

Original Research

Android-based Mobile Rapid Health Assessment in the Disaster Emergency Response Phase



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Article Info	Abstract
Article history: Received: 09 August 2023 Accepted: 29 October 2023	<i>Introduction:</i> Rapid health assessment (RHA) is an assessment during the disaster emergency response phase that requires a fast, precise, and accurate time so that the damage caused by the disaster and immediate needs of disaster victims can be recognized. Rapid assessment with manual forms will prolong the process of needs assessment and analysis. Android-based RHA applications are made to facilitate rapid assessment so that the type of assistance needed can be determined as soon as possible. The purpose of the study was to create an android-based RHA application, test the validity and usability of the application, and test it on application users. <i>Methods:</i> This research was conducted using a Research and Development design divided into two stages. In stage 1, the application was created, and five experts tested the validity and reliability. Stage 2 was socialization and application trials on 30 disaster volunteers in Lamongan. In this stage, the usability of application was measured by the System Usability Scale. <i>Results:</i> The application components had good validity (I-CVI=1) and reliability (Cronbach's alpha=0.768). The usability score showed that 84.3% of the users considered the application easy to operate, 83.67% stated that the menu display and features were easy to use, 80% stated that it was comfortable, 81.3% were satisfied with the application features, and 85.7% stated that the application was helpful in disaster. <i>Conclusion:</i> The RHA application is valid, reliable, and usable for general use for rapid health assessment in the disaster emergency response phase.
Keywords: android, disaster, emergency response, rapid health assessment	

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INTRODUCTION

Major disasters and emergencies debilitate individuals' security, well-being, and welfare worldwide. Each year, millions of individuals are influenced by disasters with numerous passings, wounds, and vagrancy. As a result, these disasters and emergencies have a critical effect on people's lives [1].

Within the past ten years, several disasters have caused numerous casualties which affected the welfare and safety of individuals worldwide. Indonesia is one of the foremost disaster-prone nations since it is geologically found within the assembly zone of the world's significant plates, namely the Eurasian, Indo-Australian, Pacific, and Philippine plates which have a series of volcanoes throughout the Asia-Pacific or called "Ring of Fire." The zone or region between the plate meeting and the volcano series (forearc) has active faults that make Indonesia a country prone to natural disasters such as earthquakes, tsunamis, volcanic eruptions, and landslides [2].

Many disasters have happened in Indonesia over the past four years. From 2016 to 2019, there were 2,302 occasions with 3,161,231 individuals affected and uprooted, 2,853 events with 3,674,168 individuals affected and uprooted; 2,572 occasions with 10,333,309 individuals affected and uprooted; and 721 occasions with 186,204 individuals affected and evacuated. As of August 2023, there have been 996 disaster events in Indonesia. These statistics show that there are a large number of people affected and evacuated by recent disasters in Indonesia [3], [4]. In East Java, throughout

2022, there were 212 disasters, and up to August 2023, 127 disasters had occurred. In Lamongan Regency, from 2017 to 2022, there have been 34 disasters [3].

Ideally, the rapid health assessment response provides organizations with the information they need to coordinate disaster relief quickly, reliably, and without bias, covering all types of standard and unique needs experienced by disaster survivors [1]. Rapid assessment response aims to understand better the needs and problems of people influenced by a disaster within one to two weeks. It may be a doable and fast elective to conduct a point-by-point evaluation of the issues and needs of each influenced person. Rapid needs assessment should be distinct from post-disaster health research. [5]. When disasters occur, a quick and effective response is essential to help communities, reduce casualties, and mitigate economic impacts [6]. Properly evaluating and tending to the well-being needs of influenced population conveniently is necessary, as community versatility depends on mental working [7]. In addition, rapid assessments can be valuable in deciding behavioral well-being needs in case local health and medical systems are overpowered or disturbed by the catastrophe and cannot give this data [8].

