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# Developing a Mobile Health System for Elderly Care in Depok: An Action Research Study

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## ABSTRACT

**Background:** The aging population presents unique health challenges that require innovative solutions. In Depok, Indonesia, monitoring elderly health is critical to improve their quality of life. **Research Objective:** This study aims to develop and evaluate a mobile-based health monitoring system for elderly care in Depok, enhancing data accuracy and efficiency. **Method:** An action research methodology was employed, divided into four phases: Action Plan, Act, Observe, and Reflect. The initial pilot was conducted at Puskesmas Pondok Ranji in South Tangerang, and the second cycle involved 9 community health workers (kader) from RW 13, the head of Sukamaju Baru Health Center, the person responsible for the elderly program, and the administrative head. **Result:** The system significantly improved the quality and accuracy of health data collection. Training sessions empowered kader, though older kader faced technological challenges. The integration of comprehensive geriatric assessments enabled early identification of health issues. The pilot validated the system's scalability and adaptability. **Conclusions:** The health monitoring system demonstrated promise in enhancing elderly care through improved data collection and early intervention. Future iterations should address technological difficulties faced by older kader. The system will be refined for broader adoption in Depok and potential scaling to other regions, offering a practical approach to addressing public health challenges through technology.

**Keywords:** Elderly, Health Monitoring System, Action Research, Public Health Innovation

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## INTRODUCTION

The public sector plays a vital role in enhancing the quality of life for its citizens, particularly vulnerable groups such as the elderly. As governments grapple with an aging population, the need for innovative and transformative solutions to address the unique health concerns of this demographic becomes increasingly crucial. This research aims to bridge this gap by developing a mobile-based information system to monitor the health of elderly residents in the Depok area.

Aging populations are a global phenomenon with extensive implications for public health and social welfare institutions, not just a local issue. Projections indicate that by 2050, two-thirds of the global population aged 60 and older will reside in low- and middle-income countries (Maresova et al., 2019). This demographic shift necessitates innovative healthcare approaches, particularly for the elderly. In the context of Depok, where the elderly population is growing, monitoring their health is not only significant but essential. Implementing a robust health surveillance system is crucial for promoting healthy aging and improving the quality of life for this vulnerable group.

The elderly population in Depok faces a variety of health challenges, primarily chronic health conditions and frequent falls. According to the World Health Organization (WHO), approximately 15% of individuals aged 60 and older suffer from mental disorders, and about 7% have substance abuse problems (WHO, 2022). Additionally, falls are the second leading cause of accidental or unintentional injury deaths worldwide, with the highest number of fatal falls occurring among adults aged 65 and older (OASH, 2020). In the context of Depok, where the elderly population is increasing, these global statistics underscore the critical need for an effective health monitoring system. Providing accurate and current health data can facilitate early intervention and preventive care, thereby improving the overall health of this vulnerable population.

The challenges faced by the elderly in Depok are complex and require a comprehensive approach to address them. Chronic diseases and other age-related limitations can significantly affect the quality of life for the elderly. However, currently, there is no system in place to monitor the health of the elderly in Depok, with all monitoring being done manually by community health workers (kader).

This highlights the need for an innovative solution to tackle the health challenges faced by the elderly. The search results do not provide specific information on the health challenges faced by the elderly in Depok but suggest that chronic diseases are prevalent among this population.

This research paper proposes the development of a health monitoring system for elderly residents in Depok. The proposed system will utilize a mobile-based information system. It is designed to have a user-friendly interface, facilitating the efficient collection of health parameter data by kader. The data will be stored on a server and accessible through a dashboard available to local health centers (puskesmas) and the local government. The primary goal of the proposed system is to effectively address the health-related issues encountered by elderly residents in Depok. By prioritizing healthy aging, the system aims to enhance their overall well-being and improve their standard of living. This study will discuss the approach used for system design, describe the system's features, and evaluate any potential benefits it offers to the elderly population in Depok.

## RESEARCH DESIGN

The study utilizes an action research approach to explore and address the information and needs related to the Elderly Monitoring Information System. Action research integrates both research and practical action in a series of flexible cycles, including data collection, analysis, interpretation, action planning, and evaluating changes until the results are deemed publishable.

