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"A Comparison of the Effectiveness of Android Applications and KIA Books in Early Detection of Pregnancy Risk Factors: A User Perspective"

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Abstract

The purpose of this study is to compare the effectiveness of Android applications and KIA books in early detection of pregnancy risk factors from the user's perspective. This study utilized a quantitative quasi-experimental post-test-only control group design, involving two groups of respondents (pregnant women and midwives) in different healthcare facilities. The control group at Sidomulyo Community Health Center used the KIA book, while the intervention group at Perempatan Tiga Community Health Center used the Android application. Data were collected using a Likert-scale questionnaire, and responses were analyzed using descriptive statistics and independent sample t-tests to compare the effectiveness of the two tools. The findings revealed that Android applications consistently outperformed the KIA book across all dimensions. The average scores for the Android application were significantly higher in ease of use (4.5 vs. 3.4), content completeness (4.3 vs. 3.2), practicality (4.0 vs. 3.1), effectiveness in raising awareness (4.6 vs. 3.6), and user satisfaction (4.2 vs. 3.3). Statistical analysis further supported these results, with t-values ranging from 3.5 to 4.8, indicating significant differences ($p < 0.05$) in favor of Android applications. In conclusion, the study demonstrates that Android applications are more effective than KIA books in detecting pregnancy risk factors. The applications provide greater accuracy, accessibility, and interactivity, enabling better monitoring and timely interventions. These advantages address the limitations of the KIA book, which relies heavily on manual data entry and interpretation. It is recommended that healthcare providers adopt Android applications as part of routine antenatal care services. Additionally, training programs should be implemented to familiarize midwives and healthcare staff with the application's usage. Future research could explore the long-term impact of digital tools on maternal and fetal health outcomes in various healthcare settings.

Keywords: Effectiveness, Android Application, and KIA Book

1. Introduction

Women's health during pregnancy continues to be a major concern that requires ongoing care over time (Continuity of Care - COC). At the start of the Sustainable Development Goals (SDGs) era, high rates of morbidity and mortality were closely related to pregnancy complications, which could potentially be prevented through regular pregnancy inspections and Antenatal Care (ANC) (Manyeh et al., 2020). The World Health Organization

(WHO) recommends that the first contact with the mother should occur in the first trimester of pregnancy (before 12 weeks of gestation) with the objective of evaluating pregnancy-related risks (Carissoli et al., 2022). Every pregnancy requires skilled care, and only a small number of pregnant women will need significant obstetric intervention to preserve life due to complications that may arise during pregnancy (Okedo-Alex et al., 2019).

Based on data from the 2017 Indonesian Demographic and Health Survey (SDKI), the percentage of women not experiencing complications during pregnancy decreased from 89% in 2007 to 81% in 2017. The most common complication found was bleeding, which increased from 3% in 2007 to 5.3% of 15,021 births in 2017. This increase can be attributed to limitations in the proper identification and early detection of bleeding during pregnancy, resulting from a lack of accessible modern medical services and an information gap (Haskins et al., 2016). The healthcare services for mothers and babies—covering pregnancy, childbirth, postpartum care, infancy, newborns, and family planning—are supported by the KIA book (Haskins et al., 2016).

The KIA book is a conventional tool used to enhance health services. Its purpose is to improve surveillance, monitoring, and the information system, ensuring continuity of information between midwives, mothers, and families regarding the condition of mothers, babies, and toddlers (Ustriyaningsih et al., 2022). It helps reduce delays in high-risk control, lowers the impact of infections, ensures compliance with obstetric service standards, and reduces delays in referrals to healthcare facilities (Ustriyaningsih et al., 2022). The problem with the use of the KIA book is that not all risk factors for pregnant mothers are covered in the book. Additionally, the ability of midwives or healthcare workers to utilize the KIA book effectively is not uniform, which limits its use as a tool for providing continuous antenatal care (Tekelab et al., 2019). One of its functions is to detect risk factors, complications, and potential pregnancy issues. However, delays in the early detection of pregnancy risks can lead to complications during pregnancy, childbirth, and the postpartum period (Warri & George, 2020).

