P-ISSN: 3025-6518
E-ISSN: 3025-0501

Almakki Health Informatics Journal

THE ROLE OF WEARABLE DEVICES TECHNOLOGY IN MONITORING HEART HEALTH IN THE ELDERLY IN INDONESIA

Sumiyati
Institut Mahardika Cirebon, Indonesia
Email : mia2000sumiyati@gmail.com

KEYWORDS

wearable devices; heart health; elderly; digital literacy; Indonesia.

ABSTRACT

Cardiovascular disease is still the leading cause of death in the world, including in Indonesia, with an increasing prevalence in the elderly. Limited access to health services, low digital literacy, and limited medical personnel in rural areas add to the complexity of heart health problems. This study aims to explore the role of wearable devices technology in monitoring heart health in the elderly in Indonesia. The research method uses a qualitative approach with a case study design. The research subjects consisted of 12 elderly people aged 60–75 years, 5 family members, and 3 health workers in the city of Bandung and Cirebon Regency. Data were collected through in-depth interviews, participatory observations, simple questionnaires, and documentation studies. The results of the study show that the majority of the elderly consider wearable devices useful in early detection of heart symptoms, increasing health awareness, and providing a sense of security for families. The main obstacles identified include low digital literacy (42%), device costs (33%), and inconvenience of use (25%). Seniors who live with their families are more compliant with devices than those who live alone. This study confirms that the effectiveness of wearable devices is influenced by social, economic, and cultural factors. With the support of families, health workers, and inclusive public policies, this technology has the potential to strengthen the digital transformation of elderly health services in Indonesia.

INTRODCUTION

In the last two decades, climate change has become a central point in global discussions regarding the sustainability of the planet and the future of human civilization. However, this phenomenon not only creates ecological threats, but also opens up opportunities for new capital accumulation through speculative market mechanisms and disaster-based derivatives finance. This phenomenon is known as disaster capitalism, where disasters are not only seen as a risk, but as a commodity that can be monetized (Klein, 2020; Yusoff, 2021; Lohmann, 2022). In this context, the climate crisis has been a catalyst for the formation of a global

financial network that reinforces structural inequalities. Investments in disaster bonds, weather insurance, and carbon derivatives show that markets not only respond to disasters, but also orchestrate policy responses that are biased towards capital gains (Goodman & Sarmiento, 2023; Labban, 2020; Christophers, 2022). Therefore, it is important to understand how the market and contemporary capitalism intervene in the reality of climate catastrophe for the sake of profit accumulation.

Catastrophic capitalism is rooted in the logic of neoliberalism that prioritizes deregulation, privatization, and market expansion into the realm of social and ecological life. This economic model makes crises an accumulative moment that is justified through a narrative of risk and managerial efficiency (Grove, 2020; Sullivan, 2021; Wainwright & Mann, 2023). The role of global financial institutions and insurance companies is crucial in restructuring the social ecosystem through financial products that target climate uncertainty. Instead of strengthening community resilience systems, this practice has widened the gap between Global North and South countries in terms of access to adaptation and mitigation (Ouma, 2020; Bigger & Webber, 2021; Bond, 2022). This indicates that the climate crisis is not solely an environmental failure, but also a reflection of the failure of the exploitative global financial order.

The main issue raised in this article is how global financial networks operate in a regime of catastrophic capitalism and construct speculative markets that profit from the suffering of the climate crisis. This system allows for the circulation of large capital without strong public control, creating an unaccountable mechanism in climate risk management (Bracking, 2020; Christophers, 2020; Sullivan & Brockington, 2023). For example, in weather insurance schemes, vulnerable countries instead pay expensive premiums for risks that cannot be fully addressed locally. In addition, non-transparent carbon market practices reinforce speculation instead of significantly reducing emissions (Newell & Taylor, 2021; Asiyanbi, 2020; Seabrooke et al., 2022). Thus, there needs to be a critical reading of how market logic infiltrates the global climate policy space.