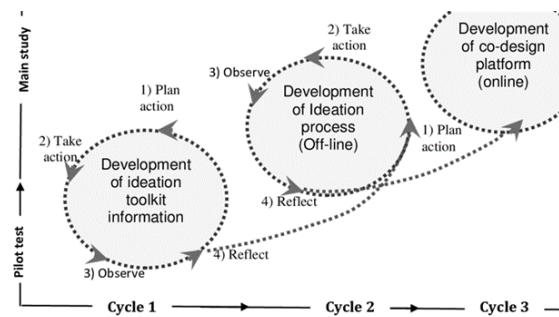


Figure 1 Action Research Cycle (Kemmis & McTaggart, 2005)

The action research cycles are not linear but rather cyclical or spiral, meaning after reflection, the researcher can revisit the planning stage to create a more refined action plan based on previous reflections. This iterative process continues until the research objectives are met (Adelman, 1993).

Stages of Action Research:

- 1) Action Plan: This stage involves planning interventions to address the identified issues or phenomena. Focus Group Discussions (FGD) are

conducted with stakeholders, such as the head of Sukamaju Baru Health Center and the person responsible for the elderly program, to gather critical data and understand the health needs of the elderly in the area.



Figure 2 Process of Focus Group Discussion

- 2) **Taking Action:** This implementation stage involves putting the planned actions into practice through collaboration with research participants, while ensuring ethical considerations. New features for the Elderly Monitoring Information System are developed based on the identified needs from the previous stage.
- 3) **Observation:** This stage focuses on observing how community health workers (kader) perform basic health checks on the elderly and input this data into the application. Before field deployment, kader receive training to equip them with the necessary skills and knowledge.

- 4) **Reflection:** In this stage, the effectiveness and impact of the health monitoring system are evaluated. Data collected during the observation phase, including performance assessments of the kader and feedback from caregivers and healthcare facilities, are analyzed to identify strengths and areas for improvement. This reflective process informs any necessary modifications to the system and provides insights for scaling the project to other communities.

The study targets the stakeholders involved in elderly care at Sukamaju Baru Health Center in Depok. This includes the head of the health center, the person responsible for the elderly program, the administrative head, and nine community health workers (kader) who participated in the training and use of the system. Data were collected from primary sources, including these stakeholders and the kader.

Data were gathered using several methods:

- **Focus Group Discussions (FGD):** Conducted with stakeholders to gather qualitative data on the health needs and context of the elderly population.
- **Observations:** Conducted by trained kader to monitor the health of the

elderly and input data into the mobile application.

- Interviews: Conducted with caregivers and health facility staff to gather feedback on the system's usability and effectiveness.

The research follows multiple cycles, initially piloted at Pondok Ranji Health Center in South Tangerang, and later extended to UPTD Sukamaju Baru in Depok to test the system's scalability and adaptability. This iterative approach ensures continuous improvement and refinement of the health monitoring system based on feedback and observed results.

## RESULT AND DISCUSSION

This study employs an action research methodology, segmented into four pivotal phases: Action Plan, Act, Observe, and Reflect. This research builds upon an initial pilot conducted at Puskesmas Pondok Ranji in Tangerang Selatan and extends to UPTD Sukamaju Baru in Depok. The outcomes of this second phase are intended to refine the tool for community health workers (kader) and local healthcare facilities (puskesmas) in Depok, offering scalable solutions to the health challenges faced by the elderly population. The second-cycle pilot testing in Depok was carried out over a period of

three months, from July to September 2023, with health parameters monitored by the health monitoring system.

### 1) Stage 1 – Action Plan

The first stage, known as the 'Action Plan,' was executed through two primary approaches. First, a Focus Group Discussion (FGD) was conducted with the head of the Sukamaju Baru Health Center in Depok and the person responsible for the elderly program. Second, on-site observations were carried out at the second-cycle test location in Depok. The FGD provided crucial data, including demographic information and the current state of elderly care services, which formed the foundation for designing and tailoring the health monitoring system to be piloted.

### 2) Stage 2 – Take Action

In the implementation stage, the plan formulated during the Action Plan phase was put into practice. This involved collaboration with research participants while prioritizing ethical aspects. Lantera version 2 introduced two main features: tracking monthly visits of the elderly to health centers, categorized by gender, and cumulative information on monthly visits to Posbindu.