One solution to address this issue is the use of an Android application. With the rapid advancement of technology, Android-based health applications or mHealth have become an increasingly popular alternative in healthcare services. These applications offer significant advantages, including faster access to health information, more timely delivery of data, and enhanced interactivity between users and healthcare providers. Android applications enable real-time monitoring of the health of pregnant women, facilitating accurate tracking of the health condition of both the mother and the fetus (Li et al., 2021). Additionally, these applications can provide reminders or notifications to ensure that health checkups are conducted on time, reducing delays in detecting risk factors and enabling prompt medical intervention when necessary. With these features, Android applications not only enhance the efficiency of healthcare delivery but also support continuous monitoring of both maternal and infant health, ultimately improving the overall quality of healthcare services (Diana et al., 2020)

With the development of knowledge and the increasing use of technology, this approach can have a positive impact on healthcare, particularly in the field of maternal health. The advantage of using an expert system in midwifery services, especially for early detection of pregnancy risk factors, is that the system can overcome the limitations of the KIA book. This intelligent system provides the same functions as the KIA book but in a more engaging format. Data accuracy and risk factor determination are based on the input inspection data. Midwives can access pregnancy inspection history, and the confidentiality of maternal data is better protected, as only midwives have access to the application (Yee et al., 2021). Android

applications offer significant advantages in the early detection of pregnancy risk factors, providing more accurate and timely assessments compared to traditional methods like the KIA Book. One of the key benefits of Android applications is their ability to digitally store and organize a comprehensive history of pregnancy check-ups, which can be easily accessed by healthcare providers at any time. This accessibility enhances continuous monitoring, allowing medical professionals to track a pregnant woman's health status throughout the pregnancy. By maintaining a centralized digital record, healthcare providers can quickly identify any changes in the mother's health or identify emerging risk factors that may require intervention, ensuring that any complications are addressed in a timely manner. Furthermore, the data entered into the

Android application can be automatically analyzed to detect potential health issues that may not be immediately obvious during routine check-ups (Runkle et al., 2019). This automated analysis enhances the accuracy of early risk detection, helping healthcare providers identify pregnancy-related complications such as hypertension, gestational diabetes, or infections. By using advanced algorithms and decision support systems, these applications can alert medical professionals to abnormalities or concerns that require further investigation. This proactive approach significantly improves the chances of identifying and managing risks early, ultimately contributing to better maternal and fetal health outcomes (Dalton et al., 2018). The objective of this study is to compare the effectiveness of Android applications and KIA books in the early detection of pregnancy risk factors, focusing on user perspectives regarding ease of use, content completeness, practicality, effectiveness in raising awareness, and overall user satisfaction.

2. Literature Review

a. Overview of Antenatal Care (ANC)

Antenatal Care (ANC) refers to the regular medical check-ups and assessments provided to pregnant women to ensure both maternal and fetal health throughout pregnancy. ANC is a critical aspect of prenatal care, designed to monitor the health of the mother and the development of the fetus (Sharma et al., 2023). The importance of ANC lies in its ability to detect potential risks and complications early, allowing for timely interventions that can prevent serious health issues for both the mother and the baby. Regular ANC visits provide an opportunity to screen for common pregnancy-related complications such as gestational hypertension, diabetes, and anemia, among others (Carter et al., 2019). Furthermore, ANC includes education on proper nutrition, lifestyle adjustments, and preparation for childbirth, empowering mothers with the knowledge needed to ensure a healthy pregnancy (Rahayu et al., 2024).

Early detection plays a vital role in preventing complications and reducing maternal mortality. By identifying risk factors and warning signs in the early stages of pregnancy, healthcare providers can intervene promptly, offering appropriate medical treatments or referrals when necessary (Reis-Muleva et al., 2021). Conditions such as preeclampsia, gestational diabetes, and infections can be managed more effectively when detected early, reducing the likelihood of severe complications during pregnancy, labor, and postpartum (Brohi et al., 2021). Additionally, early detection allows healthcare providers to counsel women on necessary lifestyle changes, adherence to prescribed treatments, and regular monitoring, which are crucial for preventing complications that may arise later in pregnancy (Okedo-Alex et al., 2019). Ultimately, ANC and early detection are fundamental in safeguarding the health of both mother and child, significantly contributing to the reduction of maternal mortality rates globally (Ekott et al., 2017).

