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Original Research

Mobile Health Interface Analysis: Usability Assessment of the Sembada Application for Non-Communicable Disease Monitoring

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ABSTRACT

Background: Early detection of non-communicable diseases (NCDs) through integrated guidance posts (Posbindu PTM) can be enhanced through mobile health applications. This study aimed to develop and evaluate the usability of Sembada m-Health, an Android-based application for conducting Posbindu PTM activities at Sleman Regional General Hospital. **Methods:** This Research and Development study employed the Four D model (Define, Design, Develop, Disseminate). The define phase involved stakeholder needs assessment through Focus Group Discussions. The design phase encompassed application development by IT experts, while the develop phase included multi-level testing by material experts (n=2), media experts (n=2), and end-users (n=30). Structured questionnaires assessed media and material aspects, while the Post-Study System Usability Questionnaire (PSSUQ) evaluated user experience. The disseminate phase included application socialization and qualitative evaluation. The study was conducted in Yogyakarta from October 2021 to April 2022, with feasibility thresholds set at ≥4.20 for media and material aspects and ≤2.82 for PSSUQ. **Results:** The application exceeded all feasibility thresholds, scoring 4.62 for media aspects, 4.23 for material aspects, and 1.71 on the PSSUQ. Stakeholders expressed high satisfaction with Sembada m-Health's system functionality, particularly its support for individual health monitoring, program implementation, NCD risk factor tracking, and personalized recommendations. **Conclusions:** Sembada m-Health demonstrated high usability and feasibility for supporting the Posbindu PTM program. Future research should focus on evaluating its long-term impact on NCD prevention and management outcomes.

Keywords: Mobile health application; non-communicable diseases; usability testing; health informatics; preventive healthcare; android development

1. INTRODUCTION

Non-Communicable Diseases (NCDs) constitute the primary cause of mortality in Indonesia, with WHO data indicating that 73% of deaths are NCD-related, representing a significant public health concern that demands immediate attention.(1) The 2018 Riskesdas findings demonstrate elevated NCD prevalence rates in the Special Region of Yogyakarta

compared to national averages, encompassing conditions such as diabetes mellitus, heart disease, hypertension, and chronic respiratory diseases, highlighting the region's particular vulnerability.[2] Contemporary risk factors including tobacco consumption, sedentary lifestyles, poor dietary choices, and harmful alcohol consumption continue to drive NCD emergence in modern society, creating a complex web of health challenges.[3] The complexity of NCD management necessitates a multifaceted approach involving diverse stakeholders, innovative solutions, and sustainable intervention strategies that can effectively address both prevention and treatment aspects. The increasing burden of NCDs demands immediate attention due to their substantial impact on community health outcomes, healthcare systems, and socioeconomic development.

The government's Posbindu PTM (Integrated Development Post for Non-Communicable Diseases) initiative, launched in 2012, is a community-based healthcare program that focuses on early detection and monitoring of NCD risk factors. As a Community-Based Health Effort (UKBM), Posbindu PTM involves community participation in planning, implementation, monitoring, and evaluation of health activities. The program aims to empower communities in health management through five systematic stages: registration, risk factor interviews, anthropometric measurements, blood pressure and blood glucose measurements, and NCD risk factor identification with appropriate follow-up actions. These activities are carried out regularly and periodically by trained community health workers called kaders, making preventive healthcare more accessible to the community.[4] While Posbindu PTM demonstrates significant potential in raising public health awareness and facilitating risk monitoring, its implementation faces numerous operational challenges that require systematic solutions and continuous improvement efforts.[5] Resource constraints in Sleman Regency, including limited personnel, infrastructure, and financial resources, significantly hinder program effectiveness and sustainability in delivering essential health services.[6] Qualitative assessments reveal additional challenges such as inadequate cadre training, limited community engagement, time constraints, and insufficient understanding of the program's importance among target populations.[7] These operational barriers necessitate innovative solutions to enhance program delivery and impact, particularly through the integration of modern technology and improved management systems.