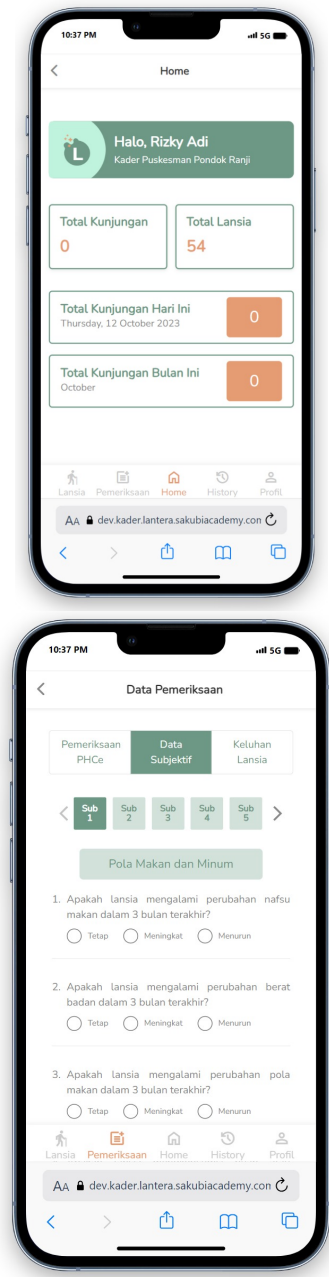


Figure 3 display of a mobile phone-based elderly monitoring information system for inputting elderly data

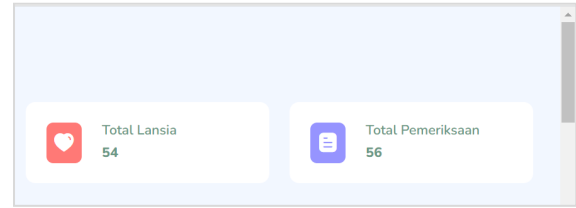
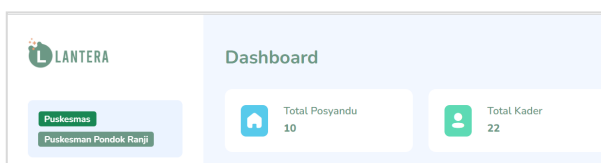


Figure 4 elderly monitoring information system dashboard which provides information on the number of elderly posyandu/posbindu, number of community health workers, number of elderly and number of examinations

The image shows the elderly monitoring information system dashboard that provides information on the number of elderly posyandu/posbindu, number of community health workers, number of elderly and number of examinations. The dashboard has four sections, each displaying a different type of data in a graphical or numerical format. The sections are:

- Elderly Posyandu/Posbindu: This section shows the number of elderly posyandu/posbindu in each district/city in the region. The data is presented in a bar chart, with the x-axis showing the names of the districts/cities and the y-axis showing the number of elderly posyandu/posbindu. The user can see the total number of elderly posyandu/posbindu in the region at the top right corner of the section.

- **Community Health Workers:** This section shows the number of community health workers who are involved in the elderly monitoring program in each district/city in the region. The data is presented in a pie chart, with each slice representing a different district/city and showing the percentage and number of community health workers. The user can see the total number of community health workers in the region at the center of the section.
- **Elderly:** This section shows the number of elderly people who have been registered and screened by the elderly monitoring program in each district/city in the region. The data is presented in a line chart, with the x-axis showing the months and the y-axis showing the number of elderly people. The user can see the total number of elderly people in the region at the top right corner of the section.
- **Examinations:** This section shows the number of examinations that have been conducted by the elderly monitoring program in each district/city in the region. The data is presented in a table, with each row representing a different

district/city and each column showing a different type of examination, such as blood pressure, blood sugar, weight, height, and body mass index. The user can see the total number of examinations in the region at the bottom right corner of the section.

The dashboard aims to provide an overview and comparison of the performance and progress of the elderly monitoring program across different districts/cities in the region. The user can use this information to evaluate and improve the quality and effectiveness of the program.



Figure 5 Annual and monthly inspection data view

The image shows the annual and monthly inspection data view that is designed to run on a mobile phone. The view allows the user to see the data of inspections that are conducted every year and every month for a car.

The data includes the date, time, mileage, service type, and cost of each inspection. The user can also see the total number and cost of inspections for each year and month. The view has a simple and user-friendly interface, with clear labels and icons for each data field. The user can easily navigate through the view by swiping left and right or tapping on the icons. The view also has a filter function that allows the user to select a specific year or month to see the data of inspections for that period. The view aims to help the user keep track of their car's condition and performance, as well as plan their budget and schedule for future inspections.



