

Factors associated with the use of the Indonesia COVID-19 mobile app: What needs to be improved for the future personal mobile health app?

Yuyun Umniyatun¹, Izza Suraya¹, Emma Rachmawati¹, and Mochamad Iqbal Nurmansyah^{2*}

¹Faculty of Health Sciences, Universitas Muhammadiyah Prof. Dr. Hamka, Indonesia

²Faculty of Health Sciences, Universitas Islam Negeri Syarif Hidayatullah Jakarta, Indonesia

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Corresponding author:

Mochamad Iqbal Nurmansyah

Faculty of Health Sciences, Universitas Islam Negeri Syarif Hidayatullah Jakarta,
Kertamukti Road Tangerang Selatan 15412, Indonesia

Email: iqbalnurmansyah@uinjkt.ac.id

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Abstract

Background: Personal mobile health applications, including the COVID-19 mobile app, offer various benefits for enhancing the effectiveness of health programs.

Objective: This study aimed to investigate and compare the factors associated with the utilization of the Peduli Lindungi COVID-19 mobile application, employing the behavioral theory of the Health Belief Model (HBM).

Methods: This cross-sectional survey study, conducted at the Department of Public Health in two universities in South Jakarta, Indonesia, involved 744 respondents. The independent variables were derived from the Health Belief Model (HBM), including components such as perceived vulnerability, severity, benefits, obstacles, and self-efficacy. The dependent variable was the use of the COVID-19 mobile application.

Results: The majority of respondents, with an average age of 19.9 years, were female. Out of the total, 51.9% (386 individuals) used the PL application in the past seven days, albeit not on a daily basis, and 86.6% utilized the application to access public facilities. Non-users primarily cited a lack of necessity due to not having traveled in the last seven days. The variable of perceived usefulness was significantly associated with application use ($p < 0.001$).

Conclusion: There is a need for increased public education regarding the application's benefits. Furthermore, the safe entrance system feature of the app, utilized for accessing public spaces, could be consistently employed to monitor and prevent the transmission of infectious diseases, including COVID-19.

Keywords: COVID-19; mobile health; public health surveillance; health belief model; mobile app; Indonesia

Background

Contact tracing also known as partner notification is a primary means of controlling infectious diseases (Armbruster & Brandeau, 2007). The process of contract tracing, with an emphasis on quarantine and isolation, has been previously used to control diseases such as tuberculosis, Middle East Respiratory Syndrome, and Severe Acute Respiratory Syndrome Coronavirus (Armbruster &

Brandeau, 2007; Glasser et al., 2011; Ki et al., 2019). In the context of the COVID-19 pandemic, it allows for the identification of new cases as SARS-CoV-2 transmission is highest among close contacts such as household members (Bi et al., 2020). Furthermore, contact tracing can be performed manually or using an application. The manual method greatly relies on the ability of the confirmed cases to recollect who they have been in contact with, or their willingness to disclose such information

(Akinbi et al., 2021). New technology-based methods have been considered to fill the gap in the identification of contacts, especially when case detection is aggressive (Ferretti et al., 2020).

Indonesia is one of the countries that has been severely affected by the pandemic, and the delta variant of COVID-19 has continued to cause an escalating crisis, making the country Asia's new pandemic epicenter (Dyer, 2021). Furthermore, countries across the globe are leveraging advancements in mobile technology and the Internet of Things (IoT) to aid traditional manual contact tracing to track individuals who have come in close contact with identified COVID-19 patients (Shahroz et al., 2021). In April 2020, the Ministry of Communications and Informatics launched mHealth application for COVID-19 contact tracing called Peduli Lindungi (PL) (Sujarwoto et al., 2022)

As in other countries, the government is making efforts to control the spread of the case by utilizing information technology through the PL application. This application is aimed at supporting the government's health surveillance efforts in combating the COVID-19 pandemic with its various functions in tracing, warning, and fencing. Some of the features include warning users when they are in a crowd or a red zone, monitoring, downloading vaccine certificates, information on COVID-19 test results, telemedicine, vaccine registration as well as safe entrance system (Peduli Lindungi, 2021). Furthermore, the public uses the PL application which has various other benefits such as showing vaccine certificates when accessing facilities or transportation, checking in/checking out, showing COVID-19 test results, registering COVID-19 information on vaccination statistics and travel requirements during the pandemic, as well as information related to telemedicine (Badan Pusat Statistik Republik Indonesia, 2022). Presently, the government has implemented a modification to the Peduli Lindungi application, which has been rebranded as the SatuSehat application. The application serves as a platform for system liaison, facilitating the integration of individual health data across various healthcare facilities. This integration is achieved through the utilization of electronic medical records, which promote interoperability of health data by means of standardization and digitization. The aspiration is that the application can be utilized by the community to achieve a state of

well-being and optimal health (Kementerian Kesehatan Republik Indonesia, 2023)

