Perspectives of The Community Regarding Electronic-Based Dengue Vector Surveillance in the COVID-19 Pandemic

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ABSTRACT

Background: *Penjaga is a google form-based application that helps families share their weekly larva monitoring data online. A study of community perceptions of the Penjaga application needs to be carried out to see the advantages and barriers to its implementation. This study measures the response rate and the public's perception of the online larva monitoring application.*
Method: *The study used a cross-sectional design. Data were collected through an online survey involving 284 households in RW 3 and 7 in the South Rejowinangun Village, Magelang City, Central Java Province, in 2021. The online questionnaire includes questions about demographic information, perceptions of the application (convenience of use, duration of use, appearance, and benefits for preventing dengue), barriers to use, and suggestions for application improvement. Data analysis was done descriptively using the Product-Moment correlation statistical test.*
Results: *Most respondents (59.5%) were female and 56.3% had completed their senior high education. Most of the respondents were in their pre-retirement and middle-aged. An average response rate of 86.3 % indicated that the family answered the application questions satisfactorily. The response rate dropped by 5.8 % when the health cadres released the application assistance. The community views the Penjaga application as user-friendly, quick, easy to use and learn, practical, and fascinating. The three most common challenges are the lack of respondents' cell phone data quota and familiarity with Android devices. This study encourages health cadres to use the app, especially for elderly and non-mobile phone-owning families.*

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Article History
Received 27 July 2022
Revised 20 September 2022
Accepted 22 October 2022
Available Online 29 November 2022

Keywords
Dengue
Vector surveillance
GIRIJ
Perception
Online monitoring

DOI
10.14710/jpki.18.1.25-33

INTRODUCTION

Dengue Haemorrhagic Fever (DHF) is one of endemic vector-borne diseases that can potentially cause outbreaks in Indonesia.[1] The national DHF Incidence Rate (IR) in 2019 was 51.53 per 100,000, increasing to 26.1 and 24.75 per 100,000 in 2017 and 2018. The IR of DHF for Central Java Province was lower in 2019 (25.9 per 100,000 people) than the national IR, despite an increase of 21.6 and 10.2 per 100,000 people between 2017 and 2018.[2] Magelang City is the region with the highest DHF IR in 2017 and the second highest IR in 2018 in Central Java Province. The incidence rate in Magelang City in 2018 decreased compared to that in 2017 (54.3 per 100,000). However, in 2019, there was an increase in IR of 61.4 per 100,000 population from 41.25 per 100,000 population in the previous year.[3] Controlling the vector population is crucial for preventing the disease since Aedes sp mosquito bites are the primary way dengue is spread.[4] The rapid expansion of dengue transmission in the community is associated with dengue vector habitats from domestic water containers in residential areas.[5] Therefore, weekly mosquito larval surveillance is essential to monitor the vector population and identify any potential transmission risk early. One Larva Monitor Officer Program / *Gerakan Satu Rumah Satu Jumantik* (G1R1J) is a family approach from the Indonesian government to reduce DHF incidence by increasing empowerment and community involvement in dengue vector management through The Eradication of Mosquito Nests (*PSN 3M Plus*) activities. The G1R1J movement has been encouraged by the Ministry of Health of the Republic of Indonesia, but the implementation requires further community participation to succeed.[6] The GIRIJ program needs families to independently check, monitor, and eradicate mosquito larvae. The results of larva monitoring are entered weekly into the larva monitoring manual form. Health cadres as regional coordinators recapitulated larvae-free numbers index from the Neighborhood Unit (*RT*) and Community Unit (*RW*) to village levels and reported monthly to the health officer. The regional

coordinator is also confirming the larva monitoring data from the household by conducting field inspections using a sampling method in each Neighborhood Unit.[7]

During the COVID-19 pandemic, the Indonesian government implemented several local and national policies to control population mobility, prevent the increase and break the chain of COVID-19 transmission. Through the Circular Letter of the Directorate General of Disease Prevention and Control of the Ministry of Health number HK.02.02/IV/2360/2020, the Government also released rules regarding the procedures for implementing prevention and control of DHF in the COVID-19 pandemic situation. According to the guideline, households are responsible for controlling dengue vectors inside home independently. The PSN 3 M Plus activities and the use of household pesticides are two methods that each family can put the G1R1J into practice.[8] Therefore, it is essential to educate the community about the relevance of G1R1J and its application in society.