Disaster needs assessments are often ineffective and slow after a major natural disaster, leading to inefficient and uncoordinated responses [9]. Conducting a rapid assessment response in a disaster can cause several challenges for health workers and disaster volunteers, including identifying and reaching target populations, collecting field groups, and securing funding and ethics

review board approval [10]. Another critical challenge that can ruin fast arrangement of assessment teams is the need for existing assessment tools to assess influenced individuals [8]. Although it is recommended that health workers or disaster volunteers develop questions used in pre-disaster activities [11], this is only sometimes possible.

In 2015, research on creating a website-based RHA application was conducted in Aceh Province [12]. However, this application was still not widely used nor downloaded because it was a website, not an Android application. In this study, the researchers sought to create an information system to accelerate and improve the accuracy of disaster data in the rapid health assessment (RHA) response phase using android mobile. On the other hand, Information and Communication Technology (ICT) has proven to have strong prospects in advancing the field of disaster access services [13]. Mobile technology seems promising in improving access and efficiency of healthcare services [14]. Shan [15] used a dynamic, real-time disaster loss assessment model based on social media data. Experiments using actual data from the Jiuzhaigou earthquake were conducted to verify the model, and the results could speed up the process of reporting human loss information at various levels and departments and assess casualties in real time and dynamically.

Based on this phenomenon, a system is needed to produce fast and precise data during disaster emergency response. Android-based RHA is easy to access anywhere and anytime because most people have android phones. This application can be

installed on android-based smartphones, which disaster volunteers and health workers can use. Smartphones are considered advanced gadgets that combine the customary highlights of a cell phone with progressed preparation and computing capabilities that permit clients to get to and run different portable applications [16].

This research aimed to create an android-based RHA application and test the internal consistency reliability, content validity index, and usability of the application so that it can be used by the wider community, especially disaster volunteers.

METHODS

Design

This research used a research and development approach to produce and test certain products [17]. This exploratory research aims to determine or open new areas by designing an information system [12]. This research was conducted in two stages. Stage 1 was the application of RHA development and testing of internal consistency and Individual Content Validity Index (I-CVI) of the application. The second stage was socialization, followed by a test for usability for the user application.

Samples

Stage 1 is application development. Then, the application was reviewed by five experts who have experience in disaster response for more than five years to measure the internal consistency and content validity index of the application.

Stage 2 was socialization, followed by a test for usability on 30 disaster volunteers from various disaster agencies in Lamongan Regency recruited by purposive sampling technique. Inclusion criteria for respondents in the application trial were disaster volunteers in Lamongan Regency who had received disaster education and training, had responded to local or national disasters, and had an android cellphone. Exclusion criteria were disaster volunteers who had never responded to a disaster even though they had received training and or could not operate an android cellphone.

Stage I: Application RHA development

The RHA application development was carried out in June-August 2023. The application development involved IT (information technology), while the RHA application content was reviewed by the researchers together with a team of disaster experts in Lamongan.

The RHA form was adopted from the disaster emergency response assessment form by Muhammadiyah Disaster Management Center (MDMC) and modified by the researchers which included general disaster data (type of disaster, location, time of occurrence, affected area), victims and damage, community conditions (temporary shelter, clothing, food, clean water, sanitation, public facilities, major protection issues in the community, education, and health), information sources, recommendations for emergency response assistance locations. The application content was general so that it could be used in all types of disasters.

The validity tests were carried out with the Individual Content Validity Index (I-CVI) scores. The reliability was tested using internal consistency reliability (Cronbach's alpha). The CVI assessment was carried out by five disaster experts in Lamongan, including one disaster consultant doctor from the Indonesian Ministry of Health and four senior nurses specialized in disaster and HPCRED facilitators. They have also been involved in disaster management for more than five years. The focus Group discussion was done in August 2023 at Universitas Muhammadiyah Lamongan.