Figure 6 distribution map of the elderly in Depok

The image shows the distribution map of the elderly in Depok, a city in West Java, Indonesia. The map uses different colors to indicate the percentage of elderly population in each sub-district of Depok.

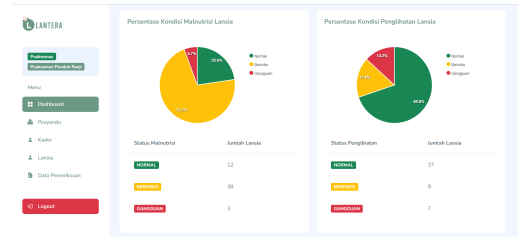


Figure 7 graph of elderly examination results

The image shows a graph of elderly examination results that is designed to display the percentage of conditions of six intrinsic elements of elderly people (hearing, vision, cognitive, mobility, nutrition, depression) in the categories of normal, at risk, and impaired. The graph uses different colors to indicate the type of element, such as green for normal, yellow for at risk, and red for impaired.

The additional features in this information system are made to facilitate UPTD Puskesmas Sukamaju Baru and Posyandu/Posbindu Elderly in managing data of elderly people. The process of data collection and reporting of elderly data previously required a considerable amount of time, because it was done manually with paper. After the manual process, the data was then inputted into Microsoft Excel for reporting. This traditional approach proved to be inefficient, especially for urgent needs. However, with the elderly monitoring information system, data management



becomes faster and can be adjusted according to the needs of the Health Center. It is important to note that information on elderly visits to Posbindu/Posyandu Elderly and Health Center is very essential. This is because the information is one of the indicators of performance achievement set by the Depok City Health Office. The basis for its determination is Presidential Regulation Number 2 of 2028 concerning Minimum Service Standards Article 6 related to services at an advanced age (Presiden RI, 2018).

The percentage of performance achievement for residents aged 60 years and over who undergo health screening according to standards is calculated based on the number of individuals aged at least 60 years who have received health screening at least once in a district/city area during one year. Then, the number is divided by the total number of residents aged 60 years or more in the same area during the same period. The result of this division is then multiplied by 100%. With the additional features mentioned, health centers and posbindu/posyandu elderly can more easily monitor their performance

achievements (Menteri Kesehatan RI, 2019).

### 3) Stage 3 – Observe

This stage focused on observing how kader performed basic health checks on the elderly and input this data into the application. Kader underwent training to ensure they had the necessary skills and knowledge to use the system effectively. Observations during this stage provided valuable insights into the system's usability and the quality of health data collection.

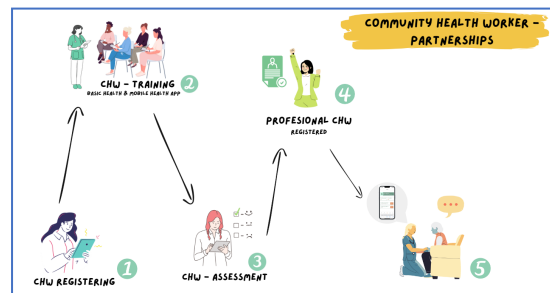


Figure 8 Training and Assessment phase for enhancing the CHWs' competencies in caregiving and application usage

The role of community health workers, or CHWs, in health monitoring systems has been widely recognized. CHWs are trained to provide basic health services and education to their communities, and they play a critical role in bridging the gap between the community and the formal healthcare system. The training of CHWs is

crucial in ensuring that they have the necessary skills and knowledge to effectively utilize the health monitoring system and provide quality care to the elderly population. The training should cover key competencies such as individual and community assessment, health education strategies, health improvement plans, care coordination, and system navigation. The observations during the Observe stage will provide valuable insights into the effectiveness of the training and the quality of health data collection by the 'kader.'