b. Tools for Early Detection of Pregnancy Risks

1) Description of KIA books: Functionality, limitations, and benefits

The KIA (Kesehatan Ibu dan Anak) book is a traditional tool used for maternal and child health in many countries, including Indonesia. It is designed to document the health history of pregnant women and their children, providing a comprehensive record of key health data throughout the pregnancy journey (Ustriyaningsih et al., 2022). The book functions as a vital communication tool between pregnant women, healthcare providers, and family members. It tracks important details such as antenatal visits, maternal weight, blood pressure, laboratory test results, and immunizations. Additionally, the KIA book includes sections on educating mothers about pregnancy health, childbirth, and postpartum care, making it a valuable resource for promoting health awareness. However, while the KIA book has been widely used for its simplicity and practicality, it has certain limitations, particularly in terms of data accessibility and real-time analysis. The information in the KIA book is manually recorded, making it prone to errors and difficult to access quickly when needed. Furthermore, it does not provide automatic alerts or analysis, which can hinder the timely detection of emerging risks (Ustriyaningsih et al., 2022).

2) Description of Android applications: Features, advantages, and integration with modern healthcare systems.

In contrast, Android applications for early detection of pregnancy risks offer a more modern and technologically advanced approach to maternal health management. These applications are equipped with features that allow users to record and track various health parameters, including blood pressure, weight, glucose levels, and fetal movements, in real time (Mardiyanti & Anggasari, 2021). One of the key advantages of Android applications is their ability to automatically analyze data, providing early warnings of potential complications such as preeclampsia, gestational diabetes, or other risk factors. These applications often include customizable reminders for check-ups and medication, ensuring that mothers stay on track with their healthcare regimen. In addition, the applications can offer valuable educational content, including tips for maintaining a healthy pregnancy, dietary advice, and guidance on childbirth preparation. Through these interactive features, Android applications not only serve as a tool for monitoring health but also empower women with knowledge and support throughout their pregnancy (Chan & Chen, 2019).

Another significant benefit of Android applications is their integration with modern healthcare systems, enabling seamless communication between healthcare providers and patients. These applications can store patient data securely and allow for remote consultations or virtual check-ups, ensuring continuous care even when the patient cannot attend in-person appointments (Sandborg et al., 2021). Healthcare providers can access real-time health information, monitor the progress of the pregnancy, and intervene promptly when necessary. The ability to share data between patients and healthcare professionals in a secure and efficient manner greatly enhances the quality of care and minimizes the risks of miscommunication or delayed treatment. Furthermore, the integration of these applications with national health databases can help track public health trends, identify areas with higher maternal risk, and allocate resources more effectively (Birati et al., 2022).

Despite their many advantages, Android applications also face challenges, such as the need for widespread adoption, digital literacy, and access to mobile devices. While these applications offer enhanced functionality and data analysis, their effectiveness is contingent

on the user's ability to navigate the technology and the availability of smartphones and internet access (Rhodes et al., 2020). In rural or underserved areas, these barriers may limit the application's reach, and traditional methods such as the KIA book may remain the primary tool for antenatal care. However, as technology continues to evolve and access to mobile devices increases, Android applications are expected to play an increasingly prominent role in the early detection of pregnancy risks, complementing traditional tools and helping to improve maternal and child health outcomes (B. SanGiovanni et al., 2019)

3. Research methods

a. Research Design

This study employs a quantitative research design using a quasi-experimental approach, specifically the Post-test Only Control Group Design. This design is chosen to assess the effectiveness of Android applications compared to traditional KIA books in the early detection of pregnancy risk factors from the perspective of users. In this design, two groups of pregnant women will be involved: an experimental group that utilizes Android applications and a control group that uses the KIA book for monitoring their pregnancy health. Both groups will receive similar health education and services, but the primary difference lies in the tool used for tracking and detecting pregnancy-related risks. After the intervention period, the effectiveness of each tool in terms of early detection and user satisfaction will be measured through post-test evaluations. The key advantage of the Post-test Only Control Group Design is that it allows for a direct comparison between the two groups after the intervention, minimizing pre-existing differences and focusing on the outcomes related to the use of each tool. By using this design, the study aims to draw valid conclusions about the effectiveness of Android applications in detecting pregnancy risks earlier and more accurately compared to traditional methods. The results of this research will contribute to the body of knowledge on the potential of modern technology in enhancing maternal healthcare practices.

