complied to do vaccination because they receive financial support, especially for the continuation of family health. However, the findings of this study could not represent West Java Province due to the small sample size.

This study indicated that mother attitudes in supporting immunization programs in West Java Province were relatively high and significantly associated with completed immunization status. This is in line with the results of other studies, which explain that a person's views and attitudes regarding immunization in their children will provide an overview of the tendency of parents to provide complete and on-schedule immunization (Febriastuti et al., 2014; Atkinson et al., 2019). A supportive attitude towards immunization can grow from the exposure of the parents to information related to immunization. In this study, it is identified that mothers who are informed about the immunization are the mothers who have taken advantage of PrimaKu immunization features. The function of the immunization schedule feature of the app is to provide a reminder of the immunization schedule, provide information on current immunization that has not or have already been immunized, and access information on immunization details that are adjusted to the age of each child (Burgess et al., 2017).

Providing complete immunization information in PrimaKu encourages mothers to immunize their children. The results of other studies found that 80% of respondents state that information about immunization from mobile applications was the main source of information (Burgess et al., 2017). This is due to the fact that the correctness of the information can be justified, and this information rectifies various myths about immunization that exist in the community. The existence of doubts about immunization causes parents to seek reliable information to help differentiate fact and fiction (Seeber et al., 2017). A study has shown that information that emphasizes the risk of disease due to not being immunized can be an effective promotional method to increase the intention and motivation to immunize (Nyhan et al., 2014).

This study found a significant relationship between mothers having under-5-year-old children who use and do not use the PrimaKu immunization feature. This is in line with several studies which reveal that mobile applications that carry immunization themes can increase immunization coverage (Bangure et al., 2015; Domek et al., 2016; Haji et al., 2016; Kazi et al., 2018). The use of applications on mobile devices has been proven to raise concerns about immunization and support the success of immunization programs (Wilson, Bakkabulindi, et al., 2016). Immunization-related mobile applications contain accurate information about immunization and children's health to answer misinformation rife on the internet to social media. The successful use of mobile applications in increasing immunization coverage is supported by increasingly sophisticated mobile devices. Today's mobile devices, with

the help of the internet and Web 2.0 platforms such as mobile applications, are slowly changing the ability of the general public to make crucial decisions regarding individual health (Bartfay & Bartfay, 2016). The existence of various components of the intervention in mobile applications that aim to provide information related to immunization to parents can effectively increase knowledge and increase the intention to provide immunization to children (Fadda et al., 2017). Technological interventions have shown promising results regarding the timeliness of vaccination because nearly everyone's mobile devices have them and are easy to use.

This study also found no significant relationship between the age of the mother and complete immunization status, which is consistent with previous studies (Chiabi et al., 2017; Mbengue et al., 2017). A non-significant correlation could be affected by the mother's age in the early adulthood group (≤ 35 years old) and the majority of whom have lived separately from their parents. At that time, there is often psychological unpreparedness in making decisions in family life, including the decision to give immunization or not to their child (Hasibuan & Sinambela, 2020). However, several studies stated that the mother's age was positively and significantly influenced immunization coverage (Mohamud et al., 2014; Harmasdiyani, 2015; Legesse & Dechasa, 2015). The early adulthood group already had mature thinking, experience, and a better understanding of the dangers of disease threats (Harmasdiyani, 2015). These experiences could influence mothers to take actions that focus more on children's welfare and more sensitive to healthy lifestyles, one of which was to support basic immunization programs for their children.

The limitation of this study was the difficulty in finding respondents using PrimaKu. In addition, this study also did not look at specific immunization features in the PrimaKu application nor see the advantages and disadvantages of the application from the user's point of view. However, this can be used as an area for further study to improve users' comfort and the success of childhood immunization in Indonesia.

Conclusion

The findings of this study highlighted the low coverage of basic immunization among children under five years in West Java Province. Furthermore, there was a significant relationship between mothers' attitudes toward immunization and the use of the PrimaKu mobile application with complete basic immunization status. Therefore, the need for advocacy from the government is recommended to implement a policy on the use of the application to support increased complete basic immunization coverage. Public health nurses should also provide comprehensive training to improve the literacy of mothers to use the application so that more parents can experience its benefits. For further study, it is suggested to replicate the study by using more and varied respondents.

Declaration of Conflicting Interest

All authors declare no conflict of interest in this study.

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Authors' Contributions

Data collection: NN. Data analysis and interpretation: NN, SC. Drafted the article: NN, RA, AA. Critical revision of the article: NN, SC, RA, AA. All authors agreed with the final version of the article.

Authors' Biographies

Dr. Nani Nurhaeni, S.Kp., MN is an Associate Professor at the Pediatric Nursing Department, Faculty of Nursing, Universitas Indonesia, Indonesia.

Siti Chodidjah, S.Kp., MN is a Senior Lecturer at the Pediatric Nursing Department, Faculty of Nursing, Universitas Indonesia, and a PhD Candidate at Thammasat University, Thailand.

Ns. Robiyatul Adawiyah, S.Kep is a student of Master Nursing Program, Faculty of Nursing, Universitas Indonesia, Indonesia.

Astuti, S.Kep.,Ns is a student of Master Nursing Program, Faculty of Nursing, Universitas Indonesia, Indonesia.

Data Availability Statement

The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

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