Stage II: Socialization and application trials

Application socialization and measuring the effectiveness of the application on users (Disaster institutions in Lamongan) were carried out in September 2023. Disaster volunteers who met the criteria were given informed consent and an invitation to attend the socialization if they wished to become the respondents. Those who agreed to participate in the socialization were included in the Whatsapp group to communicate and remind them of the schedule. The offline socialization and testing of the application were carried out at Muhammadiyah Lamongan University. The respondents were provided with a username and password and were then asked to log in and fill out the application. After all the features and contents of the application were tested, respondents were asked to fill out a questionnaire.

Research Instruments

The instruments used in this research were the RHA application and a questionnaire prepared by the researchers. There are two kinds of questionnaires in this research. The first questionnaire was distributed to five experts to measure the Content Validity Index (CVI) and Individual Content Validity Index (I-CVI) scores. In contrast, the second questionnaire was used for the users.

The questionnaire for experts consists of 19 items about application content. The measurement scale was 1 (Not relevant), 2 (somewhat pertinent and requires many changes), 3 (entirely appropriate, but needs a little modification/change), and 4 (very relevant). In addition, to perceive the extent to which the instrument is understood, a measurement scale of 4 (good/very good), 3 (needs slight improvement), 2 (needs much progress), and 1 (needs improvement/replacement) were employed. The application is acceptable when the I-CVI score equals 1.00 (for categories 3-5 experts). In addition, the reliability test was tested using Cronbach's alpha.

The application trial questionnaire used the System Usability Scale for disaster volunteers consisted of 11 questions about the use of the application: menu, features, and appearance (2), operation (1), comfort (1), convenience (4), functionality and usefulness (3), and usage satisfaction (1). The answer consists of 5 options, including strongly agree (5), agree (4), neutral/no opinion (3), disagree (2), and strongly disagree (1), with a minimum score of 0 and a maximum score of 100. The validity test results of the

questionnaire showed that 11 questions had an r-value of 0.822 - 0.966 ($r_{count} > r_{table}$, $r_{table} = 0.361$), meaning that 11 questions were declared valid. The reliability test results showed Cronbach alpha=0.977, indicating that the questionnaire was reliable.

Data Analysis

Research data obtained from questionnaires filled out by disaster experts were then analyzed using Microsoft Excel to determine the I-CVI score on each question item. At the same time, the data from the questionnaire filled out by the users were analyzed using the SOS formula in the form of percentages and descriptive statistics.

The formula for the SU5S score [18] is as follows:

$$\bar{x} = \frac{\sum x}{n}$$

\bar{x} : mean
 $\sum x$: Total number of Score
 n : Number of Sample

Ethical Clearance

This research proposal was declared ethically feasible by the Ethics Committee of the University of Muhammadiyah Lamongan No. 329/EC/KEPK-S2/06/2023 on June 13, 2023.

RESULT

Application development was started in June 2023. Stage 1 was developing the RHA application starting in June - August 2023, then conducting internal consistency reliability and content validity index tests on

five disaster experts in August 2023 (Table 1). Stage 2 was to test the application to 30 disaster volunteers in Lamongan, including BPBD, MDMC, DMC RSML, LPBI NU, and UMDC (Table 2) in September 2023.

Step 1: RHA Application Development. The RHA application content was adapted from the MDMC RHA paper-based form. Application features include the login menu, dashboard, forms, and results. The menu to be filled in is the "Form," which consists of data on the team reviewing; type, location, and time of the disaster; disaster affected areas; victims and damage; vulnerable groups; temporary shelter; clothing; food; clean water; sanitation; public facilities; major protection issues in the community; education; health; records and information sources.

The results of the validity and reliability tests shown in Table 1 indicated two application contents with an I-CVI of 0.8, namely clothing and education. The experts believed that clothing and education could be reviewed later. Still, they could be included at the end of the display (as supporting data, if possible). The remain of the application contents (17 items) showed that the I-CVI value was 1, meaning that the RHA application was acceptable, and the application has good internal consistency reliability (Cronbach's alpha = 0.768). The application has been tested on 30 disaster volunteers in Lamongan.

Each volunteer filled in the RHA application until they saw the display features of the results of the filling and downloaded the contents of the application in PDF and or Excel format. After that, volunteers were asked to fill out an assessment questionnaire about the RHA application.