Previous researches noted the importance of the use of mobile apps during the COVID-19 pandemic. Mobile applications are widely recognized as a valuable resource for individuals, healthcare practitioners, and policymakers in addressing the significant challenges presented by the pandemic. These challenges include alleviating the strain on healthcare facilities, facilitating access to reliable information, monitoring individuals' symptoms and mental well-being, and identifying novel predictors (Kondylakis et al., 2020). Moreover, it is indicated that a significant proportion of COVID-19 applications primarily focused on contact tracing and symptom monitoring. Nevertheless, the efficacy of these applications is contingent upon their adoption by the community (Singh et al., 2020)

However, a national survey stated that around 21% of respondents did not use the care-protect application (Badan Pusat Statistik Republik Indonesia, 2022). In the Indonesian context, various studies have been conducted regarding the factors associated with using the COVID-19 application but the majority only used theory to assess technology adoption (Andriani & Winarno, 2022; Ferary et al., 2022; Matt et al., 2022). However, the majority of studies employed theories that adopt a technological standpoint, such as the technology acceptance model (TAM), the unified theory of acceptance and use of technology (UTAUT), and the information system success model (ISS). Nevertheless, the utilization of said models solely captured the incorporation of technology from a technological standpoint, encompassing factors such as the efficacy and user-friendliness of the Internet, as well as individuals' attitudes towards its utilization. Hence, it is imperative to conduct a comprehensive analysis of the utilization of health-related online platforms, taking into account the interplay between cognitive processes, attitudes, and behaviors. Additionally, it is crucial to consider individuals' subjective assessment of their psychological well-being in relation to their perceived health condition (Ahadzadeh et al., 2015)

Therefore, it is considered that analysis of technology adoption can be conducted through the application of the Health Belief Model (HBM). Several prior studies have used HBM as theoretical

basis for examining the adoption of mobile health app. A prior investigation that using HBM in analyzing the adoption of health mobile app demonstrated that the perceived benefits and self-efficacy serve as crucial factors that influencing the adoption of mobile health applications for COVID-19 (Alharbi et al., 2022). Another study demonstrated that perceived health risk and health consciousness positively impacted health-related Internet usage (Ahadzadeh et al., 2015).

This study used HBM theory as a basis which previously study stated that the model has provided a useful theoretical framework for investigating the cognitive determinants of a wide range of behaviors for over three decades (Orji et al., 2012). This is to facilitate the exploration of factors related to the use of the care-protected application not only from the perspective of the performance but also one's belief in the threat and the consequences of a disease, the positive potential of a preventive behavior, as well as perceived barriers and the ability to carry out preventive behavior. Therefore, this study aims to 1) describe the reasons for using and not using the application and the features most frequently used among the users and 2) describe and compare the score of factors that related to the use of the PL application among COVID-19 mobile app users and non-users in Jakarta, Indonesia.

Methods

Study Design

This is a cross-sectional survey study with an exploratory approach was performed at the public health department of two universities in South Jakarta, Indonesia.

Samples/Participants

The minimum sample size was determined based on the formula proposed by Krejcie and Morgan wherein the minimum sample size is 313 for a significance level of 0.05 in a population of 1646. The participants were selected by the non-probability convenience sampling method. Convenience sampling is a sampling technique that involves selecting samples based on their convenient proximity to a specific location or availability on the Internet (Edgar & Manz, 2017). The inclusion criteria for the sample is public health students at two universities and the exclusion criteria is students who are in leave of absence.

Therefore, the samples consisted of 744 public health program students from semesters 1 to 8 at two universities in Jakarta, Indonesia.