The COVID-19 control policy influences the community's larva monitoring system. In many countries, routine mosquito vector surveillance and control programs are suspended or stopped during ongoing lockdowns.[9–11] The pandemic obstructs the control and prevention of dengue because public health workers and community participation focus on preventing COVID-19.[12] The health cadre of larva monitoring officer (*Jumantik*), whom the District Office previously assigned to monitor GIRIJ activities to the family routinely, cannot access every household to monitor mosquito breeding sites.[7] This situation makes health workers' reports on the monitoring of larvae for managing vector surveillance data insufficient due to barriers to visiting houses, which caused the dengue vector surveillance process to be disrupted during the pandemic era. The online application for reporting the monitoring larvae data is an approach for determining the community's role in monitoring and notifying authorities of the surveillance results.[13,14] The reporting of the larvae-free index is affected by the limited ability of *Jumantik* cadres to observe mosquito larvae directly and to complete the monitoring form manually. As a result, an alternative online reporting system is required, allowing families to report the data of independent larvae monitoring.

The Penjaga application is a Google Form-based application created to facilitate online larva monitoring reports by families. Every week, each family uploads the findings of its larva monitoring in their home by completing the application. The application provides information on the type and the number of indoor and outdoor water containers with Aedes sp larvae in each house. Additionally, the Penjaga application records family members' frequency of vector control activities at each water container. The output of the Penjaga application is weekly data on larva-free numbers index at the Neighborhood Unit to Neighborhood Unit levels and the number of households actively participating in G1R1J. The Penjaga application pilot project implementation was conducted in Magelang City. A study of public perceptions of the Penjaga application needs to be carried out to see the advantages and barriers to its performance. This study aims to assess the response rate and perception of the community of the online larva monitoring application during the COVID-19 pandemic to provide information for the DHF control program, particularly for community dengue vector surveillance activities.

METHOD

The study used a cross-sectional design. Data collection was carried out in the South Rejowinangun Village, Magelang City, Central Java Province, in 2021. Three Community Units in the South Rejowinangun Village (RW 3, 5, and 7) were selected based on the number of dengue cases and the larvae-free index from the Magelang City Health Service data in the last two years. The research population includes all families in the South Rejowinangun Village, Magelang City. The sample selection used the total sampling method on families living in the selected RW. The respondents were at least 15 years of age, able to read, have an Android smartphone, lived as a permanent resident in the research area for at least the last six months, and were willing to participate in research activities. The exclusion criteria were respondents who were unable to communicate.

The Penjaga application was applied for 14 weeks in the study area. The Jumantik coordinator at the Neighborhood Unit level assists the household in filling out the Penjaga application during week 1 through 12, particularly in elderly groups or families without smartphones. Health cadres did not help respondents fill out the application in weeks 13 and 14. The response rate for using the application was measured every week based on the %age of families who filled out the application compared to the total number of respondents. Data on community perception were collected through an online survey. The online perception questionnaire includes questions about demographic information (gender, age, educational background), perceptions of the application (convenience of use, duration of using it, appearance, and benefits for preventing dengue), barriers to use, and suggestions for application improvement. The maximum number of questionnaire responses that each respondent may submit is one. The research team used the earliest questionnaire responses that had already been received on the data server as primary research data. Validity and reliability testing was conducted on 34 people. The validity test revealed that seven of the ten questions were

valid. Three misleading questions were fixed. According to the reliability test, a Cronbach's Alpha value of 0.675 was obtained in the moderate reliability group. The results of the validity and reliability analysis showed that the questionnaire used in the study was valid and reliable.

