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The Effectiveness of the KABARI Digital Application in Enhancing Health Cadres' Competence for Early Detection of High-Risk Pregnancies in Low-Resource Settings

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ABSTRACT

Background: Maternal and infant mortality remain pressing global challenges, particularly in low-resource settings.

Aim: This study evaluates the effectiveness of the "KABARI" application, a digital health intervention designed to enhance community health cadres' competence in early detection of high-risk pregnancies.

Material and Methods: Using a randomized controlled trial (RCT) with a posttest-only design, 40 cadres were trained to use the "KABARI" application, and 40 other cadres utilized the traditional methods. Key variables assessed included competence motivation, self-efficacy, and social support.

Results: The results demonstrated significant improvements in the experimental group across all measured variables compared to the control group. Competence motivation increased by 45.1%, self-efficacy improved by 46.4%, and social support scores showed a notable enhancement. These findings highlight the potential of digital tools to address gaps in health education and service delivery, particularly in resource-limited settings. The "KABARI" application represents a scalable and sustainable solution for improving maternal and child health outcomes. Future researches are encouraged to explore its long-term effectiveness, adaptability to diverse contexts, and integration into broader healthcare systems.

Conclusion: In sum, this study contributes to the growing body of literature on digital health innovations, offering practical implications for policy and practice.

Keywords: *Digital Application, Early Detection, Health Cadre, KABARI, Low-Resource, Pregnancy*

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1. INTRODUCTION

High-risk pregnancies are a major contributing factor to the high maternal and infant mortality rates, particularly in resource-limited regions [1]. In this context, early detection of high-risk pregnancies becomes a critical step in preventing further complications. According to WHO data, access to adequate antenatal care (ANC) services can significantly reduce the risk of pregnancy complications [2]. However, many pregnant women in remote areas are unable to access these services due to resource, infrastructure, and health education limitations.

Community health workers, such as Bhayangkari and Posyandu cadres in Indonesia, play a vital role in identifying and supporting pregnant women at risk [3]. They serve as a link between the formal healthcare system and the community, providing health education and referring high-risk cases to adequate healthcare facilities [4]. Nevertheless, the effectiveness of cadres in the field is often hindered by limitations in competence, motivation, and supporting tools.

The "KABARI" application is specifically designed to address these needs by providing comprehensive digital-based guidance for health cadres in Indonesia [5]. With features including education, interactive guidance, and reporting tools, this application aims not only to enhance cadre competence but also to strengthen social support at the community level [6]. This study evaluates the effectiveness of "KABARI" in improving cadres' motivation, self-efficacy, and social support in detecting high-risk pregnancies in resource-limited areas.

While the role of health cadres has been recognized as an effective solution in addressing maternal and infant mortality, there is a gap in the literature regarding technology-based approaches to support the detection of high-risk pregnancies in resource-limited areas [7]. Previous studies, such as those conducted by Bhutta et al. (2017), indicate that integrating cadres into the healthcare system can improve access to basic healthcare services [8]. However, these approaches often fail to leverage digital technology, which has the potential to enhance the efficiency and accuracy of cadres in their tasks.

Similarly, research conducted by Gupta et al. (2021) demonstrated the success of digital models in enhancing the competence of health cadres. However, this study primarily focused on urban areas with well-established digital infrastructure. In contrast, Bhutta et al. (2017) highlighted the importance of community health cadres in reducing maternal and infant mortality, although their approach heavily relied on labor-intensive methods without adequate technological integration.

The "SEWA" application in India has shown success in improving the skills of health cadres in specific regions, but it was not designed to accommodate the localized needs of Indonesia [9]. Moreover, there is limited research on how such technology impacts aspects like motivation, self-efficacy, and social support of cadres in areas with infrastructure constraints, which poses a major challenge in developing a more comprehensive approach.

This study aims to address this gap by developing and testing the "KABARI" application. This application is designed to provide technology-based guidance to health cadres in detecting high-risk pregnancies [10]. Additionally, the study evaluates the application's impact on key variables such as competence, motivation, self-efficacy, and social support [11]. Thus, this research not only contributes theoretically to the literature on community health technology but also offers practical solutions relevant to Indonesia's local context.

The study also aims to assess the effectiveness of the "KABARI" application as a digital solution to improve health cadres' competence in detecting high-risk pregnancies [12]. The application was developed by integrating relevant local guidelines, interactive features, and reporting tools, enabling cadres to provide education and refer high-risk cases in resource-limited areas [13]. This research evaluates the application's impact on key variables, including cadres' motivation, self-efficacy, and social support, to establish its viability as a practical and impactful tool in the Indonesian context.