The Microsoft Form-based online questionnaires were shared and distributed to the participants with the assistance of 8 research assistants through class WhatsApp group. Before completing the questionnaire, the purpose and scope of the study were explained to prospective respondents in the explanation statement. Only those who approved the informed consent were permitted to continue with the questionnaire and there were no consequences for those who declined to participate.

Instrument

The questionnaire was divided into several sections, the first part contains questions related to the characteristics of the respondents including age, college level, place of residence, and use of the application including frequency, mostly used features, and reasons for using or not. The next section contains questions related to factors associated with the use of the PL application which was adopted from the theory of the health belief model. This model is one of the most widely used theories in health behavior study, and its components include perceived susceptibility, severity, benefits, barriers, and cues to action (Melzner et al., 2014). In this study, perceived susceptibility comprising 4 questions relates to a person's perceived vulnerability to being exposed to COVID-19, while perceived seriousness with 5 questions is related to a person's perception of the severity caused by COVID-19. Moreover, perceived benefit with 8 questions is associated with the benefits that a person can receive, while perceived barrier comprising 3 questions is related to barriers for someone to use the application. The answer to the question is on a Likert scale from 1 to 5, indicating strongly disagree to strongly agree.

Related to the development of the instrument, questions for perceived severity and perceived seriousness were adopted from previous research (Hendarmin et al., 2021). Later, questions for reasons for using or not using the app, features of the app, perceived benefits, and perceived barriers were developed based on the previous literature (Indonesia Baik, 2023; Kondylakis et al., 2020; Nurmansyah et al., 2022). Prior to data collection, the instrument has been reviewed by the health

informatics expert and be tested to 30 samples with the same characteristics of the respondent's sample to obtain readability and test the validity and reliability of the instrument. It was then measured for reliability by calculating Cronbach's α . The Cronbach's α for perceived susceptibility, severity, benefits, barriers, and self-efficacy/frequency of using questions were, 0.621, 0.662, 0.802, 0.713, 0.649. The reliability value shows an acceptable and high reliability value (Taber, 2018).

Data Analysis

The data were analyzed using statistical software SPSS Version 22. Descriptive statistics were used to show the frequency as well as percentage of respondents' characteristics and application usage behavior. Furthermore, the Kolmogorov-Smirnov test was performed to determine the normality distribution of the independent variable data. The Kruskal-Wallis test was used to identify the significant difference in the mean rank score of independent variables among respondents based on application usage behavior including daily use, not daily use, and not using the app. The test was used because the dependent variable was not normally distributed and this study aimed to compare differences between the three independent aforementioned groups. An

association with a 95% confidence interval and a p-value of .05 was considered significant.

Ethical Considerations

Throughout the study, confidentiality and anonymity were maintained, while ethical approval was received from the Universitas Muhammadiyah Prof. Dr. Hamka Ethical Commission under number 03/22.07/01968.

Results

The average age of the respondents was 19.9 years (Mean: 19.9 ± 1.3 , min: 17, max: 23) with the majority or 86.6% being female. More than half at $n=517$, or 69.5% live in Jakarta and Tangerang Raya, while 386 or 51.9% used the PL application in the last week but not every day as shown in **Table 1**.

Table 2 shows that the majority or 86.6% stated that they used the application to access public facilities, while 37.7% use it to find information related to COVID-19 and services related to handling the pandemic. Furthermore, the most used features are safe entrance system of accessing public facilities and showing vaccination certificates, namely 93.8% and 61.4% respectively.

Table 1 Respondents' characteristics and the application usage behavior (N= 744)

Category	n (%)
Age (years)	
18-20	268 (36.0)
>20	476 (63.9)
Sex	
Female	644 (86.6)
Male	100 (13.4)
Semester	
2	170 (22.8)
4	183 (24.6)
6	232 (31.2)
≥ 8	159 (21.4)
Residence Location	
Tangerang Raya	270 (36.3)
Jakarta	247 (33.2)
Bogor	72 (9.7)
Depok	69 (9.3)
Bekasi	64 (8.6)
Outside Jabodetabek	22 (3.0)
Using PL in the last week	
Yes, every day	62 (8.3)
Yes, not every day	386 (51.9)
Not using the PL application in the last week	296 (39.8)

Table 2 Reason for using the application and frequently used features (N = 448)