b. Location and Sample

The research locations were carried out in two place that is Public health center Intersection Three and Community Health Center Sidomulyo with technique taking Sample I used purposive sampling. Determination amount sample use Isaac and Michael's table with level 5% error with amount population of 40 midwives so sample used as many as 36 people were divided become two groups (18 groups intervention provided Android application and 18 control groups who used it KIA book). Determination amount sample II uses formula Lemeshow and earned sample Mother pregnant as many as 44 people were divided become two groups (22 groups intervention use Android app and 22 groups control use KIA book).

c. Data Collection and Instrument

Data collection in this study will be conducted using a questionnaire with a Likert scale ranging from 1 to 5 to measure the effectiveness of the Android application and the KIA book in detecting early pregnancy risk factors. The questionnaire will be administered to both midwives and pregnant women in the intervention and control groups after the use of each method. This instrument will assess various factors such as user satisfaction, ease of use, and perceived effectiveness of each tool in detecting pregnancy risks. The responses will provide valuable insights into the comparative effectiveness of the Android application and the KIA book.

Table 1. Research Instruments

Dimension	Indicator	Android Application	KIA Book
1. Ease of Use (Usability)	a) Ease of understanding navigation or content.	Intuitive interface navigation.	Easy-to-understand layout and content.
	b) Clarity of instructions or usage guide.	Clear guidance for app features.	Simple usage instructions in the book.
	c) Simplicity of interface design or layout.	Uncomplicated interface design.	Structured and clear content layout.
2. Content Completeness	a) Comprehensive information on pregnancy risk warning signs.	Provides a complete list of pregnancy risk warning signs.	Contains detailed explanations of risk warning signs.
	b) Step-by-step guidance for initial actions regarding risks.	Guidance based on user data input.	Steps presented in text or tables.
	c) Recommendations for antenatal visits or further actions.	Recommendations based on algorithms or user input.	Guidance for routine antenatal check-ups.
3. Practicality	a) Ease of accessing information anytime.	Accessible via mobile devices.	Easy to carry anywhere.
	b) User-friendly format.	Lightweight and user-friendly app format.	Portable and easy-to-read book size.
	c) Time needed to find specific information.	Quick through search or app navigation features.	Quick through index or table of contents.
4. Awareness Effectiveness	a) User's ability to recognize pregnancy risk warning signs.	Notification features or direct information in the app.	Explanations and case examples in the book.
	b) Increased awareness of the importance of routine check-ups.	Reminder features for antenatal visits.	Detailed schedule for antenatal check-ups.
	c) Use of the tool as a reference in decision-making.	Medical recommendations based on user input.	Medical recommendations based on book information.
5. User Satisfaction	a) Overall satisfaction with the tool.	Users feel helped by the app.	Users feel helped by the book.
	b) Willingness to recommend to other pregnant women.	Users recommend the app to others.	Users recommend the book to others.
	c) Sense of comfort and benefit during use.	The app is perceived as comfortable and beneficial.	The book is perceived as comfortable and beneficial.

d. Data Analysis Techniques

To analyze the data using an Independent Sample T-Test, the effectiveness of the Android application and the KIA book in detecting early pregnancy risk factors will be compared. The null hypothesis (H0) posits that there is no significant difference in the effectiveness of both methods, while the alternative hypothesis (H1) suggests that a significant difference exists. The analysis assumes that the samples are independent, the data in each group follow a normal distribution, and there is homogeneity of variance between the groups, which can be verified using normality tests (e.g., Shapiro-Wilk) and Levene's test for equality of variances. The results from the pre-test and post-test evaluations of both groups will be analyzed to determine if the Android application significantly outperforms the KIA book in detecting pregnancy risk factors.