The emergence of Android-based health applications presents promising opportunities for improving community healthcare delivery, offering solutions that can overcome traditional program limitations and enhance service accessibility.[8] Recent developments in mobile health technology have produced various successful applications, demonstrating the potential for digital solutions in public health management, particularly in areas of prevention, monitoring, and early intervention of NCDs. This study aims to develop and evaluate the Sembada m-Health application using the comprehensive Four-D framework as illustrated in Figure 1, which represents an effort to modernize Posbindu PTM services by incorporating user-centered design principles and evidence-based health management strategies.[9] The technological approach being developed aims to enhance program accessibility and efficiency through digital innovation, providing features that support both healthcare providers and community members in managing NCD-related health concerns. The systematic development and evaluation methodology, following established practices outlined in the Four-D model (Define, Design, Develop, Disseminate), is designed to ensure application quality and effectiveness while maintaining adaptability to user needs and technological advancements.[10] The systematic development approach illustrated in Figure 1 demonstrates a comprehensive framework that ensures quality, usability, and effectiveness of the final product through iterative testing and refinement processes. This methodological approach incorporates continuous feedback loops and quality assurance measures, ensuring that the application meets both technical requirements and user needs effectively. The integration of technology in healthcare services represents a significant step forward in public health management, offering potential solutions to long-standing challenges in healthcare delivery and accessibility. Modern digital solutions provide opportunities for real-time monitoring, data analysis, and improved communication between healthcare providers and community members. This research aimed to develop and evaluate a user-friendly Android application to support Posbindu PTM activities at Sleman Regional General Hospital. The study is

significant as it addresses key challenges in implementing Posbindu PTM programs, particularly the limitations of manual data collection, time constraints, and the need for more accessible healthcare screening tools. Using the Four-D model (Define, Design, Develop, Disseminate) and PSSUQ evaluation framework, this research offers three main contributions: (1) development of a dual-interface application serving both healthcare providers and participants, (2) integration of automated health risk assessment with appropriate follow-up recommendations, and (3) streamlined data collection and reporting system compatible with the Ministry of Health's SIPTM format. The success of this application could serve as a model for modernizing community-based healthcare services, potentially improving the effectiveness and accessibility of NCD prevention programs in Indonesia.

2. METHODS

2.1 Research Stages

The study implemented a Research and Development approach utilizing the Four D framework (Define, Design, Develop, and Disseminate) as its foundational methodology, with the following specific phases:

2.1.1 Define phase

The Define phase began with a Focus Group Discussion (FGD) methodology to analyze the development requirements and specifications. Nine key stakeholders were purposively selected, representing various important perspectives: hospital management, program implementers, media experts, content specialists, and end users. The FGD discussion guide was designed to explore various aspects of the application requirements, including current issues in Posbindu activities, application needs and specifications, identification of target users, expected benefits and advantages, and reference sources for content development. Additional aspects included expected outputs and outcomes, common problems in similar applications, current media use in Posbindu activities, application limitations and constraints, and stakeholder expectations. The FGD was conducted in a single session with a moderator guiding the discussion while the research supervisor and programmer were present as observers. The discussion was recorded and transcribed for analysis. This methodological approach aimed to collect comprehensive qualitative data to establish the application development framework and design parameters.

2.1.2 Design phase

The Design phase employed collaborative development methodology between researchers and programmers. Design process began with literature review of the Ministry of Health's 2019 Posbindu PTM Technical Guidelines, followed by analysis of FGD results and stakeholder input. The application features and interface designs were developed through iterative planning sessions between researchers and programmers. User interface designs were created for two distinct user types: participants and administrators. System architecture and workflow were documented using flowchart methodology to map user journeys, data flow, and system processes. The design process included multiple review sessions to refine interface elements, system features, and terminology based on technical guidelines and stakeholder feedback. Interface prototyping was conducted to visualize the application's structure and functionality before proceeding to development. Documentation methods included system flowcharts, user journey maps, and interface wireframes to ensure comprehensive design specification for the development phase.

2.1.3 Develop phase

The Develop phase implemented a comprehensive validation and testing methodology consisting of three main approaches. First, material validation was conducted by two content experts with backgrounds in medical services, quality development, and NCD program management. The experts utilized a structured assessment instrument examining content accuracy, completeness, and relevance. Second, media validation was performed by two media experts specializing in health education and health promotion. Their assessment focused on interface design, usability aspects, and technical functionality using standardized evaluation criteria. Third, usability testing was conducted with 30 hospital employees selected through purposive sampling to represent various roles within the healthcare system. The Post-Study System Usability Questionnaire (PSSUQ) was employed as the evaluation instrument, measuring four key dimensions: overall usability, system quality, information quality, and interface quality. The development process incorporated an iterative improvement methodology, where feedback from both expert validation and user