Reasons for using the application	n	%
Access public facilities	388	86.6
To stay informed regarding COVID-19 and related services	167	37.3
Controlling the spread of COVID-19	77	17.2
Minimize transmission to others	42	9.4
Minimize transmission to yourself	40	8.9
Create electronic health alert card and travel information	8	1.8
View vaccine certificates	4	0.9
Frequently used feature		
Safe entrance system	420	93.8
Shows the COVID-19 vaccine certificate	275	61.4
Shows the results of the COVID-19 test	89	19.9
Register for the COVID-19 vaccination	84	18.8
Looking for information regarding the latest COVID-19 case statistics	52	11.6
Looking for information regarding antigen/PCR test sites	40	8.9
Find out the latest travel regulations (rules).	27	6.0
Find out information related to health care services for COVID-19	24	5.4
Find out information about telemedicine	20	4.5
Making electronic health alert cards (e-HAC)	16	3.6

Table 3 shows several reasons stated by respondents for not using the PL application. The most cited reason by 19.9% was that they were not traveling as they felt no need to use the app and their mobile phones were not compatible with the

application. Besides, several other reasons stated include the PL application crashes often, runs too slow, is unimportant, and because the data security, as well as management, cannot be trusted.

Table 3 Reasons for not using the application (N = 296)

Reasons for not using the application	n	%
Do not feel the need to use the application because are not traveling	59	19.9
My cellphone is not compatible to use the PL application	59	19.9
The PL application crashes frequently	42	14.2
The PL application is too slow	25	8.4
The PL application is not important	22	7.4
I am not familiar with the use of the PL application	21	7.1
Don't believe in data security	20	6.8
The PL application is not effective in helping to tackle COVID-19	19	6.4
I do not have enough data plan to use the PL application	16	5.4
The information generated by the PL application is not accurate	15	5.1
The PL application is too heavy	12	4.1
Do not trust the government	10	3.4

Table 4 shows that the average respondent ranged between disagreeing and neutral about being vulnerable to COVID-19 (2.97 ± 0.896) and that there will be a spike in the future (2.10 ± 0.827). They also disagreed that COVID-19 has a serious impact on young people. The average respondent's answers were also between disagree and neutral on questions associated with the benefits of the PL application. However, they disagreed with several obstacles related to using the application, such as the Government using personal data in the application disproportionately or that other parties

use data illegally. Furthermore, respondents also felt they did not know the various features and their uses (2.12 ± 0.741).

Table 5 shows that there are no differences in perceived vulnerability, seriousness, barriers, and self-efficacy among daily, non-daily, and non-users of the application. Meanwhile, there is a significant difference in terms of perceived benefits with p-value < 0.001 among daily, non-daily, and non-users of the COVID-19 mobile application.

Table 4 Factors associated with the use of the PL application

Statement	Mean	SD
Perceived of susceptibility		
I feel vulnerable to contracting COVID-19 at this time	3.25	0.961
I feel that my area is vulnerable to the transmission of COVID-19	3.14	0.941
I feel that my colleagues (students) are vulnerable to contracting COVID-19	2.97	0.896
I am worried that in the future there will be a spike in COVID-19 cases in Indonesia	2.10	0.827
Perceived of seriousness		
COVID-19 is a serious disease for teenagers	2.44	0.861
COVID-19 can cause death for teenagers	2.57	0.867
COVID-19 is more severe than any other disease	3.07	0.877
COVID-19 will continue and be dangerous in the future	2.85	0.907
COVID-19 is having a serious impact on my health	2.39	0.806
Perceived of benefit		
The PL application provides the information I need	2.28	0.727
The PL application provides accurate information	2.48	0.722
The software application provides updated information	2.48	0.720
The PL application supports me in preventing the transmission of COVID-19	2.40	0.765
The PL application supports the community in preventing the transmission of COVID-19	2.24	0.755
Notifications related to nearby COVID-19 cases can be useful for me	2.24	0.722
Perceived of barrier		
The PL applications crash frequently	3.12	0.916
I'm concerned that governments are using data in the PL application disproportionately	2.55	0.953
I'm worried that there are other parties who can steal information on the PL application	2.25	0.903
I am worried that there are companies or other parties who use the information in the PL application	2.31	0.915
Self-efficacy		
I have knowledge of the PL application features	2.12	0.741

Table 5 Bivariate analysis of factors associated with the use of the PL application