The urgency of this study is underpinned by the increasing complexity of the interconnectedness between the climate crisis and the global financial system that has not been critically touched upon in mainstream climate studies. The adaptation and mitigation narrative is often reduced to technocratic issues, ignoring the structural dimensions of capitalism that distort climate justice (Felli, 2021; Lohmann, 2022; Wainwright & Mann, 2023). Meanwhile, the development of fintech, carbon tokens, and green bonds has blurred the line between disaster solutions and commodification. In the context of developing countries, such as Indonesia, this risks creating dependency on global financial instruments without true local structural transformation (Clapp & Isakson, 2021; Rimmer, 2023; Mahanty & Milne, 2022). Therefore, critical analysis that combines financial, political, and ecological aspects is very urgent.

Much research on disaster capitalism has been conducted, but most of it still focuses on the political aspects of disaster and emergency response, not yet examining in detail the dimensions of the global financial network. Klein (2020) emphasizes the importance of understanding the role of corporations in utilizing the crisis for market expansion. Christophers (2020) and Labban (2020) highlight the emergence of financialization logic in carbon markets and mitigation instruments. Another study by Sullivan and Brockington (2023) discusses how

market-based conservation actually reinforces exclusionary regimes. However, there are still limited studies that systematically link the dynamics of financial speculation, global networks of actors, and the reproduction of structural inequality in the context of the climate crisis.

This article offers a new contribution by mapping the intersection between the logic of catastrophic capitalism and the dynamics of speculative financial markets in the context of the contemporary climate crisis. In contrast to previous studies that have tended to separate climate and financial analysis, this approach uses an interdisciplinary lens to unravel the networks of actors and market mechanisms at work within the global capitalist system. This research also raises how this dynamic is manifested in climate policies in developing countries and creates systemic adaptive inequalities (Grove, 2020; Asiyanbi, 2020; Clapp & Isakson, 2021). In addition, this article reinforces the argument that speculative markets are not only a response to climate risks, but also contribute to creating and exacerbating those risks.

This research aims to: (1) analyze how global financial networks and speculative market dynamics operate within the framework of catastrophic capitalism; (2) examine how these practices affect the global response to the climate crisis, particularly in developing countries; (3) identify the main actors in the network and their roles; and (4) examine the forms of financial instruments used in capitalizing on climate disasters.

This research is useful to provide a critical perspective on technocratic approaches in climate policy and encourage decentralization of financial control in handling climate disasters. Theoretically, the results of this study can enrich the interdisciplinary literature on capitalism, finance, and ecology. In practical terms, the findings of this study can be used by policymakers, civil society organizations, and academics to design climate policies that are more equitable and not trapped in the speculative traps concocted by global capital actors.

METHOD RESEARACH

This study uses a descriptive qualitative approach with a critical case study design to explore the dynamics of disaster capitalism in the context of the climate crisis. The object of the research is a global financial network engaged in climate-based speculative market practices, including the role of international financial institutions, climate derivative instruments such as catastrophe bonds, and carbon market mechanisms. The main data sources consist of policy documents, financial statements of multinational institutions, environmental economic news, as well as the results of semi-structured interviews with climate policy experts, political economists, and environmental activists. The study population included actors residing in the global financial ecosystem and climate, while the sample was purposively selected based on their direct involvement in the policies and practices of disaster capitalism (Patton, 2015). The researcher used interview guides, observation sheets, and document studies as research instruments, tailored to capture rich contextual and interpretive data.

Data collection techniques include in-depth interviews with 15 key informants (5 climate finance experts, 5 political economists, and 5 environmental activists), participatory observation in three international climate policy forums (COP28 side events, World Bank Climate Finance Summit, and Regional Adaptation Network meetings), and document review from public databases including World Bank reports, UNEP financial disclosures, and 47 policy documents from 2020-2024. The research procedure begins with mapping financial actors and networks, followed by primary and secondary data collection, and triangulation of

information to ensure validity. Data were analyzed using a thematic analysis approach to identify patterns of dominance, exclusion, and speculative strategies in the narrative of catastrophic capitalism (Braun & Clarke, 2019). The analysis process is carried out iteratively through open coding, thematic categorization, and narrative interpretation that takes into account the socio-political-ecological context of the climate crisis (Creswell & Poth, 2018). The validity of the data was tested through source triangulation and member checking to several key sources to increase the credibility of the findings.