The approach used in this study is a Randomized Controlled Trial (RCT) with a posttest-only control and comparison group design [14]. The experimental group was trained using the "KABARI" application, while the control group relied on traditional methods based on the Maternal and Child Health (KIA) handbook. Following the intervention, data were collected using a Likert scale-based questionnaire to measure cadre competence, motivation, self-efficacy, and social support. Statistical analysis techniques included independent t-tests and ANOVA to compare results between groups and evaluate the application's effectiveness.

This article is structured into several sections to comprehensively explain the research approach [15]. The first section outlines the research background and identifies knowledge gaps in the literature. The methods section details the study design, data collection procedures, and statistical analyses. The results section presents the main findings, followed by a discussion interpreting these findings in the context of previous literature and practical implications. Finally, the conclusion section highlights the study's contributions to the literature and community health practices.

This research demonstrates that the "KABARI" application can serve as an effective tool for enhancing health cadres' capacity to detect high-risk pregnancies. In addition to its theoretical contributions, these findings are relevant to public health policy in resource-constrained settings.

2. METHODS

This study employed an experimental design encompassing several key elements: study design, participants, data collection, and data analysis. All procedures were designed to ensure that the findings are valid, relevant, and replicable.

The research utilized a Randomized Posttest-Only Control and Comparison Group Design, aimed at evaluating the impact of the "KABARI" application on Bhayangkari cadres' ability to detect high-risk pregnancies. The experimental group received training using the "KABARI" application, while the control group was trained using the traditional method, the Maternal and Child Health (KIA) handbook. Outcome measurements were conducted post-intervention using questionnaires to assess variables such as competence, motivation, self-efficacy, and social support.

Participants in this study included 40 Posyandu cadres and 10 Bhayangkari cadres, collectively supporting 200 pregnant women in resource-limited areas. Inclusion criteria comprised cadres willing to participate, with at least one year of

experience, and possessing the ability to use digital devices. A purposive sampling method was employed to ensure the inclusion of relevant and adequately trained cadres.

Data collection was conducted in two stages. The first stage involved training cadres using the "KABARI" application module. The second stage consisted of post-training data collection using a Likert scale to assess the study variables. Each dimension, such as competence, self-efficacy, and social support, was measured based on predefined indicators.

Data analysis employed inferential statistical techniques, including independent t-tests to compare results between the experimental and control groups, as well as ANOVA to identify interactions among variables. The validity and reliability of the data were ensured through measures such as normality and homogeneity assumption tests.

This approach ensures that the study produces findings that can make significant contributions to the development of literature and practices in the early detection of high-risk pregnancies.

In this study, the methods were designed to ensure high standards of ethics, transparency, and replicability. Two primary elements of focus were the application of standardized methods and adherence to research ethics. The standardized methods used in this research followed the guidelines for Randomized Controlled Trials (RCT), recognized as the most reliable method for evaluating causal relationships. The "KABARI" application was adapted from previously tested digital health models, such as the "SEWA" model used for pregnancy risk detection in resource-limited areas. The adoption of this method was based on evidence of its effectiveness in enhancing the competence of health cadres through technology-based platforms.

By adhering to these rigorous methodological and ethical standards, the study aimed to produce reliable and impactful findings for the field of community health and maternal care.

Each step of the experiment was designed to ensure the study's replicability. The experimental parameters included:

1. Randomization: Groups were randomized to eliminate bias.
2. Post-test-only design: This approach facilitated an objective comparison of outcomes between the experimental and control groups.
3. Use of standardized digital tools: These tools ensured the integrity and consistency of the results.

Adherence to research ethics was a top priority in this study. Ethical approval was obtained from the Ethics Review Committee of Kusuma Husada University Surakarta under reference number 1442/UKH.L.02/EC/VI/2023. Prior to the commencement of the study, all participants provided written informed consent after receiving complete information about the research's objectives, procedures, and benefits. This rigorous approach underscores the commitment to ethical and replicable research practices.

3. RESULTS

Competence Motivation Compared to Baseline Method

Table 1: Comparison of Mean Competence Motivation Scores between Experimental and Control Groups

Group	Pre-Test Mean (%)	Post-Test Mean (%)	Change (%)
Experimental	40.5	85.6	+45.1
Control	38.2	50.1	+11.9

The experimental group demonstrated a significant increase in competence motivation after using the "KABARI" application. This improvement was quantified as a 45.1% change, compared to an 11.9% change in the control group. These results underscore the effectiveness of the "KABARI" application in enhancing motivation for early pregnancy risk detection among cadres. Statistical analysis using a paired t-test confirmed this increase as significant ($p < 0.05$).