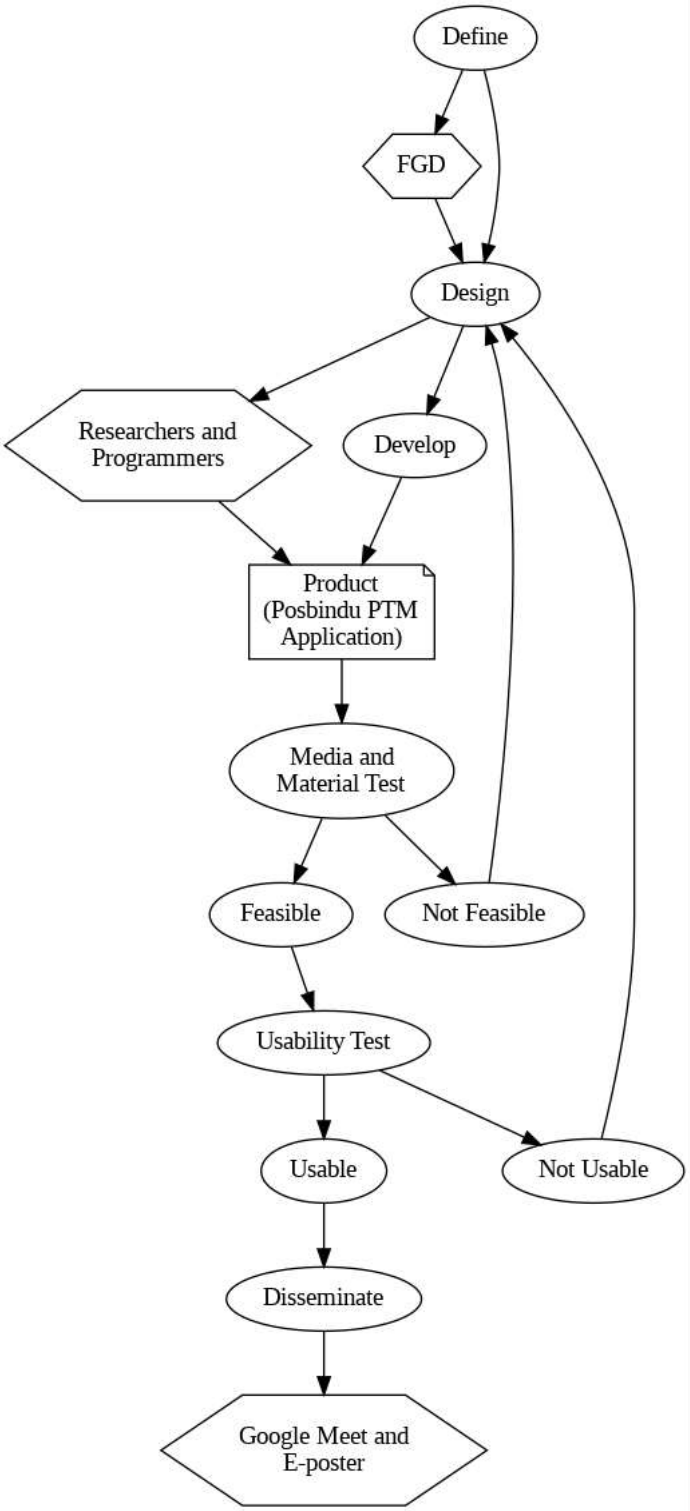

Figure 1. Research flow diagram based on the Four-D model framework

testing was systematically analyzed and implemented. Documentation of all testing procedures, feedback, and subsequent modifications was maintained throughout the development phase.

2.1.4 Disseminate phase

The Disseminate phase utilized multiple methodological approaches to ensure comprehensive information distribution. The primary dissemination method involved organizing an online meeting platform via Google Meet, targeting both FGD informants and research respondents. The meeting agenda included systematic presentation of the application development process, live demonstration sessions, and interactive user simulation activities. The

second dissemination method employed digital media distribution through electronic posters, utilizing social messaging platforms for wider reach. The dissemination strategy incorporated both rational and authority-based approaches to address different stakeholder needs. Feedback collection methodology utilized online forms to gather structured responses from participants regarding usability, potential implementation, and future recommendations. The dissemination effectiveness was evaluated using six criteria: information clarity, data validity, target audience reach, response generation, distribution timeliness, and resource practicality. Documentation of all dissemination activities, participant feedback, and implementation suggestions was maintained throughout this phase.