The respondents' informed approval before completing the online survey confirms their willingness to participate voluntarily. Data analysis was done descriptively using a statistical correlation test. The Health Research and Development Agency's Ethics Committee approved this study through letter LB.02.01/2/KE.031/2021, dated February 19, 2021.

RESULTS AND DISCUSSION

A total of 284 respondents filled out the online perception questionnaire. Table 1 shows the characteristics of the respondents who participated in the online survey. Figure 1 displays the responses from the household during the Penjaga online application implementation. From Table 1, most respondents (59.5%) were female, and 56.3% had completed their senior high education. Most of the respondents were in their pre-retirement and middle-aged.

From Figure 1, the average response rate from households on the Penjaga application implementation was 86.3 %. Response rates of the community ranged from 89.8% to 86.8% when the respondents received health cadres' guidance. Based on the perception questionnaire data, most respondents (91.5%) said they would be willing to complete the application each week. In comparison, 4.6% said they would be ready to provide it, 3.5% said they would not, and 0.4% said they would be very reluctant to do otherwise.

Table 1. Demographic characteristics of respondents in Magelang, 2021

Variables	n (284)	%
Gender		
Male	115	40.5
Female	169	59.5
Age Group		
15-24 (young age)	9	3.2
25-34 (early workers)	41	14.4
35-44 (middle-aged)	77	27.1
45-54 (pre-retirement)	77	27.1
55-64 (retirement)	60	21.1
65-80 (elderly)	20	7.0
Background Education		
Never went to school	1	0.4
Did not finish elementary school	4	1.4
Elementary school	31	10.9
Junior High School	59	20.8
Senior High School	160	56.3
College	29	10.2

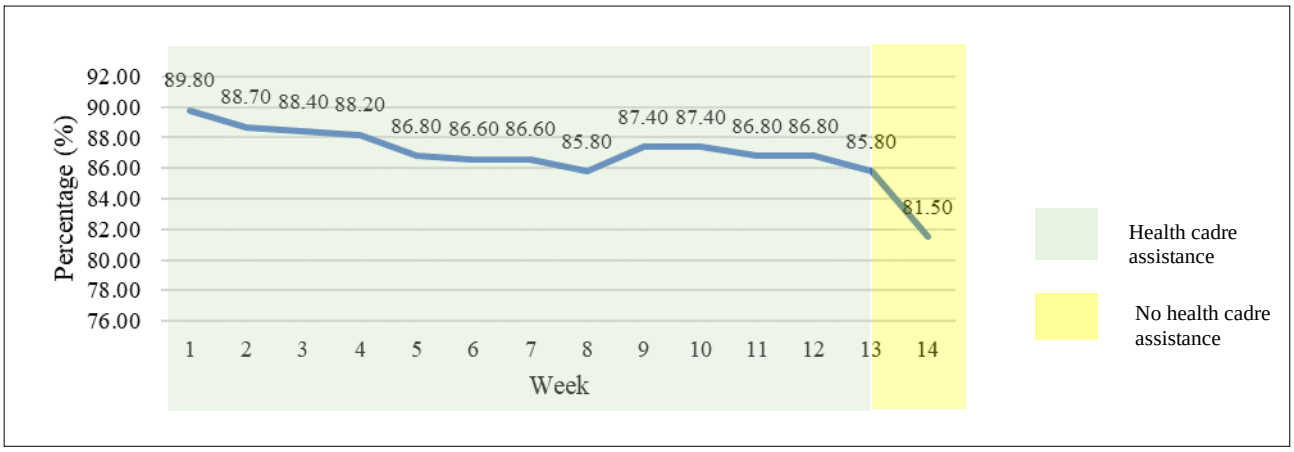

Figure 1. Family response in filling out the Penjaga application in Magelang City in 2021

Table 2. Community responses to the Penjaga application in South Rejowinangun Village, 2021