The result of the SUS score shows in Figure 1: 87.3% of users stated that the application is easy to understand, 82.6% stated that the menu display is easy to recognize, 84.7% stated that the application is easy to operate, 80% stated that it was convenient, 81.3% stated that they were satisfied with the features, 87.3% stated that the application was proper and by the needs in disaster, 86% stated that the application was easy to learn, 79.3% stated that filling errors could be avoided, 82.6% stated that the application functions as expected. The minimum SUS score was 79.3, and the maximum SUS score was 87.3, with a mean SUS score of 83.9, indicating that the application was excellent (mean score ≥ 80).

The results of the review on disaster volunteers in the conclusion section showed 36.7% of volunteers rated it very good/good, 43.3% of volunteers considered it needed a slight improvement, 1% volunteers considered needed improvement/replacement of items, and 1% volunteer suggested much progress.

Table 1
Validity of RHA Application by Disaster Expert

Content	Expert 1	Expert 2	Expert 3	Expert 4	Expert 5	I-CVI
Review Team Data	3	3	4	4	3	1
Type, Location, and Time of Disaster	3	3	4	4	3	1
Disaster Affected Areas	3	3	4	3	3	1
Victims and Damage	4	3	4	3	4	1
Vulnerable Groups	4	3	4	4	4	1
Temporary Shelter	4	4	4	4	4	1
Clothing	2	4	4	3	1	0.8
Food	3	4	4	3	4	1
Clean Water	3	4	4	3	4	1
Sanitation	3	4	4	3	4	1
Public Facilities	3	4	4	3	4	1
Key Protection Issues in the community	4	4	4	3	4	1
Education	2	4	4	3	1	0.8
Health	3	4	4	3	4	1
Notes and Sources of Information	4	3	4	3	4	1
Overall content of the application	3	3	3	3	3	1
Language used	4	3	4	3	3	1
Use of the app	4	3	4	3	4	1
Recommendation	3	3	3	3	3	1

Table 2
Characteristics of Respondents (User) (n= 30)

Variable	n	%
Gender		
Male	22	73.3
Female	8	26.7
Institution		
BPBD Lamongan*	2	6.7
MDMC Lamongan*	2	6.7
LPBI NU Lamongan*	1	3.3
DMC RSML*	11	36.7
UMDC*	14	46.6

*BPBD ; Badan Penanggulangan Bencana Daerah (Regional Disaster Management Agency),

*MDMC; Muhammadiyah Disaster Management Center,

*LPBI; Lembaga Penanggulangan Bencana dan Perubahan Iklim (Institute for Disaster Management and Climate Change)

*DMC; Disaster Medical Committee Rumah Sakit Muhammadiyah Lamongan (Disaster Medical Committee of Lamongan Muhammadiyah Hospital)