The methodology enabled systematic development with continuous stakeholder involvement and multiple validation steps to ensure the application met user needs and technical requirements.

2.2 Data Analysis

The data analysis process was conducted in several stages:

2.2.1 Define phase analysis

The Define phase analysis involved a qualitative examination of FGD transcripts collected from nine key stakeholders, including hospital management, health program coordinators, and potential users. The analysis process encompassed systematic data coding and thematic analysis of the FGD results to identify key application requirements and implementation challenges. This methodological approach allowed for comprehensive understanding of stakeholder needs and potential barriers to application adoption.[11]

2.2.2 Design phase analysis

The Design phase analysis consisted of a systematic evaluation of design requirements, incorporating both insights from the FGD results and specifications from the Ministry of Health's 2019 technical guidelines. This phase included detailed documentation of design specifications and comprehensive flowcharts to map the application's functionality and user interface requirements. The analysis process ensured alignment between stakeholder needs and official health protocols while maintaining technical feasibility.[11]

2.2.3 Development phase analysis

The Development phase analysis incorporated two distinct evaluation approaches. First, expert validation was conducted using a 5-point Likert scale, involving assessments from two material experts and two media experts. Second, a comprehensive usability analysis was performed using the PSSUQ questionnaire administered to 30 respondents. This questionnaire measured four key dimensions: overall usability score, system quality score (SYSUSE), information quality score (INFOQUAL), and interface quality score (INTERQUAL). This dual analytical approach provided both expert perspectives and end-user feedback on the application's functionality and user experience.[12]

2.3 Analytical Framework

The analytical process involved comparative assessment of material tests, media tests, and user tests against predetermined benchmarks, with material and media tests requiring scores of ≥4.20 for acceptance. PSSUQ usability criteria established specific thresholds: overall score ≤2.82, SYSUSE ≤2.80, INFOQUAL ≤3.02, and INTERQUAL ≤2.49 (13). Microsoft Excel served as the primary tool for data analysis. The analytical framework ensured objective evaluation of all components. These benchmarks provided clear metrics for success determination.

2.4 Research Context and Participants

The research spanned from October 2021 to April 2022 in Sleman, Yogyakarta, with carefully selected participant groups for each phase. The Define phase engaged nine key stakeholders, while the Develop phase involved four expert evaluators for material and media assessment. The study population for PSSUQ testing comprised Sleman Regional Hospital employees, with 30 participants selected through purposive sampling based on specific inclusion criteria. The participant selection process ensured representative feedback from all stakeholder groups.

2.5 Data Collection Strategy

Primary data collection was conducted using the following instruments:

2.5.1 Material expert validation forms

Material expert validation was conducted using specialized forms assessed by two experts: one from the PTM Division of Sleman Health Office and another from RSUD Sleman. The validation forms employed 5-point

Likert scale evaluation criteria to systematically assess content accuracy and appropriateness. This comprehensive evaluation focused on ensuring the material content aligned with technical guidelines and met the requirements for Posbindu PTM activities.

2.5.2 Media expert validation forms

Media expert validation was performed using specialized forms assessed by two experts: one from Poltekkes Kemenkes Yogyakarta and another from the Health Promotion Division of Sleman Health Office. Similar to the material validation, these forms utilized 5-point Likert scale evaluation criteria. The assessment focused on technical and design aspects of the application, ensuring optimal user interface design, functionality, and overall media effectiveness.

2.5.3 PSSUQ questionnaires

The Post-Study System Usability Questionnaire (PSSUQ) was administered to 30 respondents to evaluate the application's usability. This comprehensive questionnaire measured four key dimensions: overall usability, system quality, information quality, and interface quality. Using a 7-point rating scale ranging from 1 (strongly agree) to 7 (strongly disagree), the PSSUQ provided quantitative data on user satisfaction and system effectiveness from the end-user perspective.

All data was collected through Google Forms to ensure efficient and accurate data gathering. The systematic collection strategy allowed for comprehensive evaluation of the application's effectiveness and usability from multiple stakeholder perspectives.

2.6 Ethical Clearance

The research received ethical approval from the Health Research Ethics Committee of RSUD Sleman on January 10, 2022 (No. 180/0158). All data collection was conducted through Google Forms with informed consent from participants. Data collection procedures ensured participant confidentiality and privacy in accordance with research ethics guidelines.