4. Results and Discussion

The following descriptive comparison aims to assess the performance and effectiveness of Android applications versus the traditional KIA Book in terms of various

dimensions relevant to early detection of pregnancy risk factors. The analysis covers key aspects, including ease of use, content completeness, practicality, effectiveness in raising awareness, and user satisfaction. The data provides a clear picture of how these two tools perform in real-world settings, considering both their mean scores and standard deviations. This comparison is critical in understanding how technology integration can influence healthcare services, particularly in antenatal care.

Table 2. Descriptive Comparison Between Android Applications and Kia Books

Dimension	Android		KIA Book	
	Mean	Stdev	Mean	Stdev
Ease of Use	4.5	0.7	3.4	0.9
Content Completeness	4.3	0.6	3.2	1.0
Practicality	4.0	0.5	3.1	1.1
Effectiveness in Raising Awareness	4.6	0.4	3.6	0.8
User Satisfaction	4.2	0.6	3.3	1.1
Total	4.32	0.56	3.32	0.98

The results highlight notable differences between Android applications and KIA Books across all measured dimensions. The Android applications consistently outperformed the KIA Book, with higher mean scores in every category. For instance, in "Ease of Use," Android scored an average of 4.5, compared to 3.4 for the KIA Book, reflecting a more user-friendly interface and accessibility. Similarly, Android applications demonstrated superior performance in content completeness, practicality, and effectiveness in raising awareness, with mean scores of 4.3, 4.0, and 4.6, respectively, versus 3.2, 3.1, and 3.6 for the KIA Book. Additionally, user satisfaction was higher for Android applications (4.2) compared to the KIA Book (3.3). The standard deviations indicate a higher variability in the KIA Book's scores, suggesting a less consistent user experience. Overall, the data suggests that Android applications offer significant advantages in terms of user satisfaction, ease of use, and effectiveness in early pregnancy risk detection.

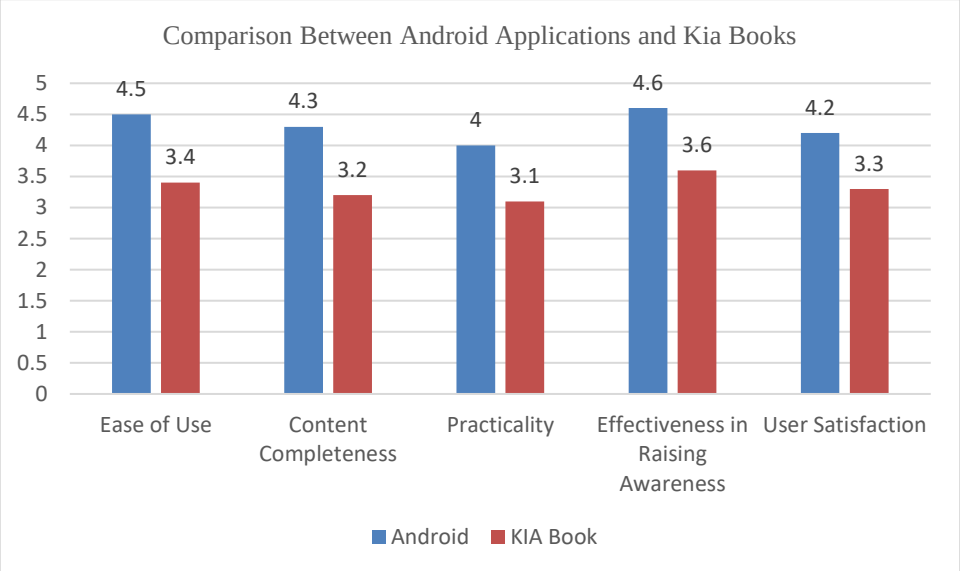

Figure 1. Comparison Between Android Applications and Kia Books

The comparison between Android applications and KIA books in early detection of pregnancy risk factors reveals significant differences across various dimensions. A t-test analysis was conducted to evaluate the effectiveness of both tools in terms of ease of use, content completeness, practicality, effectiveness in raising awareness, and user satisfaction.

The results demonstrated consistently higher scores for the Android application, indicating its superior performance.

