Frontiers in Health Informatics
ISSN-Online: 2676-7104
www.healthinformaticsjournal.com
2024; Vol 13: Issue 8
Open Access

Effectiveness Of Android-Based Preeclampsia Early Detection And Promply Treatment Education To Improve Ante-Natal Care Adherence And Prevent Ante-Natal Complications

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Cite this paper as: Nia Desriva, Tukimin Bin Sansuwito, Regidor III Dioso (2024). Effectiveness Of Android-Based Preeclampsia Early Detection And Promply Treatment Education To Improve Ante-Natal Care Adherence And Prevent Ante-Natal Complications. *Frontiers in Health Informatics*, *13 (8) 3044-3056*

ABSTRACT

Background

Indonesia is one of the Asian countries in which the maternal mortality rate has tremendously increased. That is why this study deemed to determine the effectiveness of android-based preeclampsia early detection and promptly treatment education to improve ante natal care adherence and prevent ante natal complications.

Methodology

The Solomon Four-Group Design was the research design used in this quasi-experimental study. The pre- and post-tests used a survey questionnaire that underwent pilot study and member checking from experts. The full-scale study used 80 experimental and 80 control having a total of 160 enrolled participants using the quota sampling technique with inclusion and exclusion criteria.

Results

Before implementation of the android-based preeclampsia detector for both experimental and control groups, *Complications* were found to be 26.33±30.09 significant ($p<0.05$), *Adherence* with 40±45.25 were significant ($p<0.05$), and participants' *Knowledge Levels* with 23.33±13.05 were significant ($p<0.05$). After implementation of the conventional way of detecting preeclampsia among the control group, *Complications* were found to be 1.94±0.54 with insignificant probabilities classified as “No Risk” ($p=0.175$), “Moderate Risk” ($p=0.7125$), and “High Risk” ($p=0.1125$). The *Adherence* were found to be 1.0±0.30 with insignificant probabilities classified as “Obedient” ($p=0.10$), and “Disobedient” ($p=0.90$). While participants' *Knowledge Levels* were found to be 1.68±0.71 with insignificant probabilities classified as “Bad” ($p=0.46$), “Fair” ($p=0.3625$), and “Good” ($p=0.1750$). After implementation of the android-based preeclampsia detector among the experimental group, *Complications* were found to be 1.14±0.413 significant ($p=0.046$), *Adherence* 1.38±0.487 to be significant ($p=0.0504$), and participants' *Knowledge Levels* to be 1.61 ±0.665 significant ($p<0.05$).

Conclusion

Ultimately, the Android-based preeclampsia detector has the potential to significantly improve health outcomes for pregnant women by ensuring that they have the tools and resources necessary to manage their health proactively.

Key words: Android, pre-eclampsia, treatment education, ante-natal care, ante-natal complications, pregnancy

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Background

According to WHO data, approximately 7,000 newborns and 830 pregnant women die every day due to complications during pregnancy and childbirth, with a maternal mortality rate of 216/100,000 live births (World Health Organization, 2023). Pregnancy complications kill over 500,000 mothers each year, with 90% of these deaths occurring in Asia and Africa, 10% in other developing countries, and less than 1% in developed countries. World problems, and have been identified as variables in development goals (Mboi et al., 2022).