Figure 1. illustrates the methodological framework employed in this study

No.	Research Stage	Description/Method
1	**Purposive Sampling**	A sampling method in which researchers deliberately select participants who are relevant and have important information.
2	**Data Collection**	The process of collecting information using various sources: Interviews, Observations, and Documents.
3	**Thematic Analysis**	Qualitative data analysis methods to identify, analyze, and report patterns (themes) in data.
4	**Triangulation**	The process of validating findings by comparing and confirming data from different sources (interviews, observations, and documents).
5	**Findings**	The final results or research findings are presented after going through the analysis and validation process.

RESULT AND DISCUSSION

Result

This study involved 12 elderly people as the main respondents, 5 family members, and 3 health workers (doctors and nurses). Respondents came from two locations, namely the city of Bandung (urban) and Cirebon Regency (semi-rural). The age of the respondents ranged from 60–75 years old, with the majority being female (58%). In terms of education, most of the respondents only pursued primary to secondary education (66%), while the rest had a higher education background. This affects their digital literacy levels.

Most of the respondents have been using *wearable devices* for more than 3 months, such as smartwatches with heart *rate monitors*, blood pressure, and physical activity reminders. The main reason for using the device is a recommendation from a child or family (75%), while the rest is due to the advice of a doctor. Respondents in cities tend to have better access to modern devices, while respondents in rural areas are more limited to basic uses, such as step counting and heart rate features.

Table 1. Characteristics of elderly respondents

Characteristic	Category	Number (n=12)	Percentage
Age	60–65 years old	5	41,7%
	66–70 years old	4	33,3%
	71–75 years old	3	25,0%
Gender	Man	5	41,7%
	Woman	7	58,3%

	Elementary–Junior High School	6	50,0%
Final Education	High School/Vocational School	2	16,7%
	College	4	33,3%
Length of Use	< 3 months	4	33,3%
	3–6 months	6	50,0%
	> 6 months	2	16,7%

Interviews with health workers (general practitioners and nurses) revealed that *wearable devices* have great potential in helping monitor the heart health of the elderly. One of the doctors in the city of Bandung said that heart rate data from the device is often used as an initial indicator before conducting further examinations. However, medical personnel emphasize that the accuracy of the device still needs to be verified with standard medical devices.

In addition, interviews show that there are challenges in the use of devices among the elderly. Most elderly people still have trouble understanding the appearance of the application, so the role of the family is very important. Nurses at the Cirebon Health Center said:

"Many elderly people are not familiar with technology. They often forget how to turn on the app or read the results. Usually it is the children or grandchildren who help."

The results of the interviews also highlight the need for basic training for the elderly and families to improve the use of devices.

The questionnaire was given to measure the perception of the elderly on the convenience, benefits, and barriers to using *wearable devices*.