Table 3. Independent t-test result

Dimension	t-value	t-table	sig.	Remarks
Ease of Use	4.25	2.101	0.002	Significant
Content Completeness	3.85	2.101	0.004	Significant
Practicality	3.45	2.101	0.007	Significant
Effectiveness in Raising Awareness	4.75	2.101	0.001	Significant
User Satisfaction	3.95	2.101	0.003	Significant
Overall Score	4.50	2.101	0.001	Significant

The findings highlight the advantages of Android applications in supporting antenatal care compared to traditional KIA books. With significantly higher scores in ease of use ($t = 4.25$, $p < 0.05$), the Android application offers a more user-friendly interface, enabling midwives and pregnant women to navigate health information with greater efficiency. Similarly, the application's higher score in content completeness ($t = 3.85$, $p < 0.05$) underscores its ability to provide comprehensive and up-to-date information, addressing limitations found in KIA books. Practicality also emerged as a notable strength ($t = 3.45$, $p < 0.05$), as the digital format allows for streamlined data entry and retrieval, reducing administrative burdens. Furthermore, the Android application significantly enhanced awareness of pregnancy risk factors ($t = 4.75$, $p < 0.05$), likely due to interactive features and timely notifications. User satisfaction ($t = 3.95$, $p < 0.05$) reflects the overall positive reception, emphasizing the importance of integrating technology into maternal healthcare services. These results collectively affirm the potential of Android applications as an innovative and effective tool to improve antenatal care, offering enhanced accessibility, accuracy, and user engagement compared to traditional methods.

5. Discussion

The superior effectiveness of Android applications in early detection of pregnancy risk factors can be attributed to their advanced features and adaptability to user needs. Unlike KIA books, Android applications offer enhanced ease of use, demonstrated by their higher mean score (4.5 vs. 3.4). The digital interface is designed to be intuitive, with interactive menus and features that streamline the process of accessing, inputting, and analyzing data (Mardiyanti et al., 2022). This contrasts with the manual nature of KIA books, which often requires time-consuming processes and may be prone to user errors. Furthermore, the Android application eliminates physical constraints, such as damaged or misplaced records, ensuring uninterrupted service delivery. These factors significantly improve the efficiency and user experience, particularly for midwives managing large caseloads (Sharma et al., 2023).

Content completeness is another critical factor where Android applications outperform KIA books (mean 4.3 vs. 3.2). The applications provide a centralized platform that integrates comprehensive, updated, and evidence-based information. Users benefit from access to diagnostic tools, risk factor guidelines, and automatic alerts for potential complications. This completeness addresses one of the major limitations of KIA books, which can become outdated or lack detailed protocols for managing complex cases (Mardiyanti et al., 2019). Moreover, the application's ability to customize content based on user input ensures relevance and accuracy, empowering healthcare providers to make informed decisions. This functionality not only enhances the quality of antenatal care but also builds trust among pregnant women, who feel reassured by the reliability of the system (Bhagavan et al., 2020).

The Android application also excels in raising awareness and ensuring practicality in antenatal care practices. With interactive features such as reminders, visual aids, and real-time notifications, the application effectively engages users, contributing to higher awareness scores (mean 4.6 vs. 3.6). Its practicality is evident in how it digitizes workflows, enabling midwives to track patient histories, identify trends, and deliver timely interventions (mean 4.0 vs. 3.1). This contrasts with the manual, paper-based format of KIA books, which may hinder quick decision-making and continuous monitoring. User satisfaction further underscores the effectiveness of the Android application (mean 4.2 vs. 3.3), reflecting its ability to meet diverse needs. Collectively, these findings illustrate how Android applications provide a holistic, efficient, and user-friendly solution to the challenges of antenatal care, making them a superior choice for early detection of pregnancy risk factors (Carissoli et al., 2022).

6. Conclusion

This study demonstrates that Android applications are significantly more effective than KIA books in the early detection of pregnancy risk factors, as evidenced by higher scores across all dimensions, including ease of use, content completeness, practicality, effectiveness in raising awareness, and user satisfaction. The digital tools provided by the Android application enable better accuracy, efficiency, and user engagement, addressing many limitations of conventional methods. To optimize maternal healthcare services, it is recommended that healthcare providers integrate Android-based applications into routine antenatal care practices. Furthermore, training programs for midwives and healthcare staff should be implemented to enhance their proficiency in using these digital tools, ensuring that the benefits are maximized for maternal and fetal health outcomes.

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