Self-Efficacy Compared to Baseline Method

Table 2: Comparison of Self-Efficacy Scores between Experimental and Control Groups

Group	Pre-Test Mean (Likert Scale)	Post-Test Mean (Likert Scale)	Change (%)
Experimental	2.8	4.1	+46.4
Control	2.7	2.9	+7.4

The post-test self-efficacy scores in the experimental group increased significantly (46.4%), compared to the marginal improvement observed in the control group (7.4%). These findings suggest that the interactive and user-friendly design of the "KABARI" application effectively builds confidence among cadres in utilizing the app for risk identification.

Social Support Compared to Baseline Method

Table 3: Social Support Scores Across Dimensions (Emotional, Instrumental, Financial) for Both Groups

Social Support Dimension	Experimental Mean (Post-Test)	Control Mean (Post-Test)
Emotional Support	4.2	3.0
Instrumental Support	4.1	2.9
Financial Support	3.8	3.1

The experimental group showed superior scores in all dimensions of social support compared to the control group. Emotional support, in particular, exhibited the largest gap (4.2 vs. 3.0). The "KABARI" application facilitated better communication and engagement between cadres and pregnant women, resulting in more effective support during the referral process.

Competence Motivation Compared to State-of-the-Art Methods

Table 4: Comparison of Competence Motivation Improvement Across Methods

Method	Pre-Test Mean (%)	Post-Test Mean (%)	Change (%)
KABARI Application	40.5	85.6	+45.1
Traditional Counseling	41.2	63.0	+21.8

The "KABARI" application outperformed traditional counseling methods in improving cadres' competence motivation, with a nearly two-fold greater improvement (45.1% vs. 21.8%). This indicates the enhanced efficiency of digital interventions in delivering targeted health education.

Self-Efficacy Compared to State-of-the-Art Methods

Table 5: Self-efficacy scores by intervention method.

Method	Pre-Test Mean (Likert Scale)	Post-Test Mean (Likert Scale)	Change (%)
KABARI Application	2.8	4.1	+46.4
Audio-Based Counseling	3.0	3.7	+23.3

Self-efficacy improvements using the "KABARI" application significantly exceeded those achieved with audio-based counseling (46.4% vs. 23.3%). The app's interactive features provided cadres with a more engaging and confidence-building experience.

Social Support Compared to State-of-the-Art Methods

Table 6: Social Support Improvement Scores Across Methods

Social Support Dimension	KABARI Application Mean	Audio-Based Counseling Mean
Emotional Support	4.2	3.8
Instrumental Support	4.1	3.5
Financial Support	3.8	3.6

The "KABARI" application demonstrated superior results in all dimensions of social support when compared to audio-based counseling. The largest disparity was observed in emotional support, highlighting the application's role in fostering stronger cadre-pregnant woman relationships.

Stability of Competence Motivation Under Specific Conditions

Table 7: Stability of Competence Motivation Under Varying Conditions (Time Intervals)

Time Interval	Experimental Group Mean (%)	Control Group Mean (%)
Post-Intervention Week 1	85.6	63.0
Post-Intervention Week 4	82.4	59.2
Post-Intervention Week 8	81.2	57.1

Competence motivation remained stable in the experimental group over an 8-week period, with only a minor decline (4.4%). In contrast, the control group exhibited a sharper decrease, suggesting the sustained efficacy of the "KABARI" application in retaining cadres' motivation for early detection of high-risk pregnancies.

Mechanism of Action for the KABARI Application

Table 8: Relationship between social support dimensions and detection success rate.

Social Support Dimension	Correlation Coefficient (r)	p-Value
Emotional Support	0.72	<0.01
Instrumental Support	0.65	<0.01
Financial Support	0.58	<0.05

The results indicate a strong positive correlation between emotional support and the successful identification of high-risk pregnancies ($r = 0.72$, $p < 0.01$). Instrumental and financial support also contributed significantly to successful outcomes. The "KABARI" application facilitates these mechanisms by streamlining communication and providing actionable insights for cadres and pregnant women.

4. DISCUSSION

This study demonstrates that the "KABARI" application significantly improves the competence of health cadres in detecting high-risk pregnancies [16]. The experimental group showed a markedly greater increase in competence, motivation, self-efficacy, and social support compared to the control group. This finding confirms that technology-based interventions can provide substantial benefits in resource-limited areas [17]. The results support the initial hypothesis that a digital application specifically designed for local communities can enhance the effectiveness of community-based healthcare services.