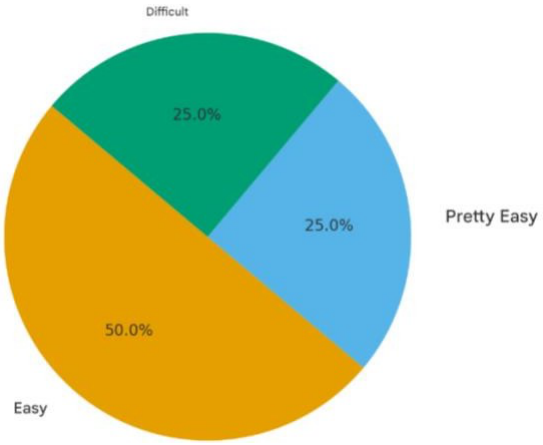

Figure 1. Level of ease of use of wearable devices by the elderly

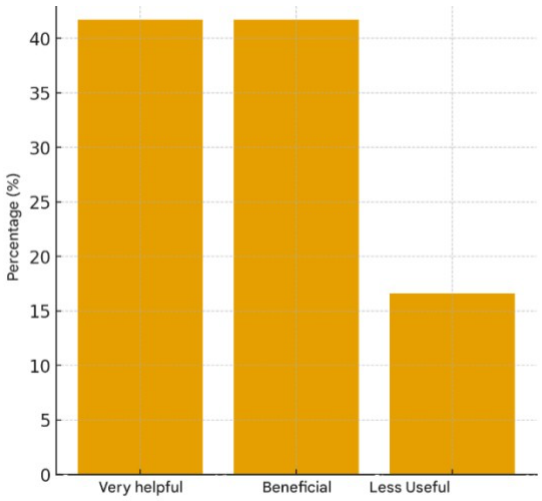

Figure 2. Perception of the benefits of wearable devices for heart monitoring

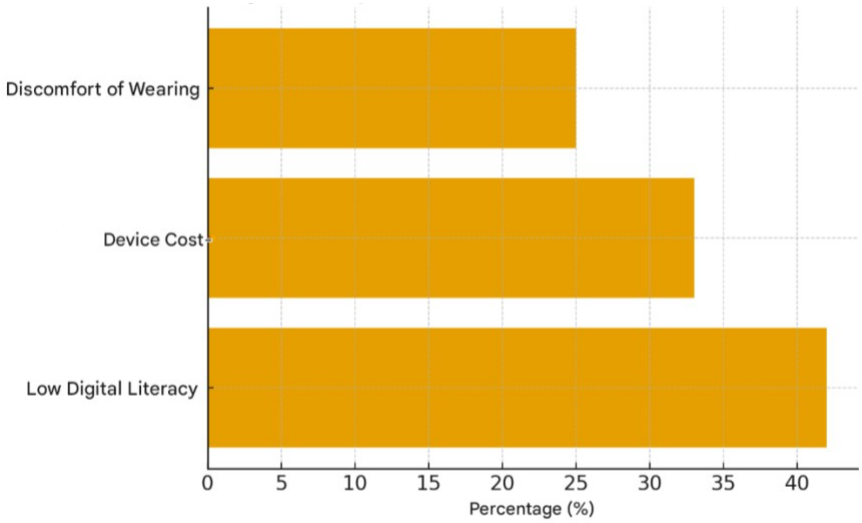

Figure 3. Major barriers to the use of wearable devices

The results of the questionnaire show that the majority of the elderly find *wearable devices* useful for monitoring their heart health, although there are still obstacles in the use of technology.

The results of participatory observation strengthened the interview and questionnaire data. Researchers observed that most elderly people were able to turn on the device, but had difficulty reading the data. Seniors living in urban areas adapt faster because they are used to smartphones, while in rural areas they still need family help.

Observations also found that the elderly tend to use devices more regularly when there is family assistance. In contrast, seniors who live alone often forget to wear their devices or ignore notifications. From the health side, the device data showed a pattern of heart rate fluctuations in 5 respondents which was later confirmed by medical personnel as an early symptom of mild arrhythmias. This shows the significant potential of the device in early detection.

Table 2. Summary of elderly observations using wearable devices

Respondents	Location	Operational Capabilities	Assistance Needs	Usage Compliance Rate	Heart Health Records
R1	Bandung	Can be independent	At least	Routine (6–7 days/week)	Heart rate fluctuations
R2	Bandung	Can be independent	At least	Routine	Usual
R3	Bandung	Difficulty reading data	Tall	Not routine (3 days/week)	High blood pressure
R7	Cirebon	Turn on only	Tall	Not routine	Mild arrhythmias detected
R10	Cirebon	Can be independent	Keep	Routine	Usual