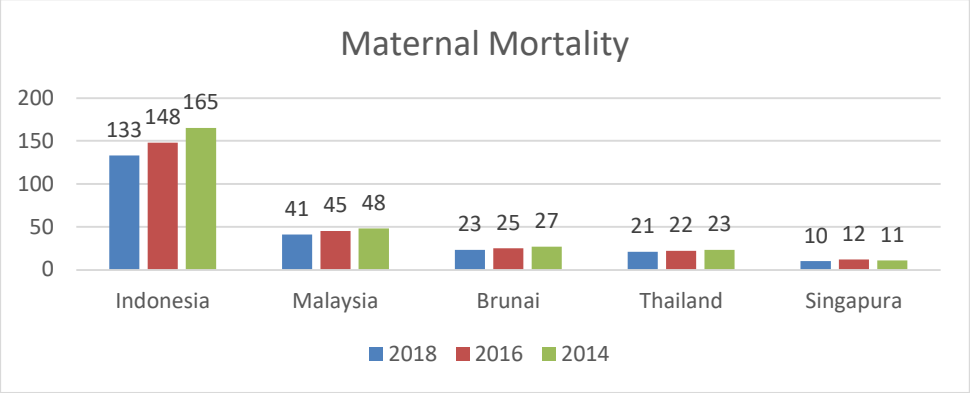


Figure 1. Maternal Mortality in Indonesia

In several Asian countries, the trend of maternal mortality has not shown a significant decline. It can be seen from Figure 1.1 above, from 2014 – 2018 Indonesia has the highest maternal mortality rate compared to other countries (World Health Organization, 2023). The maternal mortality rate in Malaysia in 2018 was 41/100,000 live births, in Brunei it was 23/100,000 live births, Thailand was 21/100,000 live births, Singapore was 10/100,000 live births, and the highest was Indonesia at 133. /100,000 live births. Likewise with the trend of infant mortality rates that occur in several Asian countries, based on data obtained from the Asean Statistical Yearbook (2015), the infant mortality rate in Singapore is 1.1/1000 live births, Malaysia 4.3/1000 live births, Brunei 4.4/1000 live births (Gayatri et al., 2023).

Indonesia is one of the Asian countries in which the maternal mortality rate has tremendously increased (Mboi et al., 2022). It can be seen in Figure 2, that the maternal mortality rate is still increasing every year. Meanwhile, the infant mortality rate in Indonesia since 2015 is 14.1/1000; in 2014 27.1/1000, and in 2010 it was 16.4/1000 live births. Completely, the mortality rate in Indonesia can be presented in the following line chart (Laksono et al., 2022).

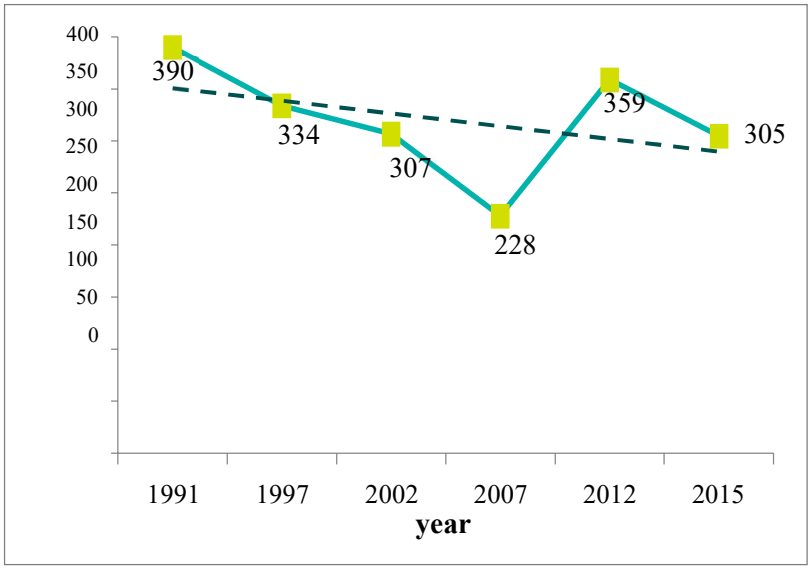


Figure 2. Maternal mortality rate in Indonesia

Riau Province is a province in Indonesia which is located in the middle of the east coast of the island of Sumatra, the capital and largest city in Riau is Pekanbaru City. The maternal mortality rate in this province is still very high.in 2016 which was 29%, experienced a decrease in 2017 which was 25% and became 23% in 2018, but experienced a surge again in 2019 namely 32%.Likewise, the infant mortality rate has also increased, as in 2018 it was 442/1000 live births, in 2019 it became 498/1000 live births% (Idris & Sari, 2023).

Factors that directly cause maternal death are ANC Complication; bleeding in pregnant women, pre-eclampsia, eclampsia, sepsis, and the presence of infection (Guspianto et al., 2022). Factors that cause maternal death indirectly include maternal diseases that can worsen pregnancy, as well as hunger due to poverty, low education, and socio-cultural problems or because it is related to knowledge and adherence of pregnant women in carrying out ante-natal care visits (Wulandari et al., 2021).

Preeclampsia is one of the ANC complication which influencer mortality rate. It is hypertension in pregnancy which is characterized by blood pressure >140/90, accompanied by urine protein >300 mg in 24 hours (Aryastami & Mubasyiroh, 2023). Preeclampsia ranks second in the world as a contributor to morbidity and mortality for pregnant women, and can increase the risk of fetal death by four times compared to normal pregnancies. According to the World Health Organization, (2023), every day 830 mothers in the world die from diseases or complications related to pregnancy and childbirth, as well as hypertension in pregnancy.More than 90% of maternal deaths are caused by complications during pregnancy. Complications tend to increase in pregnant women who have risk factors, although they can also occur in pregnant women who are not at risk.