3. RESULTS

3.1. Define Stage Implementation

The Focus Group Discussion (FGD) was conducted online on Friday, February 4, 2022, from 09.00-11.00 WIB (Jakarta time), with 9 informants representing diverse expertise from Sleman Hospital, Sleman District Health Office, and hospital employees. Through systematic discussion and analysis, the FGD identified essential stakeholder requirements for the Posbindu PTM android application. The key requirements included documentation capabilities aligned with SIPTM offline forms, follow-up features for abnormal examination results, dual-user functionality, and measurement feedback capabilities. The stakeholders emphasized integration with three Sleman Hospital programs: employee health screening, Human Resources health assessment, and Occupational Health and Safety (in Indonesian language: Kesehatan dan Keselamatan Kerja or K3) Hospital Program. Technical requirements focused on simplified data entry, standardized terminology, and participant-oriented features like compact app size and broad Android compatibility.

3.2. Design Phase Development

The design phase involved collaborative work between researchers and programmers to develop the Posbindu PTM android application according to the Ministry of Health's 2019 Technical Guidelines and FGD findings. The design results included:

3.2.1 User interface design

The user interface design implemented a dual login system with clear homepage graphics and version display (Figure 2). The participant registration form was simplified by making certain fields optional. Visual elements were enhanced with enlarged educational posters and improved graph presentations to support better information comprehension.

3.2.2 Application structure

The application structure consisted of five sequential Posbindu PTM stages: Stage I for registration and biodata collection, Stage II for comprehensive interviews regarding NCDs risk factors, Stage III for anthropometric measurements, Stage IV for blood pressure and laboratory examinations, and Stage V for risk factor identification and recommendations, as detailed in Figure 2.

3.2.3 Data management features

The application incorporated Excel export capabilities aligned with SIPTM format, automated BMI calculations, and risk status determinations. A data verification system was implemented for administrators to maintain data quality. The system included automated referral form generation that activates when abnormal results are detected.