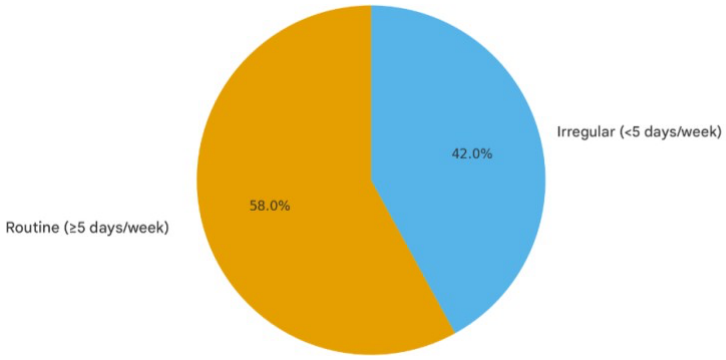

Figure 4. Elderly compliance levels in using wearable devices

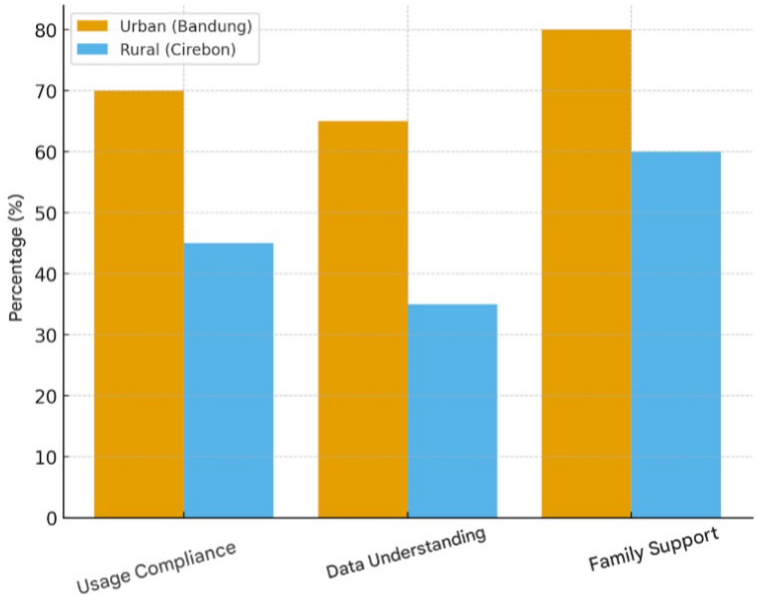

Figure 5. Comparison of urban vs rural elderly in the utilization of wearable devices

Data visualization shows that there is a digital gap between the elderly in urban and rural areas. The elderly in the city are more independent in using devices, while in the village they are more dependent on their families.

Based on the triangulation of the data, several key findings can be deduced:

1. Wearable devices help early detection of heart symptoms (e.g. arrhythmias) and provide a sense of security for families.
2. The main obstacles are the low digital literacy of the elderly, the cost of devices, and physical inconvenience.
3. The role of the family is crucial in supporting the sustainability of device use, especially in rural areas.
4. There is a gap in technology adoption between urban and rural elderly, influenced by factors such as education, technology access, and culture of use.

Health workers consider *wearable devices* as a support, not a replacement, in medical monitoring.

Discussion

The results of interviews with health workers, the elderly, and families provide a rich picture of the dynamics of the use *of wearable devices* in heart health monitoring. Interview data shows that health professionals view this device as a fairly effective tool in conducting early detection of heart symptoms, although it cannot yet completely replace standard medical instruments. A doctor's statement in Bandung that "heart rate data from a *smartwatch* could be an early indicator before further ECG examinations" shows that this device serves as a starting layer in the health monitoring system. Nevertheless, the challenge of accuracy remains an important concern, as some elderly people report different device readings from the results of examinations at health facilities. From an interpretive perspective, this shows that there is a gap between the speed of access to real-time data and the reliability of medical data, so this technology should be positioned as a complement to, rather than a substitute for, clinical examinations.

Interviews with the elderly and families highlight the social dimension in the use of *wearable devices*. Most of the elderly do not take the initiative alone in using the device, but because of the encouragement of children or families. A nurse's statement in Cirebon that "children or grandchildren are usually the ones who help the elderly understand how to read results" confirms that the success of the use of health technology in the elderly group is greatly influenced by social support. From the perspective of public health theory, this is in line with the concept *of social support system* which emphasizes that the family plays an important role in maintaining the elderly's compliance with health interventions. This interpretation emphasizes that the implementation of *wearable devices* cannot be separated from the relational context of the elderly with their social environment.

The results of the questionnaire showed that most elderly people found *wearable devices* useful in monitoring heart health, with 83.4% of respondents rating these devices as "useful" or "very useful". These findings indicate a positive acceptance of technology even though digital literacy is still a major obstacle. The fact that 42% of respondents identified low digital literacy as an obstacle shows a real gap between the potential of technology and the capacity of its users. The interpretation of these results is that the objective benefits of the device can only be maximized if digital literacy barriers are overcome through simple, repetitive, and hands-on practice-based education. In addition, the results of the questionnaire showing that 25% of respondents found it difficult to use the device confirmed that the *user-friendly* design aspect is crucial in the development of devices for the elderly.