Variable	n (284)	%
The difficulty level of filling out the application		
Very easy	41	14.4
Easy	222	78.2
Difficult	21	7.4
Language of application		
Very easy to understand	32	11.3
Easy to understand	244	85.9
Difficult to understand	8	2.8
Interpreting output information		
Very easy	32	11.3
Easy	244	85.9
Difficult	8	2.8
Application filling time		
Very quick	26	9.2
Quick	240	84.5
Long time	18	6.3
Application interface		
Very attractive	12	4.2
Attractive	263	92.6
Not attractive	9	3.2
The benefits of the application in dengue prevention		
Very helpful	40	14.1
Beneficial	243	85.6
Useless	1	0.4

This study showed that the community is expected to complete the Penjaga Application independently. According to the survey's findings, 78.9% of the respondents can fill out the application without the assistance of cadres, compared to 15.1% who are unwilling and 6.0% who are incredibly willing. A larva monitoring form is a G1R1J tool for reporting vector surveillance. Family members' inconsistent completion of the manual form every week is the main obstacle to GIRIJ implementation.[15] According to a study conducted in Tangerang City, communities with high endemic DHF incidence had the lowest compliance rates for filling out monitoring forms.[16] The Penjaga application can be an alternative method to increase families' response in reporting the free larvae index to the health officer. The active participation of families in G1R1J can be seen in the %age of families who submit data to the Penjaga application. Family response rate data can be monitored regularly by the village head and Primary Health Care (PMC), which can be used to make local policies related to community participation to prevent dengue transmission.

Community participation in the study sites in filling out applications is quite good. After the health cadres stopped assisting with the application, there was a slight decrease in community response, dropping by 5.8 % from 86.6 to 81.5 %. Health cadres are a reinforcing factor for community dengue vector control behavior.[17] According to the study conducted in Pekanbaru City, health cadres can help the community by providing a system of information for GIRIJ and PSN activities.[18] The Penjaga application is a recent innovation that needs community adaptation before it can be used regularly. Before conducting the research, health cadres in the study area received training on GIRIJ, empowerment assistance, and application instruction. Therefore, a trained cadre is supposed to be able to encourage households to appropriately carry out PSN behaviors and self-monitoring of larvae at home while also assisting community members with application instruction.

Table 2 shows the community responses to the Penjaga application in the study location. According to Table 2, the majority of the respondents were able to complete the online form accurately. The Penjaga application is simple, the language and the information are easy to understand, and it only takes a short amount of time to complete. Most respondents thought the application's appearance was attractive, and 85.6% said it contributed to dengue prevention in their neighborhood. Based on the research, the community generally accepts the use of Penjaga for online larva reporting. The public readily accepts online programs that use basic hardware in the digital era. In general, most adults and children are accustomed to using smartphone applications during the

COVID-19 pandemic. Smartphones are used as a communication tool for understanding and assessing school or work assignments in situations where social restrictions on community activities existed. Google Form is the application most frequently used for online evaluation. A study in Semarang City found that Google forms are more practical, quick, and effective for general users.[19] Along with Google Docs, Google Slides, and Google Sheets, the Google Form application is available in Google Drive. The google form app can process survey response data and quickly present it in graphic format.[20]

In this study, a google form application was created for the online collection of family larvae monitoring data. Cadres do not need to visit people's houses because the findings of online reporting can provide figures and data on larva-free numbers (ABJ). Families can track weekly changes more easily in the development of the larva-free number data since the data is provided as a graph. Families can report the status of the dengue vector larvae index any time and from their homes by submitting a Penjaga application. Additionally, the respondents positively perceived the benefits of the Penjaga for dengue prevention efforts. The study's findings are similar to Budiharjo et al., in that a mosquito larva monitoring system based on android reported 89 % relevance, 66 % accuracy, 80 % timeliness, and 86 % ease of access when used in the neighborhood.[21] The use of an online monitoring system is recommended during the COVID-19 pandemic. Novitasari's study also stated that independent larva monitoring by family members during the pandemic would prevent the potential of COVID-19 transmission from house visits by larva monitoring personnel. Reporting method also simplifies the multilevel routine reporting process from the RT level to the level above.[13] According to studies conducted in Central Java, the use of mobile applications for monitoring larvae provides data on locations that may be vulnerable to the risk of dengue fever based on the density of the larvae. The visual technique of the display makes it more attractive so that app users can quickly understand the transmission risk data in their neighborhood.[22]

Figures 2 to 4 illustrate the distribution of the respondents based on the ease of filling out the Penjaga application by gender, age group, and education level.