*UMDC;University of Muhammadiyah Lamongan Disaster and Emergency

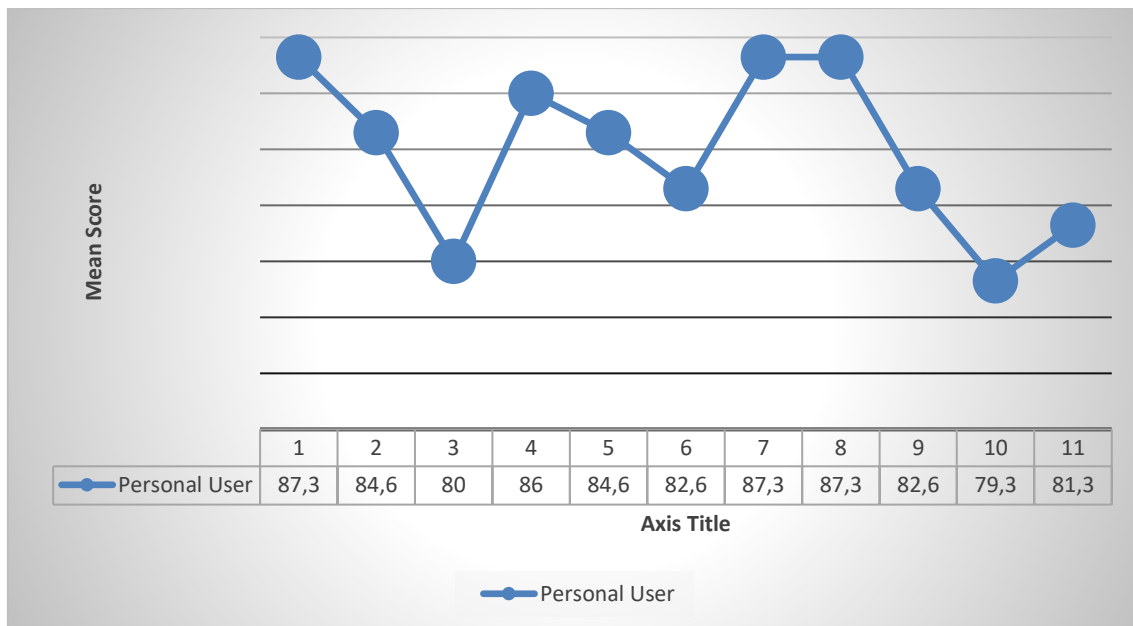


Fig. 1. The mean score of personal user application

DISCUSSION

The RHA application is proven to be valid and reliable for use in conducting rapid health assessments in the disaster emergency response phase. This application is specifically designed for disaster volunteers in Indonesia to assess health quickly to accelerate decision-making about the type of assistance needed by disaster victims. Mobile phone is the primary tool victims require during a disaster while evacuating to a safe place [19].

Previous research has been conducted by creating a website-based RHA application and using different forms [12]. The android-based RHA application makes it easier for volunteers to conduct rapid health assessments during disasters compared to website and paper-based types. Previous research conducted an RHA assessment of the flood disaster in Gresik Regency, East Java,

which used paper-based forms [20]. However, the effectiveness needed to be analysed.

The use of android-based RHA applications is still relatively new. Several mobile/android-based applications have been created to monitor elderly patients with atrial fibrillation [21], oncology patients [22], and post-natal patient care [23]. The android-based RHA application can be used to assess the impact of disasters and the existence of potential threats in the health sector, prove the existence of a disaster emergency, assess capacity in existing emergency response, determine the type of immediate needs, and make recommendations for priority actions in the process of implementing emergency response [24]. Rapid assessment is critical to take the right policy in disaster management and to fulfill the needs of affected communities in disaster areas in terms of quality and quantity [25].

Rapid health assessment in the disaster emergency response phase focuses more on the damage and condition of physical victims, such as damage to infrastructure, as well as victims who are injured, dead, and survived. This RHA application does not assess the psychological condition of disaster victims because the main focus in the emergency response phase is to save lives and prevent victims from increasing. Mental Health Assessment can be carried out in the post-disaster phase which has been researched previously using the rapid behavioral health assessment module on disaster victims who are assessed in person, by telephone, and by website [10].

Widespread use of Android-based RHA applications could facilitate faster assessments and improve our ability to compare outcomes across disaster types and affected populations. Through this system, volunteers and medical teams can quickly assess health needs, refer for medical service if necessary, allocate resources effectively, and accurately target interventions to help promote recovery and the overall well-being of affected communities.

Limitation

This application can only be used when there is internet (cannot be used offline). In addition, this application is still partly in Indonesian, especially in the form-filling section, and cannot be used for cellphones other than Android. Users and passwords are not made independently by the users to avoid pranks. Therefore, volunteers who want to complete the application must contact the

administrator to create a username and password.

Nursing Implication

The results of this study can be used as a reference in the process of rapid health assessment in the disaster emergency response phase as one of the materials studied in disaster nursing. The existence of this application is expected to facilitate the assessment process and data recapitulation so that damage, casualties, and urgent needs can be identified as soon as possible.