Given the high maternal mortality rate, the Government of Indonesia through the Ministry Health makes policies to reduce maternal mortality realized through the Making Practice Safer (MPS) activity as part of Safe Motherhood Program, one of the MPS activities is the provision of services antenatal care, carried out by health workers during the period pregnancy, as an early prevention effort from risk factors that occur in pregnancy (Fauzi et al., 2021).

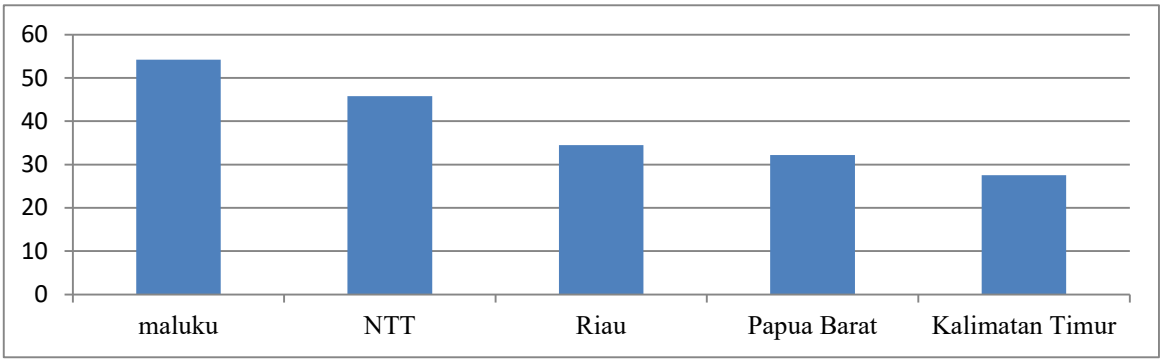
Weakness in carrying out early detection of risks or complications during pregnancy can be one of the causes of death for pregnant women. Compiled from the recording of the family health program, shows that the maternal

mortality death in Indonesia is 4,627, this number has increased compared to in 2019 there were 4,221 deaths (Fauzi et al., 2021). Indonesian government's program in making efforts to reduce maternal mortality, namely through increasing access to health services. According to the Law of the Republic of Indonesia No. 36 of 2009 concerning health article 126 paragraph (1) it is said that health services are aimed at maintaining maternal health so that they are able to give birth to healthy and quality generations and reduce maternal morbidity, and mortality rate (Fitrianti et al., 2023). The Indonesian Ministry of Health in 2004 made a policy to overcome and accelerate efforts to reduce the number maternal mortality and infant mortality (Ministry of Research Technology and Higher Education of the Republic of Indonesia, 2024).

The policy refers to the "Four Pillar Safe Motherhood" strategic interventions which include family planning, antenatal care, clean and safe delivery, and essential obstetric services (Fauzi et al., 2021). One of the four pillars that owned by the Indonesian government in an effort to detect early complications during pregnancy, especially complications in preeclampsia is to conduct ante Natal Care visits, which are planned and comprehensive programs in the form of observation, education and medical treatment for pregnant women in order to obtain a safe pregnancy and childbirth. Preeclampsia can be detected early by increasing ANC visits to health facilities. Prevention with early diagnosis can reduce the incidence, morbidity and mortality. Health services for pregnant women through ANC visits must meet the minimum frequency of visits, namely six times during pregnancy. This minimum visit standard is recommended to provide protection for the mother and fetus, in the form of early detection, risk factors, prevention and early management of pregnancy complications. Screening of mothers can be carried out since pregnancy occurs, so that early information on the risk of pregnancy can be a consideration for pregnant women to comply with ANC visits to prevent pregnancy complications.

Adherence of pregnant women in carrying out ANC visits in Riau province is still low in Indonesia, as shown in Figure 3 below, Riau is ranked third lowest (34.5%) after West Papua (32.2%) and East Kalimantan (27.5%) %) in the adherence of pregnant women with ANC, the best province in the adherence of pregnant women with ANC was DKI Jakarta province (98.9%) (Aryastami & Mubasyiroh, 2021). This is an important note for the Riau Provincial government in an effort to increase the adherence of pregnant women with ANC visits to monitor the development of healthy and safe pregnancies, by early detection of danger signs of pregnancy to avoid pregnancy complications, and indirectly help reduce maternal and infant mortality. In detail, the evidence above can be presented on the chart below (Wulandari et al., 2022).