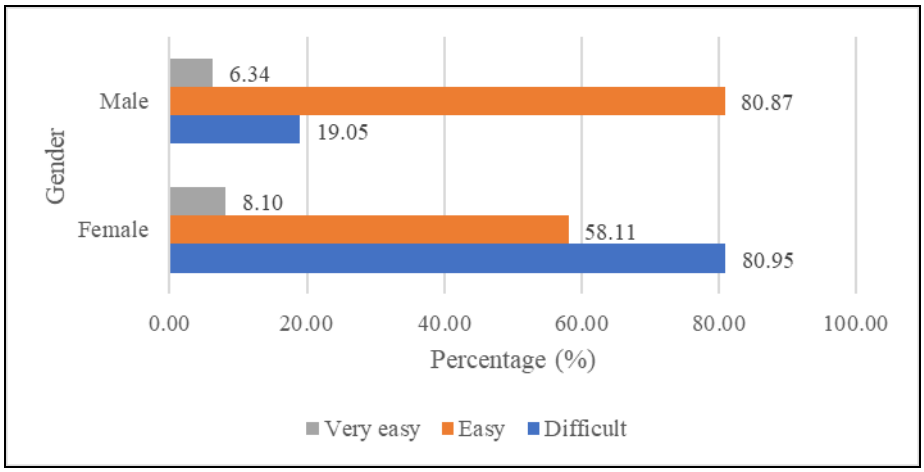

Figure 2. Distribution of respondents in the ease of filling out applications by gender in South Rejowinangun Village, 2021

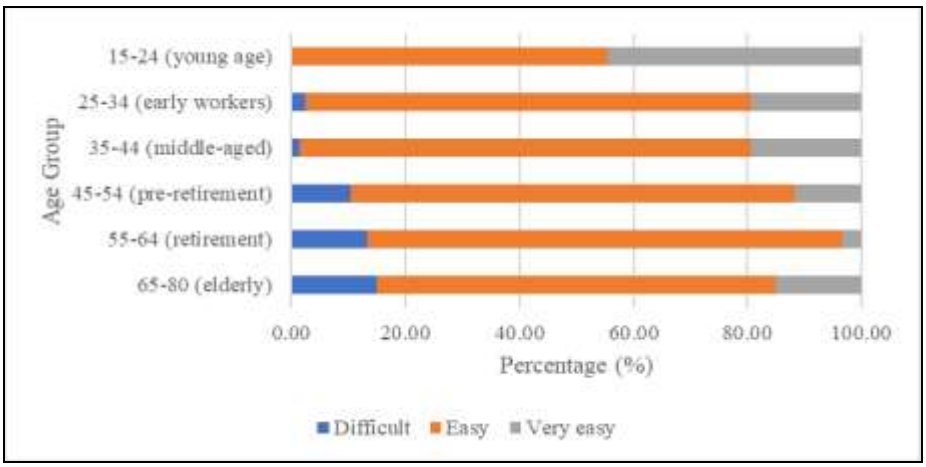

Figure 3. Distribution of respondents in the ease of filling out applications by age group in South Rejowinangun Village, 2021