CONCLUSION

The RHA application is valid, has good internal consistency, and is usable for rapid health assessment in the disaster emergency response phase. It is proven to be valid and reliable to be used in the broader community, especially disaster agencies and disaster volunteers in Indonesia. The RHA application can also be downloaded through the Play Store and used through an android cellphone. Further researchers can improve the quality of applications accessed offline or without an internet connection.

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REFERENCES

- [1] D. F. Wong, C. Spencer, L. Boyd, F. M. Burkle, and F. Archer, "Disaster Metrics: A Comprehensive Framework for Disaster Evaluation Typologies," *Prehosp. Disaster Med.*, vol. 32, no. 5, pp. 501–514, Oct. 2017, doi: 10.1017/S1049023X17006471.
- [2] BNPB, "Risiko Bencana Indonesia 2023," Jakarta, 2023.
- [3] BNPB, "Data Bencana di Indonesia," 2023. <https://dibi.bnpb.go.id/home/index2> (accessed Sep. 09, 2023).
- [4] V. R. B. Kurniawan, "Pengukuran Nilai Intangible Pada Project Based Organization," *Sci. Tech J. Ilmu Pengetah. dan Teknol.*, vol. 2, no. 1, pp. 106–111, 2016, doi: 10.30738/jst.v2i1.409.
- [5] M. W. G. Bosmans, C. Baliatsas, C. J. Yzermans, and M. L. A. Dückers, "A systematic review of rapid needs assessments and their usefulness for disaster decision making: Methods, strengths and weaknesses and value for disaster relief policy," *Int. J. Disaster Risk Reduct.*, vol. 71, no. January, p. 102807, 2022, doi: 10.1016/j.ijdrr.2022.102807.
- [6] J. H. Park, S. H. Park, and K. A. Kim, "Disaster management and land administration in South Korea: Earthquakes and the real estate market," *Land use policy*, vol. 85, pp. 52–62, 2019, doi: <https://doi.org/10.1016/j.landusepol.2019.03.040>.
- [7] R. Lyerla and D. F. Stroup, "Toward a Public Health Surveillance System for Behavioral Health.," *Public Health Rep.*, vol. 133, no. 4, pp. 360–365, 2018, doi: 10.1177/0033354918772547.
- [8] H. A. Korteweg, I. van Bokhoven, C. J. Yzermans, and L. Grievink, "Rapid Health and Needs assessments after disasters: a systematic review," *BMC Public Health*, vol. 10, no. 1, p. 295, 2010, doi: 10.1186/1471-2458-10-295.
- [9] Y. Khan, B. Schwartz, and I. Johnson, "Surveillance and epidemiology in natural disasters: a novel framework and assessment of reliability.," *PLoS Curr.*, vol. 6, Feb. 2014, doi: 10.1371/currents.dis.6773eb9d5e64b733ab490f78de346003.
- [10] E. Goldmann, D.M. Abramson, R. Piltch-Loeb, A. Samarabandu, V. Goodson, A. Azofeifa, A. Hagemeyer, N. Al Amin, R. Lyerla, "Rapid Behavioral Health Assessment Post-disaster: Developing and Validating a Brief, Structured Module," *J. Community Health*, vol. 46, no. 5, pp. 982–991, 2021, doi: 10.1007/s10900-021-00966-5.
- [11] J. Kuizinaitė, M. Morkūnas, and A. Volkov, "Assessment of the Most Appropriate