Figure 3. ANC visit



Adherence in carrying out ANC visits, can find signs – signs of pre-eclampsia, so that complications of pre-eclampsia do not need to occur. Unfortunately, there are still many pregnant women who are reluctant to make antenatal visits, moreover most pregnant women do not recognize the danger signs that can occur during pregnancy, one of which is pre-eclampsia. There are still many pregnant women who do not know the adverse effects arising from preeclampsia.

Accordingly Paratmanitya et al., (2021) stated that adherence with antenatal care visits had an effect on early detection of preeclampsia. Pregnant women who routinely carry out antenatal visits can prevent possible dangers of pregnancy as early as possible, while the most dominant risk factor associated with the occurrence of preeclampsia is antenatal care examinations carried out by pregnant women. Adherence of pregnant women in carrying out ANC visits is also influenced by messages or reminders received by the mother, pregnant women who are regularly given pregnancy care counseling and scheduled ANC visits via mobile phones, applications on mobile phones can also be an effective technology in increasing the adherence of pregnant women in conducting antenatal care visits (Prayitno, 2022).
That is why this study deemed to determine the effectiveness of android-based preeclampsia early detection and promptly treatment education to improve ante natal care adherence and prevent ante natal complications.

Methodology

In this study, quasi-experimental designs are used. The quota sampling technique was used, which is a technique for determining samples from populations that have specified criteria until they meet the desired number of samples in within groups (Siedlecki, 2020). The characteristic used for the quota sampling process is gestational age (trimester II & III). In determining the sample size, researchers can also use the Slovin formula, with the following formula:

$$n = \frac{N}{1 + \mathrm{Ne}^2}$$

Where:
n: number of samples
N: the population of pregnant women is 266 people
e 2: 5% precision level
So:

$$n = \frac{266}{1 + (266)(5\%)^2} = 159.7$$

So the sample of this research is pregnant women in the sub-district health center Pekanbaru City totaling 160 pregnant women, 80 pregnant women in the control group and 80 pregnant women in the intervention group.

Inclusion criteria:

1. ANC visit In Marpoyan Damai District
2. Have a KIA Handbook (2021)
3. Mentally healthy

Exclusion criteria:

1. Not have KIA handbook
2. False pregnancies (for example hydatidiform moles)

The Solomon Four-Group Design is a research design used in quasi-experimental research to investigate the effects of a treatment or intervention on a particular group. This design is done by selecting four groups of participants, administering pre-tests to half of them, providing the treatment or intervention to two of the groups, and then conducting post-tests for all groups.

Group 1 (pre-test-post): This group receives both a pretest and a posttest. The pretest measures their initial level of the outcome variable before any treatment or intervention. After this, they are exposed to the treatment, intervention, or educational program. Finally, they take a posttest to measure the outcome variable after the intervention.

Group 2 (pre-test-post): Similar to Group 1, this group also undergoes a pretest to measure their initial status. However, they do not receive the treatment or intervention that Group 1 receives. After a period of time, they take a posttest to measure the outcome variable again.

Group 3 (No pre-test-post-test): This group skips the pretest and only receives the treatment or intervention. Afterward, they take a posttest to measure the outcome variable.

Group 4 (No pre-test-post-test): Similar to Group 3, this group does not undergo a pre-test. They serve as a control group that does not receive the treatment or intervention.

The pilot study in this research used 20 respondents that were no longer included in the pooling of participants for the full scale research. The results used the SPSS software and yielded to a result of 8.9 Cronbach's alpha which is interpreted as highly reliable survey questionnaire that can be used for both pre- and posttests (Forero, 2023).

In the intervention phase, participants in the experimental group are given 30 days to use the android-based preeclampsia detection application. This period is critical for enabling participants to familiarize themselves with the app and integrate it into their routine pregnancy monitoring. The app is designed to assist expectant mothers in tracking their health metrics and identifying any signs of preeclampsia. During this time, participants are encouraged to actively engage with the application, inputting relevant data regarding their health and pregnancy status.