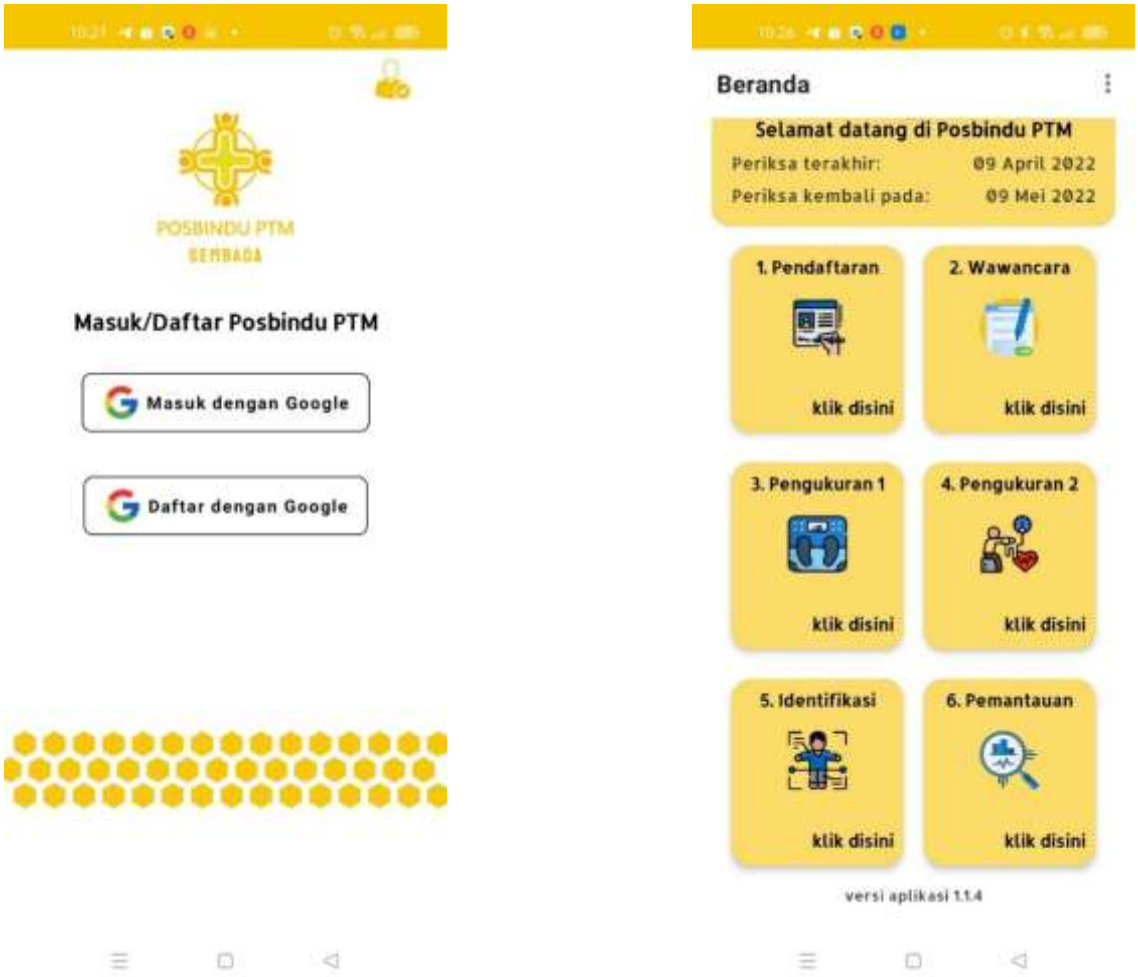

Figure 2. Application design

3.2.4 User-specific outputs

The application featured differentiated outputs - participant views displaying individual data, health measurements, and monitoring results, while administrator views provided access to comprehensive participant data, verification tools, and reporting features.

3.2.5 Technical specifications

The application was developed with specific technical parameters to ensure optimal performance. The application size was maintained below 50 MB to minimize device storage impact. The system required a minimum Android version 6.0 (Marshmallow) for compatibility. Essential permissions included camera and external storage access for documentation and data storage functionalities

3.3. Validation Process

Expert validation procedures yielded high feasibility scores, with material experts (n=2) awarding 4.62 (Table 1) and media experts (n=2) providing 4.23 ratings (Table 2). The PSSUQ evaluation demonstrated strong usability metrics: overall score (1.71), system quality (1.64) (Table 3), information quality (1.83) (Table 4), and interface quality (1.62) (Table 5). These scores exceeded standard benchmarks, validating the application's readiness for implementation.

Table 1. Material expert validation results

No.	Points assessed	Score assessment	
		Expert 1	Expert 2
1	The material in each section of the application is suitable for Posbindu PTM activities	5	5
2	The material in the application can measure each stage of Posbindu PTM activities	4	5

(*continued on next page*)

Table 1 (*continued*)

No.	Points assessed	Score assessment	
		Expert 1	Expert 2
3	The Android application has function buttons that correspond to the measurements needed for Posbindu PTM activities	5	4
4	The material in the application is limited to Posbindu PTM activities	4	4
5	The functions of the parts in the application are very clear	5	4
6	Each function in the application can produce answers that are definite, consistent and do not conflict with each other	5	5
7	The language used in the application is easy to understand and appropriate to the local culture	5	5
8	The application layout is technically very much in line with the Posbindu PTM activity flow	5	5
9	The measurement scale used in the application complies with applicable standards	4	4
10	The application is not too complicated so it can be answered easily and quickly by Posbindu participants	5	5
11	The material in the application can make participants interested in filling out the application according to the Posbindu activity flow	4	5
12	The application as a whole is in accordance with the purpose of creating the application, namely to accommodate Posbindu activities	4	5
13	The material in the application is acceptable to the local culture	5	4
Amount		60	60
Score average by person		4.62	4.62
Total score average		4.62	

Table 2. Media expert validation results

No.	Points assessed	Assessment	
		Expert 1	Expert 2
1	The application can overcome space and time limitations in Posbindu PTM activities	5	5
2	The application can be used as a medium for Posbindu PTM activities	4	5
3	The application can be used as a means of interaction between Posbindu PTM officers and participants	5	3
4	Application media can be used easily	3	3
5	The interface looks quite attractive	4	4
6	Interesting application media to use	5	4
7	The application meets quality standards as a medium for Posbindu PTM activities.	5	4
8	The application can shorten the implementation time of Posbindu PTM	4	5
9	Applications can enhance the role of Posbindu PTM participants	5	4
10	The application can align the perceptions of Posbindu PTM participants	3	3
11	The application can attract the attention of Posbindu PTM participants	5	3
12	Application suitable for Posbindu PTM targets	5	3
13	Navigation buttons and menus within the application are easy to reach.	5	4
14	The features in the application are already running well	3	4
15	Easy to install application	5	4
16	Applications can be run easily	4	4
17	The application is working according to its function	5	4
18	Safe application to use	5	4
19	How to use the application can be learned easily	5	5
20	How to use the application is easy to remember	4	5