- Measures for Mitigation of Risks in the Agri-Food Supply Chain," *Sustainability*, vol. 15, no. 12, p. 9378, 2023, doi: 10.3390/su15129378.
- [12] Y. Rimadeni, "Perancangan Sistem Informasi Berbasis Web Untuk Rapid Health Assesment (RHA) Bencana," *J. Ilmu Kebencanaan Pascasarj. Univ. Syiah Kuala*, vol. 2, no. 2, pp. 79–85, 2015.
- [13] D. Haluza and D. Jungwirth, "ICT and the future of health care: aspects of health promotion," *Int. J. Med. Inform.*, vol. 84, no. 1, pp. 48–57, Jan. 2015, doi: 10.1016/j.ijmedinf.2014.09.005.
- [14] S. R. Steinhubl, E. D. Muse, and E. J. Topol, "The emerging field of mobile health," *Sci. Transl. Med.*, vol. 7, no. 283, p. 283rv3, Apr. 2015, doi: 10.1126/scitranslmed.aaa3487.
- [15] S. Shan, F. Zhao, and Y. Wei, "Real-time assessment of human loss in disasters based on social media mining and the truth discovery algorithm," *Int. J. Disaster Risk Reduct.*, vol. 62, no. June, p. 102418, 2021, doi: 10.1016/j.ijdr.2021.102418.
- [16] N. Koehler, "Healthcare professionals' use of mobile phones and the internet in clinical practice," *J. Mob. Technol. Med.*, vol. 2, no. 1, pp. 3–13, 2013, doi: 10.7309/jmtm.76.
- [17] Sugiyono, *Metode penelitian administrasi*. Bandung: Alfabeta, 2016.
- [18] H. Setiawan, N. Hidayat, A. Farihatun, M. Indriastuti, R. Kurniawan, A. Firmansyah, E. Andarini, Y. D. L. Sandi, "Usability of Mobile Application for Implementing Genetic Counselling Intervention among Thalassemia Patients and Caregivers: A Case Study of Cyber Gen," *Elinvo (Electronics, Informatics, Vocat. Educ.*, vol. 8, no. 1, pp. 130–136, 2023, doi: 10.21831/elinvo.v8i1.55688.
- [19] V. Sukhwani and R. Shaw, "Operationalizing crowdsourcing through mobile applications for disaster management in India," *Prog. Disaster Sci.*, vol. 5, p. 100052, 2020, doi: 10.1016/j.pdisas.2019.100052.
- [20] H. Akbar, S. Ifandi, and M. Paundanan, "Rapid Health Assesment (RHA) Bencana Banjir Di Desa Pranti Kecamatan Menganti Kabupaten Gresik," *Heal. Papua - J. keperawatan dan Kesehat.*, vol. 4, no. 1, pp. 201–206, 2021, [Online]. Available: <http://36.67.90.173/jurnal/index.php/akper/article/view/49>.
- [21] K. Trymbulak, E. Ding, F. Marino, Z. Wang, and J. S. Saczynski, "Mobile health assessments of geriatric elements in older patients with atrial fibrillation: The Mobile SAGE-AF Study (M-SAGE)," *Cardiovasc. Digit. Heal. J.*, vol. 1, no. 3, pp. 123–129, 2020, doi: 10.1016/j.cvdhj.2020.11.002.
- [22] D. J. Lu, M. Girgis, J. M. David, E. M. Chung, K. M. Atkins, and M. Kamrava, "Evaluation of Mobile Health Applications to Track Patient-Reported Outcomes for Oncology Patients: A Systematic Review," *Adv. Radiat. Oncol.*, vol. 6, no. 1, p. 100576, 2021, doi: 10.1016/j.adro.2020.09.016.
- [23] L. Sardi, A. Idri, L. M. Readman, H. Alami, R. Beza, and J. L. Fernández-Alemán, "Mobile health applications for postnatal care: Review and analysis of functionalities and technical features,"

Comput. Methods Programs Biomed., vol. 184, 2020, doi: 10.1016/j.cmpb.2019.105114.

[24] Khambali, *Manajemen penanggulangan bencana*. Yogyakarta: Andi, 2017.

[25] A. Amirudin, S. Maarif, C. S. Marnani, and Wilopo, "Pengkajian Cepat Kesehatan

Lingkungan Pada Manajemen Bencana," *J. Kesehat. Indones. (The Indones. J. Heal.*, vol. XI, no. 3, pp. 111–115, 2021, [Online].

Available:

<https://makarioz.sciencemakarioz.org/index.php/JIM/article/view/19>.