Upon receiving the mobile software application, respondents in the intervention group begin filling out the Android-Based Preeclampsia application. The app allows users to record vital information, such as blood pressure readings, weight changes, and any symptoms that may indicate the onset of preeclampsia. By actively using this application, participants can closely monitor their health and potentially identify risk factors earlier than traditional methods might allow.

Furthermore, respondents in the intervention group are asked to visit their antenatal care (ANC) providers during this 30-day period. These visits serve a dual purpose: providing participants with an opportunity to discuss their experiences using the application and ensuring they receive any necessary medical support. During these visits, healthcare providers will give direct instructions on how to troubleshoot the software application effectively. Participants may encounter technical issues or have questions about how to use specific features, and having access to expert guidance will enhance their confidence in using the technology.

The implementation of the android-based preeclampsia detector in the intervention group offers a promising approach to improving maternal health outcomes. By actively monitoring key health metrics and providing educational resources, this technology empowers pregnant women to take control of their health. The structured phases of pretest, intervention, and posttest enable researchers to evaluate the effectiveness of the application while also addressing any potential challenges associated with its use.

The android-based preeclampsia detector is an innovative tool designed to empower pregnant women to monitor their health actively. To maximize the utility of this application, users should be guided through its key features and functionalities.

1. Health Metrics Tracking: The application includes features that enable users to input daily health metrics, such as blood pressure readings, weight changes, and symptoms. This real-time tracking is crucial for identifying potential warning signs of preeclampsia.

2. Symptom Reporting: Users can also report specific symptoms, such as headaches, swelling, and visual disturbances. The application can analyze this data to identify patterns and alert users to potential concerns that warrant medical attention.

3. Reminders and Notifications: The application can send reminders for scheduled ANC visits and medication adherence, ensuring that users stay on track with their prenatal care.

Troubleshooting the Application

1. Common Issues: During the 30-day intervention period, users may encounter various issues, such as difficulties logging in, syncing data, or navigating the app's features. It is essential to provide a comprehensive troubleshooting guide to help users resolve these common problems.

2. Connectivity Problems: If users experience issues related to internet connectivity, they should be advised to check their Wi-Fi or mobile data settings. The application may require an internet connection to sync data or update information.

3. Updating the Application: Users should be encouraged to keep the application updated to access the latest features and improvements. Instructions on how to update the app through the Google Play Store can be included in the troubleshooting guide.

4. Customer Support: It is beneficial to provide contact information for customer support or a help desk that users can reach out to if they encounter persistent issues. This support ensures that participants feel confident in using the technology throughout the monitoring period.

5. Feedback Mechanism: Encouraging users to provide feedback on their experiences with the application can be invaluable for continuous improvement. This feedback can help developers address any shortcomings or enhance user experience in future iterations of the app.

As participants navigate the app and receive guidance from healthcare providers during the 30-day intervention period, they are equipped to identify and manage their health more effectively. Furthermore, providing comprehensive troubleshooting resources ensures that users can overcome common obstacles, enhancing their experience and fostering adherence to prenatal care recommendations. The ongoing assessment of the app's effectiveness will ultimately contribute to better health outcomes for pregnant women and their babies, reinforcing the importance of technology in modern maternal healthcare.

The control group, on the other hand, follows a different approach. Participants in the control group are given the opportunity to choose conventional methods of preeclampsia detection. These methods include website browsing for information about preeclampsia, utilizing ANC brochures, flyers, or handbooks, and attending frequent follow-up checkups. The control group serves as a benchmark against which the effectiveness of the intervention group’s use of the application can be measured.

To minimize contamination of results, the control group is instructed not to communicate with the intervention group during the study period. This separation ensures that any changes observed in the intervention group can be attributed to the use of the android-based preeclampsia detector rather than external influences. Additionally, researchers emphasize the importance of frequent visits to the ANC for the control group. They are often contacted through phone calls, either via mobile phones or landlines, to ensure they are adhering to their recommended care regimen.

At the conclusion of the 30-day intervention period, both the intervention and control groups are required to fill out post-test questionnaires. These questionnaires are designed to assess changes in knowledge, adherence to antenatal care, and overall health outcomes. By comparing the results from the pre-test and post-test, researchers can evaluate the effectiveness of the android-based preeclampsia detection application in improving maternal health outcomes.

Permission to carry out studies by making a letter of introduction from the campus, making permits to the Pekanbaru City Ministry of Health, and arranging permits to the Marpoyan Damai sub-district was done. The ethical reference number for this experiment is xxxx-xxxx-xxxx-xxx acquired July 2023, also the time when the experiment started to commence.