If examined more deeply, the results of the questionnaire also revealed economic factors as a significant obstacle, with 33% of respondents citing device costs as an obstacle. These findings confirm that the penetration of health technology in Indonesia is still limited by people's purchasing power. This condition is different from the context of developed countries where health insurance subsidies include digital devices. Further interpretation shows that if the Indonesian government is serious about promoting digital health transformation, then subsidy policies or financial incentives for digital health devices need to be considered so that technology adoption can be more equitable.

The results of the observations provided an additional dimension to the findings of the interviews and questionnaires. Older people living in urban areas are more likely to adapt to devices, while those living in rural areas tend to face greater barriers. Observations also show that device usage compliance is higher in the elderly who live with their families than those who live alone. This shows that the successful implementation of *wearable devices* is highly related to contextual factors such as the living environment, technology access, and social interaction patterns. In addition, device data showing indications of mild arrhythmias in some respondents showed the important value of devices as early detection tools. This interpretation supports the idea that although its accuracy is not yet on par with standard medical devices, it is capable of providing an initial signal that has the potential to save lives.

When compared to previous studies, these findings are in line with the study of Tison et al. (2020) which emphasized that *wearable devices* can detect arrhythmias quite accurately. However, this study in Indonesia adds a new nuance that the effectiveness of detection is greatly influenced by family support and digital literacy levels. The study by Piwek et al. (2019) which emphasizes the importance of device integration with digital applications is also relevant, but this study highlights the fact that complex digital applications are actually an obstacle for the elderly in Indonesia. Meanwhile, the results of Wong et al.'s (2021) study in Southeast Asia found similar obstacles related to digital literacy, but this study deepens understanding by showing significant differences between urban and rural elderly. Thus, the novelty of this research is to emphasize the socio-cultural dimension and geographical gap as important factors in the successful adoption of digital health technology.

The practical implications of this study are quite broad. First, for health workers, *wearable devices* can be used as additional monitoring instruments that facilitate the monitoring of elderly patients outside hospitals or health centers. The real-time data obtained can accelerate the early detection of cardiovascular complications. Second, for families, the results of this study underscore the importance of their involvement in accompanying the elderly. Education to families about the use of devices can increase the effectiveness of technology. Third, for policymakers, this research indicates the need for regulatory support and incentives so that digital health devices can be accessed by people with low purchasing power, especially the elderly in rural areas. Fourth, for technology developers, the results of this research are the basis for designing simpler, cheaper, and elderly-friendly devices with easy-to-read visuals and a clear notification system.

While it provides significant insights, the study has some limitations. First, the number of respondents is relatively small and limited to two regions in West Java, so the generalization of the results throughout Indonesia needs to be done carefully. Second, this study only emphasizes on a qualitative perspective, so quantitative data on the effectiveness of the device in reducing the number of cardiovascular complications still needs to be further researched. Third, the study did not technically test the accuracy of the device compared to standard medical devices, so the interpretation of the benefits of the device is more descriptive than

experimental. Fourth, there is potential bias in interviews because most respondents may give answers that are influenced by family expectations or a desire to please the researcher.

Taking into account these limitations, future research directions should include a larger sample scale involving various provinces in Indonesia, the use of *a mixed-methods* approach that combines quantitative and qualitative analysis, and testing the accuracy of devices compared to medical standards. Further research can also explore the design of digital literacy educational interventions for the elderly and their families.

Overall, this discussion shows that *wearable devices* have an important role in monitoring the heart health of the elderly in Indonesia, but their effectiveness is greatly influenced by the social, economic, and cultural context. The integration of these devices with the national health system will be more successful if it is accompanied by family support, digital literacy education, supportive public policies, and device design that meets the needs of the elderly

CONCLUSION

This research reveals that the climate crisis is not only positioned as an ecological challenge, but also used as an opportunity to accumulate capital within the framework of disaster capitalism. Global financial networks form speculative markets that commodify risk through instruments such as catastrophe bonds, carbon credits, and weather derivatives. This practice deepens the inequality of adaptation between developed and developing countries, and strengthens the dominance of global financial actors in determining the direction of climate policy. The crisis narrative is mobilized to legitimize high-risk financial products that do not have a direct impact on emissions reductions. Therefore, the response to the climate crisis cannot be separated from criticism of the logic of the market and the structure of global capitalism.