(*continued on next page*)

Table 2 (*continued*)

No.	Points assessed	Assessment	
		Expert 1	Expert 2
Amount		89	80
Score average by person		4.45	4
Total score average		4.23	

Table 3. System usability score

No.	Questions	Respondent assessment			
		Amount	Average	Overall score average	Category
1	Overall, I am satisfied with the ease of use of the app	46	1.53	1.64	Usable (≤2.80)
2	The application is simple to use	47	1.57		
3	I can complete instructions/tasks in the app quickly	51	1.70		
4	I feel comfortable using the application	47	1.57		
5	Easy to learn application	46	1.53		
6	I am sure that by using the application I will be more active and routine in Posbindu activities	59	1.97		

Table 4. Information quality score

No.	Questions	Respondent assessment			
		Amount	Average	Overall score average	Category
1	In the application there is a message if an error occurs and instructions are given on how to resolve the error	63	2.10	1.83	Usable (≤3.02)
2	If an error occurs when using the application, I can resolve and fix it quickly and easily	63	2.10		
3	The application provides clear information	52	1.73		
4	In the application, I find it easy to get the information I need	55	1.83		
5	The instructions in the application make it easier for me to complete the instructions/tasks	47	1.57		
6	The layout of the application information on the monitor screen is very clear	50	1.67		

Table 5. Interface quality score

No.	Questions	Respondent assessment			
		Amount	Average	Overall score average	Category
1	Nice app view	48	1.60	1.62	Usable (≤2.49)
2	I like using this system interface	53	1.77		
3	The application's functions and capabilities are suitable for Posbindu PTM activities	46	1.53		
4	Overall, I am satisfied with the application	47	1.57		

3.4. Dissemination and Implementation

The final phase reached 34 key stakeholders through virtual platforms and digital materials. Implementation utilized Google Meet sessions for demonstrations and training, supported by e-poster distributions. A WhatsApp group facilitated ongoing engagement and support. Stakeholder feedback indicated strong acceptance and readiness for implementation within the healthcare facility.

4. DISCUSSION

The development and implementation of Sembada m-Health application demonstrated significant potential in enhancing Posbindu PTM activities through digital transformation. Electronic health records have shown remarkable improvements in healthcare documentation accuracy and efficiency.[14] The implementation aligns with recent trends showing that digital health applications can effectively streamline healthcare workflows and improve service delivery.[15] Mobile-based health applications have demonstrated superior performance in data collection and management compared to traditional methods.[16] These findings validate our application's approach to digital health documentation while suggesting opportunities for further optimization in future development cycles.

The transformation of traditional health monitoring into a digital platform has yielded significant improvements in community health screening programs. Recent studies support the effectiveness of mobile health applications in enhancing healthcare delivery and patient engagement.[17] The systematic development approach following established frameworks ensured comprehensive coverage of essential healthcare monitoring requirements.[8] Our findings demonstrate that digital platforms can effectively support community-based healthcare initiatives while maintaining high standards of data accuracy and user satisfaction. The successful integration of digital tools in healthcare monitoring suggests potential for broader implementation across various healthcare settings.

Demographic analysis revealed interesting patterns in application adoption and usage across different user groups. The implementation through virtual platforms achieved significant success in reaching target users and facilitating health monitoring activities.[18] Research shows that healthcare facilities utilizing digital health monitoring applications report substantial improvements in patient engagement and health outcomes tracking.[19] The positive user feedback and high acceptance rates at Sleman hospital suggest promising potential for scaling the application across diverse healthcare settings. These findings provide valuable insights for future development and implementation strategies in similar healthcare contexts.

The technical evaluation of Sembada m-Health highlighted several crucial aspects affecting its successful implementation. Healthcare applications supporting multiple platforms and versions demonstrate higher adoption rates and improved accessibility.[20] Integration with existing hospital information systems has shown significant benefits in improving healthcare service delivery and data management.[21] The implementation success aligns with recent trends in healthcare digitalization, suggesting potential for broader adoption across various healthcare settings. Our findings emphasize the importance of maintaining robust technical infrastructure while ensuring user-friendly interfaces for optimal adoption and utilization.