Results and Findings

Table 4. Socio demographic profile

Demography	Item selections	n	%
Mother's Age	<20 years	15	18.75%
Mother's Age	20-35 years old	50	62.5%
Mother's Age	>35 years old	15	18.75%
Mother's education	Elementary School/Equivalent	10	12.5%
Mother's education	Middle School/ Equivalent	20	25%
Mother's education	College	25	31.25%
Mother's education	High School/ Equivalent	25	31.25%
Mother's Occupation	Work	71	89%
Mother's Occupation	Doesn't work	9	11%
Husband's occupation	PNS/TNI/POLRI	20	25%
Husband's occupation	Employee (private or gov)	30	37.5%
Husband's occupation	Entrepreneur / freelance	15	18.75%
Husband's occupation	Farmer	15	18.75%
Total Monthly Income for UMP	< UMP Pekanbaru City	45	56.25%
Total Monthly Income for UMP	> UMP Pekanbaru City	35	43.75%
ANC Visits	1-2 x	20	25%
ANC Visits	3-4 x	40	50%
ANC Visits	5-6 x	20	25%
Parity	Nulliparous (never gave birth)	20	25%
Parity	primipara (one time giving birth)	30	37.5%
Parity	Multiparous (2-4 times giving	20	25%

	birth)		
Parity	Grande multipara (give birth to > 5 children)	10	12.5%
Distance Between Pregnancies	< 2 years	40	50%
Distance Between Pregnancies	> 2 years	40	50%
Distance From Residence to Health Facilities	< 2 km	45	56.25%
Distance From Residence to Health Facilities	> 2 km	35	43.75%
Who accommodates the mother	husband	35	43.75%
Who accommodates the mother	family	20	25%
Who accommodates the mother	alone	15	18.75%
Who accommodates the mother	and others	10	12.5%

Table 4 provides a comprehensive view of the socio-demographic profile of the participants involved in the study, offering insights into various factors such as age, education, occupation, income levels, antenatal care visits, parity, pregnancy spacing, proximity to healthcare facilities, and support during antenatal checkups. Understanding these factors is essential in assessing the population's characteristics and their potential influence on maternal and fetal health outcomes, particularly in the context of preeclampsia and other pregnancy-related complications.

The table 5 presents the Spearman's rho correlation coefficients between the pre-test and post-test scores of both the control and experimental groups in a study measuring the effectiveness of an Android-based preeclampsia detector.

1. Pre-test Control Group vs Pre-test Intervention Group:
- Correlation coefficient ($\rho = 0.860$) indicates a very strong positive correlation.
- p-value (Sig. = 0.000) shows that this correlation is statistically significant at the 0.01 level.
- This suggests that before the intervention, the knowledge or behavior in both groups was highly related, indicating similar baseline characteristics.

2. Pre-test Control Group vs Post-test Control Group:
- Correlation coefficient ($\rho = 0.839$) reflects a strong positive correlation.
- p-value (Sig. = 0.000) indicates significance.
- This means that the control group's performance remained relatively consistent before and after the experiment, implying minimal changes due to the absence of the intervention.

3. Pre-test Control Group vs Post-test Intervention Group:
- Correlation coefficient ($\rho = 0.678$) is a moderately strong positive correlation.
- p-value (Sig. = 0.000) shows significance.

- This suggests that while the pre-test control group is related to the post-test intervention group, the exposure to the Android-based detector introduced notable differences.

4. Pre-test Intervention Group vs Post-test Intervention Group:
- Correlation coefficient (ρ = 0.828) shows a strong positive correlation.
- p-value (Sig. = 0.000) indicates significance.
- This strong correlation implies that participants in the intervention group had a consistent improvement, possibly influenced by the intervention (Android-based detector).

5. Pre-test Intervention Group vs Post-test Control Group:
- Correlation coefficient (ρ = 0.913) represents a very strong positive correlation.
- p-value (Sig. = 0.000) is significant.
- This strong correlation suggests that both groups behaved similarly in post-tests, despite one group receiving the intervention.

6. Post-test Control Group vs Post-test Intervention Group:
- Correlation coefficient (ρ = 0.710) indicates a strong positive correlation.
- p-value (Sig. = 0.000) shows significance.
- Although both groups have been tested after the intervention, the control group didn't experience the intervention, yet there is still a strong positive correlation, likely due to baseline similarities.