The training of community health workers, or CHWs, is required to ensure that they have the necessary skills and knowledge to utilize the health monitoring system effectively and provide quality care to the geriatric population. The competency scheme for elderly caregivers issued by the Ministry of Manpower of the Republic of Indonesia and the Indonesian National Qualification Framework (KKNI) for elderly caregivers provide a nationally recognized training standard for CHWs. The training material is meticulously designed based on these standards, ensuring that the 'kader' will be equipped with the

skills and knowledge necessary to utilize the health monitoring system effectively and provide quality care to the elderly. The training will cover essential competencies such as caregiving and application usage, in addition to individual and community assessment, health education strategies, health improvement plans, care coordination, and system navigation. This comprehensive training program will ensure that the 'kader' are well-equipped to conduct basic health checks on the elderly and put the collected data into the application during the Observe phase of the action research methodology.

The community health workers, or 'kader,' will be evaluated for the two competencies—caregiving and application usage—after finishing the training. Those who pass the tests will be registered and given the right to examine the elderly for health issues. By registering, only qualified "kader" can participate in data gathering and senior care, acting as a quality control measure. The observation phase will then concentrate on how these registered 'kader' carry out fundamental health screenings and input the data into the application. This will give important information about

the usability of the system and the standard of the health data collecting, both of which are essential for the resulting "Reflect" step.

#### 4) Stage 4 – Reflect

Following the observation phase, the 'Reflect' stage evaluated the effectiveness and impact of the health monitoring system. Data collected during the observation phase, including performance assessments of the kader and feedback from caregivers and healthcare facilities, were analyzed to identify strengths and areas for improvement. Reflections from this stage informed necessary modifications to the system and provided insights for scaling the project to other communities. This reflective process was crucial for the iterative improvement of the system and for ensuring its long-term sustainability and effectiveness.

### Key Results

#### 1) Improvement in Data Collection:

The system demonstrated significant improvement in the quality and accuracy of health data collection for the elderly. The use of mobile

technology allowed for more efficient and timely data entry by kader.

#### 2) Training and Empowerment of Kader:

Training sessions equipped kader with the necessary skills to effectively use the mobile health monitoring system, leading to better engagement and more accurate health assessments of the elderly population.

#### 3) System Usability:

Observations revealed that older kader faced technological challenges, impacting data collection efficiency. This highlighted the need for ongoing support and potentially simplified interfaces for older users.

#### 4) Enhanced Health Monitoring:

The integration of comprehensive geriatric assessments, such as the Elderly Screening & Comprehensive Geriatric Patient Assessment (P3G), enabled a holistic approach to health monitoring. This allowed kader to identify potential health issues early, resulting in more effective interventions.

#### 5) Scalability and Adaptability:

The pilot study in Depok validated the system's scalability and adaptability to different community settings. The

successful extension from the initial pilot in Tangerang Selatan to Depok demonstrated the system's potential for broader application.

6) Feedback and Continuous Improvement:

Feedback from stakeholders provided valuable insights for refining the system. The iterative action research approach allowed for continuous improvement based on real-world experiences and challenges.

7) Public Health Contribution:

The technology-driven approach to aging issues positively contributed to public health by providing a model for community growth and engagement, addressing demographic challenges, and improving elderly care services.

By reflecting on the insights gained from this pilot study, the health monitoring system can be refined for broader adoption in Depok and potentially scaled to other regions. This research offers a practical approach to improving elderly care through technology and contributes to the body of knowledge on public health innovations.

## CONCLUSION

The goal of this study was to create and test a health monitoring system for the elderly in the Depok region. The system was developed and iteratively improved using the action research technique, focusing on the specific demands and challenges of the community. The method was initially piloted at Puskesmas Pondok Ranji in South Tangerang, and this second cycle was piloted at Puskesmas Sukamaju Baru in Depok, involving 9 community health workers (kader) from RW 13, the head of the health center, the person in charge of the elderly program, and the administrative head of the health center.

During the 'Observe' and 'Reflect' stages of the research, significant insights were gained. One important discovery was the technological difficulties experienced by the elderly kader, who are also part of the elderly population. Future iterations may need to consider alternative or supplemental techniques for data collection and monitoring due to these challenges. This has implications for the system's scalability and adaptability. Despite these difficulties, the system showed promise in enhancing the quality of health data collection and supporting improved elderly care.

Moving forward, the conclusions and observations from this pilot study will guide necessary adjustments to the health

monitoring system. The system will be refined for broader adoption in Depok and potentially scaled to other locations. This research presents a practical approach to enhancing elderly care through technology while considering the unique demographic challenges of the community. It also contributes to the body of knowledge on public health innovations.

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