The usability assessment of Sembada m-Health revealed exceptional performance across multiple evaluation parameters. Recent studies emphasize the importance of user interface design in healthcare applications, particularly focusing on accessibility and ease of use.[22] Our findings align with contemporary research showing that visually appealing healthcare interfaces significantly improve user engagement and retention.[23] The application's dual interface design successfully addresses different user needs while maintaining system security and data integrity. These results demonstrate the effectiveness of our user-centered design approach in developing healthcare applications.

The Posbindu PTM program's digital transformation through Sembada m-Health represents a significant advancement in community healthcare delivery. Studies indicate that integrated healthcare applications can substantially improve health monitoring and disease prevention efforts in community settings.[24] The successful implementation at Sleman hospital provides valuable insights for similar healthcare digitalization initiatives across Indonesia.

Our findings suggest that mobile health applications can effectively support public health programs while maintaining high standards of healthcare delivery. The positive outcomes demonstrate the potential for digital health solutions in addressing contemporary healthcare challenges.

The Posbindu PTM application effectively addresses key challenges in community health monitoring and disease prevention. Research shows that digital health platforms can significantly enhance early detection and prevention of non-communicable diseases.[3] The implementation success aligns with national health priorities for improving NCDs management and prevention strategies.[25] The application's comprehensive approach to health monitoring demonstrates the potential for broader implementation across various healthcare settings. These findings suggest that digital health solutions can effectively support public health initiatives while improving healthcare accessibility and efficiency.

The systematic evaluation of Sembada m-Health provides valuable insights for future healthcare application development. Current research emphasizes the importance of comprehensive testing and validation in ensuring healthcare application effectiveness.[25] Our findings demonstrate the potential of mobile health applications in supporting community-based healthcare initiatives. The successful implementation at Sleman hospital establishes a framework for similar digital health initiatives. These results suggest promising opportunities for expanding digital health solutions across various healthcare settings while maintaining high standards of care delivery.

The study's limitations include its focus on a single healthcare facility, limiting generalizability to other settings, and the absence of longitudinal evaluations to assess the application's long-term effectiveness in reducing NCDs risk factors. Additionally, the impact of varying levels of participants' digital literacy was not thoroughly examined, and the lack of a cost-effectiveness analysis restricts understanding of the financial feasibility for large-scale implementation. Addressing these gaps in future research would provide a more comprehensive evaluation of the application's potential

5. CONCLUSION

The Sembada m-Health application proved to be highly usable and effective in supporting the Posbindu PTM program for non-communicable disease (NCD) prevention and management. With features such as dual user interfaces, automated health risk assessments, and compatibility with national reporting systems, the application meets both technical and user requirements. It has the potential to significantly enhance community-based healthcare delivery and improve health monitoring outcomes.

To maximize its impact, the application should be expanded to other regions, accompanied by comprehensive training for healthcare workers and users. Future enhancements could include telemedicine features, multilingual support, and improved accessibility for users with lower digital literacy. This innovation demonstrates the transformative potential of mobile health technology in public health, offering scalable solutions for more efficient and equitable healthcare delivery while empowering communities to take proactive roles in managing their health.

This study acknowledges several limitations that may affect the generalizability and comprehensiveness of the findings. First, the research was conducted in a single healthcare facility, limiting its ability to reflect broader implementation outcomes in diverse settings. Second, the study did not include longitudinal evaluations, which could provide insights into the application's long-term effectiveness in reducing non-communicable disease (NCD) risk factors. Third, while the application demonstrated high usability scores, the study did not thoroughly assess the impact of varying levels of digital literacy among participants. Finally, the absence of a cost-effectiveness analysis limits the understanding of financial feasibility for large-scale implementation. Future research should address these gaps to provide a more holistic evaluation of the application's potential.

Ethics Approval

The Ethical approval statement should be provided including the consent. If not appropriate, authors should state: “Not required.”

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Competing Interests

The authors declare no conflicts of interest in this study's design, implementation, or reporting. The funding from Sleman Regency Government did not influence any research outcomes or conclusions. All research decisions were made independently based on scientific principles. The Sembada m-Health application development maintained complete academic autonomy. The research team conducted all evaluations with professional integrity and transparency.

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Underlying Data

The data used in this study can be accessed upon reasonable request to the corresponding author. Restrictions may apply due to confidentiality or ethical considerations.

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