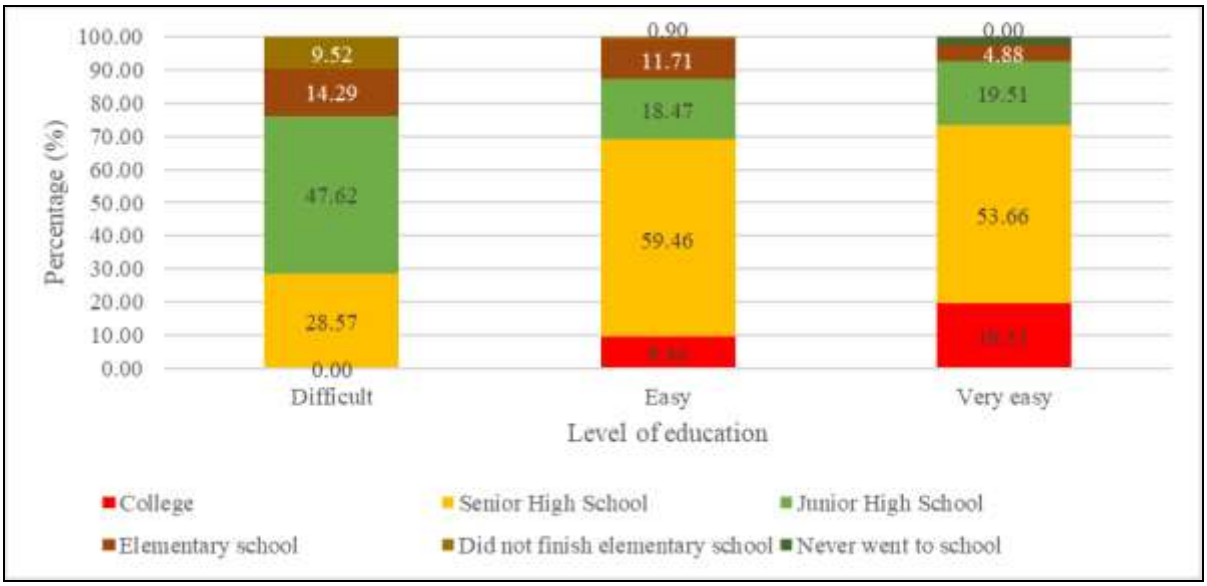

Figure 4. Distribution of respondents in the ease of filling out applications according to the level of education in South Rejowinangun Village, 2021

Based on Figure 2, the application proved more challenging to use for the female group. This finding is interesting regarding the general perspective that empowerment of dengue vector control initiatives reflects women's caregiving roles.[23] The usage of online applications improves the contribution of male family members in supporting housewives with GIRIJ vector control activities at home. Male family members are responsible for reporting online larvae, so the entire family can cooperate to complete GIRIJ activities. The result is similar to Aini et al., which stated that using android-based applications can increase the number of new *Jumantik* (larvae monitoring observer staff) for the GIRIJ program. The elimination of mosquito breeding sites implementation is improved by the number of family members participating in house larvae monitoring.[24]

Figure 3 shows that a few of the respondents (7.4%) had a difficulty in filling out the applications, especially respondents of elderly age (65-80 years) and retirement age (55-64 years). Based on educational background, respondents with a junior high school education background found filling out the Penjaga application most challenging than others (Figure 4). The statistical analysis showed a significant correlation (p-value < 0.00) between the application's ease of use and the education level and age group. The elderly group and low-level education group require support in implementing GIRIJ and Penjaga applications. According to Fuadzy et al., the elderly *Jumantik* found it quite challenging to fulfill the manual form due to their weakening sight.[16] Research in China also found that the age group above 65 avoids using mobile applications because most do not know how to use smartphones (85.9%).[25] Studies in Malaysia showed that the low education levels of smartphone users struggle to use more complex features because they lack knowledge or training in advanced technology. They do not care and think it is unnecessary to learn more sophisticated features, as long as they have access to call their friends and relatives for assistance.[26] Table 3 shows the barriers and respondents' feedback to the Penjaga application. The 54.2% of respondents did not experience obstacles in completing the information in the application. The online application was used by each respondent for the first time. Previously, the participants manually filled out the paper-based form for the larva monitoring program and forwarded their data to *Jumantik* cadres. The application's ability to be completed without any difficulties demonstrates the transition of larva monitoring factors from a paper-based format to an online version that is simple to understand and complete by the general public. A qualitative study on Digital Environmental Surveillance System in Dengue Control in Indonesia showed that using a manual system to carry out a paper-based surveillance system requires re-recording and may result in biased data. Writing reports also encountered a variety of challenges, including not being integrated and papers that may be lost, and the challenge to retrieve data. Digital technology is therefore required for carrying out regular and periodic surveillance.[20]