All correlations are statistically significant ($p < 0.01$), implying strong relationships across the different tests. However, the intervention appears to introduce changes in knowledge or behavior, as shown by the slightly weaker correlation between pre-test control and post-test intervention scores (ρ = 0.678), suggesting the detector's effect on participants in the intervention group. The consistently strong correlations suggest that, overall, participants across both groups behaved in a relatively consistent manner, but the intervention had a measurable impact on the experimental group.

Table 5. Correlations between experimental and control groups before and after exposure to Android-based preeclampsia detector for pregnancies

			Pre_test_Control_group	Pre_test_Intervention_group	Post_test_Control_group	Post_test_Intervention_group
Spearman's rho	Pre_test_Control_group	Correlation Coefficient	1.000	.860**	.839**	.678**
		Sig. (2-tailed)	.	.000	.000	.000
		N	80	80	80	80
	Pre_test_Intervention_group	Correlation Coefficient	.860**	1.000	.913**	.828**

	Sig. (2-tailed)	.000	.	.000	.000
	N	80	80	80	80
Post_test_Control_group	Correlation Coefficient	.839**	.913**	1.000	.710**
	Sig. (2-tailed)	.000	.000	.	.000
	N	80	80	80	80
Post_test_Intervention_group	Correlation Coefficient	.678**	.828**	.710**	1.000
	Sig. (2-tailed)	.000	.000	.000	.
	N	80	80	80	80

**. Correlation is significant at the 0.01 level (2-tailed).

Before implementation of the android-based preeclampsia detector for both experimental and control groups, *Complications* were found to be 26.33±30.09 significant ($p<0.05$), *Adherence* with 40±45.25 were significant ($p<0.05$), and participants' *Knowledge Levels* with 23.33±13.05 were significant ($p<0.05$).

After implementation of the conventional way of detecting preeclampsia among the control group, *Complications* were found to be 1.94±0.54 with insignificant probabilities classified as "No Risk" ($p=0.175$), "Moderate Risk" ($p=0.7125$), and "High Risk" ($p=0.1125$). The *Adherence* were found to be 1.0±0.30 with insignificant probabilities classified as "Obedient" ($p=0.10$), and "Disobedient" ($p=0.90$). While participants' *Knowledge Levels* were found to be 1.68±0.71 with insignificant probabilities classified as "Bad" ($p=0.46$), "Fair" ($p=0.3625$), and "Good" ($p=0.1750$).

After implementation of the android-based preeclampsia detector among the experimental group, *Complications* were found to be 1.14±0.413 significant ($p=0.046$), *Adherence* 1.38±0.487 to be significant ($p=0.0504$), and participants' *Knowledge Levels* to be 1.61 ±0.665 significant ($p<0.05$).

Table 6 shows the summary of the comparison between experimental and control groups before and after the implementation of the android-based pre-eclampsia as the intervention versus the conventional way of prompt treatment education to improve ante-natal care adherence and prevent ante-natal complications.

Table 6. Comparison between experimental and control groups

Variables	**Before Implementation (Experimental & Control)**	**After Implementation (Control)**	**After Implementation (Experimental)**
Complications	26.33 ± 30.09 ($p < 0.05$, significant)	1.94 ± 0.54 ($p = 0.175$, insignificant): No Risk ($p = 0.175$), Moderate Risk ($p =$	1.14 ± 0.413 ($p = 0.046$, significant)

		0.7125), High Risk (p = 0.1125)	
Adherence	40 ± 45.25 (p < 0.05, significant)	1.0 ± 0.30 (p = 0.10, insignificant): Obedient (p = 0.10), Disobedient (p = 0.90)	1.38 ± 0.487 (p = 0.0504, significant)
Knowledge Levels	23.33 ± 13.05 (p < 0.05, significant)	1.68 ± 0.71 (p = 0.46, insignificant): Bad (p = 0.46), Fair (p = 0.3625), Good (p = 0.1750)	1.61 ± 0.665 (p < 0.05, significant)

Conclusion

Through the effective implementation of the Android-based preeclampsia detector, we can make significant strides in improving outcomes for pregnant women and their babies, ultimately contributing to healthier futures for families across Indonesia.