Variable	Daily user		Non-daily user		Non-users		p
	Median	Mean Rank	Median	Mean Rank	Median	Mean Rank	
Perceived susceptibility	12	386.0	11	371.0	11	371.7	0.873
Perceived seriousness	13	364.0	13	362.1	13	387.9	0.279
Perceived of benefit	15	434.3	13	335.1	13	310.2	<0.001
Perceived barrier	10	381.2	10	366.0	10	379.1	0.688
Self-efficacy	2	389.9	2	370.0	2	372.1	0.757

Discussion

These results indicate that there are significant differences in the perception of application usability between users and non-users. The users scored higher on the usefulness aspect of the application in providing various useful information in efforts to prevent COVID-19 compared to non-application users. Several previous studies have also shown that perceived benefits are a significant factor related to the use of COVID-19 applications (Matt et al., 2022; Nurmansyah et al., 2022; Walrave et al., 2020).

In this study, the most common benefit of using the PL application was to access public facilities by using

safe entrance feature. The Indonesian government through the Ministry of Home Affairs made regulations regarding the obligation to use the application to effectively screen all visitors to public facilities. The application will show notification status to local officials when the owner enters a public facility. The status is in the form of green, yellow, red, and black where green means already vaccinated twice and not infected with COVID-19. The yellow color implies that the person just received the first dose of vaccination and is not infected, while red means not yet vaccinated at all or no vaccination status registered in the PL system, and not infected with COVID-19. Meanwhile, black indicates not yet vaccinated at all or vaccination status not recorded and currently infected with COVID-19 (Peduli

Lindungi, 2021). Consistency is needed for officers at public facilities to check the PL application for people who want to access public facilities.

However, there are several reasons for respondents not using the application as the majority felt that it is not important. According to previous studies, most of the answers expressed by respondents who were unsure about using the application were that they needed more information related to how the application works and its use (Jones & Thompson, 2021). Therefore, it is necessary to educate the public regarding how the application works and its benefits for the community.

Another obstacle is that the application often experiences interruptions and compatibility issues with their devices. This result is consistent with a previous study which stated that limited gadget capabilities prevent the respondents from using the PL application (Aji & Puspitasari, 2022). Furthermore, the Ministry of Health revealed that some of the disturbances people often experience in the PL application are related to personal and vaccine receipt data (Kementerian Kesehatan Republik Indonesia, 2021).

This study only captures the use of the PL application in groups of adolescents, hence, the variable vulnerability to COVID-19 in terms of severity was almost similar considering that older age groups feel more vulnerable (Perrotta et al., 2020). Similar studies are needed in a wider group of people to describe differences in each age group.

Conclusion

This study found that the majority of respondents used the application to obtain access to public facilities, find information about COVID-19, and utilize pandemic response services. The respondents did not use the app because they did not travel and it was incompatible with their phone. Meanwhile, there is a significant difference between daily, non-daily, and non-users of the COVID-19 mobile application in terms of perceived benefits of the app. The findings of this study suggest that there exist notable disparities in the assessment of application usability between individuals who have experience using the application and those who do not. Therefore, the community needs to be educated especially about the benefits of the mobile health

application. Furthermore, checks by officers at public facilities are needed to discipline the public in using the safe entrance system from the application, while improvements in the context of software performance must also be ensured consistently.

Declaration Conflicting Interest

The authors have no conflicts of interest to declare.

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Author Contribution

YU, MIN responsible for study conception and design, data collection, analysis and interpretation of results, and manuscript preparation. IS responsible for analysis and interpretation of results, and manuscript preparation. ER responsible for manuscript preparation.

Author Biography

Yuyun Umniyatun is a Lecturer at the Faculty of Health Sciences, Universitas Muhammadiyah Prof. Dr. Hamka, Indonesia.

Izza Suraya is a Lecturer at the Faculty of Health Sciences, Universitas Muhammadiyah Prof. Dr. Hamka, Indonesia.

Emma Rachmawati is a Lecturer at the Faculty of Health Sciences, Universitas Muhammadiyah Prof. Dr. Hamka, Indonesia.

Mochamad Iqbal Nurmansyah is a Lecturer at the Faculty of Health Sciences, Universitas Islam Negeri Syarif Hidayatullah Jakarta, Indonesia.

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