Table 3. Barriers and community suggestions on the Penjaga application in South Rejowinangun Village, 2021

Variable	n (284)	%
Barriers to filling out the application		
No obstacles	154	54.2
No quota data	25	8.8
Don't have a cell phone	24	8.5
Don't understand android phone	23	8.1
Busy	18	6.3
Internet signal/network	15	5.3
The cellphone does not support	11	3.9
Forget to fill out	8	2.8
Don't understand how to fill	5	1.8
Too many questions	1	0.4
Suggestions for the development of the Penjaga application		
Already good	179	63.0
No suggestions	71	25.0
Addition menu application	13	4.6
Simplification of questions	11	3.9
Interface improvements	4	1.4
Support assistance for persons without cell phones or who are unable to use them	2	0.7
It makes charging easier when offline	2	0.7
More socialization	1	0.4
A reminder alarm	1	0.4

The data from the paper-based larva monitoring form must be entered into a table that is organized by week, habitat type, the presence of larvae, and the location of water containers. Paper-based larva monitoring forms are generally dominated by black and white colors because the form is reproduced by photocopying documents. The Penjaga app only allows the entry of one variable per display. This means that the respondent can only move on to the following question if all the variables have been completed. Presentation per display makes it simpler for responders to fill out the variables in order and ensures the accuracy of data. Utilizing color in the application helps to reduce respondents' boredom when they re-use it.

The most common barriers are no data quota, not having a cellular phone (cell phone), and the respondents not understanding the basic manual operation of an android phone. Most respondents (63%) said that the application was interesting, while others suggested adding menus to the application (4.6%) and simplifying questions (3.9%). The study results are in line with Perdani et al., who stated that an android application has the benefits of being highly efficient, simple to use, affordable, and capable of monitoring, recording, and tracking the location of the breeding site for Aedes larvae. However, mobile applications have limitations, including requiring users to have a working internet connection and a system that requires a minimum digital memory capacity. Certain groups who struggle with inadequate technology infrastructure need help from local healthcare workers.[27]

Generally, this study has showed that the community has a good perception of the Penjaga application's use in supporting GIRIJ. Communities benefit from this application by getting quick and simple access to nearby information about the state of the larval index. Health cadres can facilitate the community during filling out the data of the larva monitoring if they have trouble using the Penjaga application, primarily because they have no smartphones, have a poor network, or are in the elderly group. According to the health belief model, perceived barriers and benefits were the most significant predictors of preventive health behavior.[28] People will be motivated to engage in preventive behavior if they have fewer obstacles and can personally relate to the advantages of the suggested preventive actions. From the study results, the community perceives that the Penjaga application positively impacts on the prevention of dengue in the home environment, so they can actively participate in the elimination of mosquito breeding places and larva monitoring activities. The Penjaga application provides a larva-free index from Neighborhood Unit to Village levels so that all families can measure the risk of dengue transmission in their neighborhood. In addition, larva-free index information from Penjaga also determines the success of elimination of mosquito breeding places that the community has carried out so far to reduce mosquito populations.

CONCLUSION

The community member responded satisfactorily to the application questions with an average response rate of 86.%. Respondent response rates decreased by 5.8% when the cadre provided assistance to the community. The community perception showed that the Penjaga application is user-friendly, quick, simple to use and understand, helpful, and engaging. The three most frequent obstacles are the respondents not having a cell phone, inadequate data quotas, and low knowledge of how android smartphones operate. This study recommends health cadres to use the application, particularly for elderly and families not having a mobile phone.

ACKNOWLEDGMENTS

We would like to express our gratitude to the Director of National Institute of Health Research and Development, the Director of the Institute of Vector Reservoir Control Research and Development, the Director of the Magelang City Health Service and staff, the Director of the Magelang City Health Center and staff, the Director of the South Rejowinangun Village and staff, the health cadres of the South Rejowinangun Village, the IVRCRD data collection teams, and all individuals who have helped with the implementation of research activities.

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