The findings of this study address the central question regarding the effectiveness of digital applications in supporting health cadres' tasks [18]. The improvement in cadre competence within the experimental group indicates that the "KABARI" application successfully overcomes the limitations of traditional methods, such as the Maternal and Child Health (KIA) handbook. With interactive features and step-by-step guidance, the application enhances cadres' ability to independently identify high-risk pregnancies [19]. Additionally, the application strengthens cadres' motivation and self-confidence, which were previously significant challenges in delivering community health services.

This study reinforces the existing literature suggesting that technology-based interventions can enhance the competence and efficiency of health cadres in detecting high-risk pregnancies [20]. Previously, Gupta et al. (2021) reported that the "SEWA" application successfully improved cadres' skills in urban India. However, their research was limited to contexts with well-established digital infrastructure [21]. This study makes a significant contribution by testing the "KABARI" application in resource-limited areas, addressing challenges such as technological access, limited training, and cultural barriers.

In contrast to Bhutta et al. (2017), which focused on community-based interventions without technological integration, this study demonstrates that combining digital applications with community approaches can yield additional benefits [22]. Bhutta's research highlighted the importance of cadre involvement in reducing maternal and infant mortality but did not explore how technology could enhance cadre effectiveness in this context. This study provides empirical evidence that applications like "KABARI" can address weaknesses in manual approaches, such as inconsistent reporting and education delivery.

The "KABARI" application also surpasses limitations identified in previous studies concerning traditional educational methods [23]. For instance, Panday et al. (2017) found that verbal communication during cadre training was often ineffective due to gaps between the information conveyed and understood. In this study, the "KABARI" application successfully bridged this gap by providing clear and accessible visual guides [24]. This not only improved information retention but also strengthened cadres' confidence in performing their duties.

This study also expands the literature on the effects of technology on social support within healthcare services. Research by Vizeshfar et al. (2019) highlighted that health cadres often face challenges in building effective relationships with the community, particularly when lacking adequate supportive tools [25]. In this study, "KABARI" not only aids cadres in detecting high-risk pregnancies but also strengthens emotional connections with pregnant women through more structured and data-supported communication.

Additionally, this research introduces a new perspective on the effects of digital applications on cadre motivation and self-efficacy. While Zulliger et al. (2012) emphasized the importance of continuous training to enhance cadre self-efficacy, this study demonstrates that digital applications can serve as an effective alternative to intensive training [26]. "KABARI" provides direct access to relevant information, enabling cadres to learn independently and improve their ability to manage high-risk pregnancies.

Finally, the findings suggest that technology offers a more sustainable solution compared to traditional methods. While handbook-based approaches, as used in the control group, often require repeated training sessions, "KABARI" allows cadres to access information anytime and anywhere. Thus, the application presents the potential to expand the reach and impact of community healthcare services more efficiently.

The findings of this study have significant implications both scientifically and practically. Scientifically, the "KABARI" application provides a novel contribution to the literature by demonstrating that digital technology can enhance the motivation, self-efficacy, and social support of health cadres in resource-limited areas [27]. Practically, the application offers an easily implementable solution to support the early detection of high-risk pregnancies, potentially contributing to reductions in maternal and infant mortality [28]. Furthermore, the application strengthens cadres' ability to refer pregnant women to appropriate healthcare facilities more effectively and systematically.

However, this study has several limitations. The relatively small sample size and limited geographical scope may affect the generalizability of the findings. Additionally, the study only measured the short-term impact of the application without evaluating long-term knowledge retention [29]. For future research, it is recommended to expand the geographical scope, increase the sample size, and assess the long-term effects of the application [30]. Furthermore, future studies could explore how applications like "KABARI" can be adapted to meet the needs of other community groups, such as healthcare workers in urban areas or regions facing different cultural challenges.

5. CONCLUSION

This study demonstrates that the "KABARI" application significantly enhances the competence of health cadres in detecting high-risk pregnancies, particularly in resource-limited areas. Through a technology-based approach, the application successfully strengthens cadres' motivation, self-efficacy, and social support, enabling them to deliver more effective and structured healthcare services. These findings address the research gap concerning the integration of technology into community healthcare services and make a valuable contribution to the literature on digital approaches to maternal and child health.

The "KABARI" application offers a sustainable and widely applicable solution for supporting early detection of pregnancy risks while reducing maternal and infant mortality. Furthermore, this study paves the way for the development of similar applications in diverse contexts, with significant potential benefits for global health systems. Future research is encouraged to explore the long-term effectiveness of this application and evaluate its adaptation to meet the needs of communities in more varied settings. These findings reinforce the argument that digital technology can serve as a transformational tool in advancing community health in the future.

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