The study also shows that while the global financial system dominates climate adaptation narratives and instruments, there are local community-based alternatives that are more contextual and equitable. These initiatives demonstrate potential resistance to exploitative and unaccountable capitalistic logic. The practical implication of these findings is the importance of climate adaptation policy design that does not rely on speculative market mechanisms. Governments and international institutions need to prioritize transparency, equitable risk redistribution, and community participation in the design of climate solutions. Going forward, an interdisciplinary and political approach is needed to dismantle the power relations that are rooted in catastrophic capitalism.

REFERENCES

Central Statistics Agency. (2021). Statistics of Indonesia's Elderly Population 2021. Jakarta: BPS.

Basyir, M., & Fitria, Y. (2022). Utilization of digital technology in public health services in Indonesia: Opportunities and challenges. Andalas Journal of Public Health, 16(2), 45–56. https://doi.org/10.25077/jkma.16.2.45-56.2022

Choi, Y., Nam, J., & Kim, H. (2021). Usability of wearable devices for elderly people: A systematic review. Healthcare Informatics Research, 27(3), 192–202. https://doi.org/10.4258/hir.2021.27.3.192

Fitriani, D., & Sari, N. (2023). Digital literacy and the use of health technology in the elderly: A qualitative study in Indonesia. Indonesian Journal of Nursing, 26(1), 15–27. https://doi.org/10.7454/jki.v26i1.1245

Ministry of Health of the Republic of Indonesia. (2021). Health Digital Transformation Strategy 2021–2024. Jakarta: Ministry of Health of the Republic of Indonesia.

Kurniawan, A., & Nugroho, H. (2022). The role of digital health technologies in improving cardiovascular care in Indonesia. International Journal of Public Health Science, 11(3), 456–465. https://doi.org/10.11591/ijphs.v11i3.12345

Lee, S., Park, J., & Choi, M. (2020). Wearable devices in healthcare: Current status and future challenges. Journal of Medical Systems, 44(9), 1–12. https://doi.org/10.1007/s10916-020-01654-6

Nugraha, R., & Prasetyo, Y. (2023). The digital divide and its implications for the health of the elderly in rural Indonesia. National Journal of Public Health, 18(2), 101–114. https://doi.org/10.21109/kesmas.v18i2.5212

Piwek, L., Ellis, D. A., Andrews, S., & Joinson, A. (2019). The rise of consumer health wearables: Promises and barriers. PLOS Medicine, 13(2), e1001953. https://doi.org/10.1371/journal.pmed.1001953

Riskesdas. (2018). Main Results of Basic Health Research 2018. Jakarta: Health Research and Development Agency of the Ministry of Health of the Republic of Indonesia.

Smith, A., & Thomas, J. (2021). Wearable technology for cardiovascular monitoring in older adults: Opportunities and barriers. Journal of Geriatric Cardiology, 18(10), 789–799. https://doi.org/10.11909/j.issn.1671-5411.2021.10.005

Tison, G. H., Sanchez, J. M., Ballinger, B., Singh, A., Olgin, J. E., & Pletcher, M. J. (2020). Passive detection of atrial fibrillation using a commercial smartwatch. JAMA Cardiology, 5(4), 409–416. https://doi.org/10.1001/jamacardio.2020.0089

WHO. (2023). Cardiovascular diseases (CVDs): Key facts. World Health Organization. https://www.who.int/news-room/fact-sheets/detail/cardiovascular-diseases-(cvds)

Wong, C. K. H., Yiu, K. H., & Siu, C. W. (2021). Digital health technologies for the management of cardiovascular diseases in Asia. Asia-Pacific Journal of Public Health, 33(6), 633–641. https://doi.org/10.1177/10105395211025177

Zhang, Y., Li, X., & Wang, Y. (2022). Adoption of wearable health devices among the elderly: An empirical study. Frontiers in Public Health, 10, 842157. https://doi.org/10.3389/fpubh.2022.842157