An Android-based preeclampsia detector offers a promising solution for improving maternal health outcomes in Indonesia. By leveraging mobile health technology, the app could facilitate early detection of preeclampsia, promote adherence to antenatal care recommendations, and provide valuable health education to pregnant women. While there are challenges to consider, including limited access to technology in some areas and the need for accurate data input, these disadvantages are outweighed by the potential benefits of the app. The ethical contributions of the app are also significant, as it promotes health equity and empowers women to take control of their health. With proper development, testing, and implementation, an Android-based preeclampsia detector could become a valuable tool in reducing maternal morbidity and mortality in Indonesia.

References

1. Aryastami, N. K., & Mubasyiroh, R. (2021). Traditional practices influencing the use of maternal health care services in Indonesia. *PLOS ONE*, *16*(9), e0257032. https://doi.org/10.1371/journal.pone.0257032
2. Aryastami, N. K., & Mubasyiroh, R. (2023). Optimal utilization of maternal health service in Indonesia: a cross-sectional study of Riskesdas 2018. *BMJ Open*, *13*(9), e067959. https://doi.org/10.1136/bmjopen-2022-067959
3. Fauzi, R., Kyi, Y. P., Mon, M. M., Munira, L., Herman, B., Hounnaklang, N., & Viwattanakulvanid, P. (2021). Factors affecting optimal antenatal care utilization in Indonesia: implications for policies and practices. *Journal of Public Health Policy*, *42*(4), 559–573. https://doi.org/10.1057/s41271-021-00307-9
4. Fitrianti, M. Y., Fakhriah, E. L., & Handayani, T. (2023). The Principle of Legal Protection in the Provision of Emergency Contraception Services for Rape Victims under Law 36 of 2009 on Health. *Nurani Hukum Jurnal Ilmu Hukum*, *6*(1), 117–140. https://doi.org/http://dx.doi.org/10.51825/nhk
5. Forero, C. G. (2023). Cronbach's Alpha. In *Encyclopedia of Quality of Life and Well-Being Research* (pp. 1505–1507). Springer International Publishing. https://doi.org/10.1007/978-3-031-17299-1_622
6. Gayatri, R. V., Hsu, Y.-Y., & Damato, E. G. (2023). Utilization of Maternal Healthcare Services among Adolescent Mothers in Indonesia. *Healthcare*, *11*(5), 678. https://doi.org/10.3390/healthcare11050678

7. Guspianto, Ibnu, I. N., & Asyary, A. (2022). Associated Factors of Male Participation in Antenatal Care in Muaro Jambi District, Indonesia. *Journal of Pregnancy*, *2022*, 1–7. https://doi.org/10.1155/2022/6842278
8. Idris, H., & Sari, I. (2023). Factors associated with the completion of antenatal care in Indonesia: A cross-sectional data analysis based on the 2018 Indonesian Basic Health Survey. *Belitung Nursing Journal*, *9*(1), 79–85. https://doi.org/10.33546/bnj.2380
9. Laksono, A. D., Wulandari, R. D., Widya Sukoco, N. E., & Suharmiati, S. (2022). Husband's involvement in wife's antenatal care visits in Indonesia: What factors are related? *Journal of Public Health Research*, *11*(2), 1–6. https://doi.org/10.1177/22799036221104156
10. Mboi, N., Syailendrawati, R., Ostroff, S. M., Elyazar, I. R., Glenn, S. D., Rachmawati, T., Nugraheni, W. P., Ali, P. B., Trisnantoro, L., Adnani, Q. E. S., Agustiya, R. I., Laksono, A. D., Aji, B., Amalia, L., Ansariadi, A., Antriyandarti, E., Ardani, I., Ariningrum, R., Aryastami, N. K., … Mokdad, A. H. (2022). The state of health in Indonesia's provinces, 1990–2019: a systematic analysis for the Global Burden of Disease Study 2019. *The Lancet Global Health*, *10*(11), e1632–e1645. https://doi.org/10.1016/S2214-109X(22)00371-0
11. Ministry of Research Technology and Higher Education of the Republic of Indonesia. (2024). Justice, Equity, and Human Rights in the Globalized Era: Towards a Harmonized Legal Framework. *Nurani Hukum : Jurnal Ilmu Hukum*, *7*(1), 1. https://doi.org/10.51825
12. Paratmanitya, Y., Helmyati, S., Nurdiati, D. S., Lewis, E. C., Gittelsohn, J., & Hadi, H. (2021). The effect of a maternal mentoring program on the timing of first antenatal care visit among pregnant women in Bantul, Indonesia: Results of a cluster randomized trial. *Health Promotion Perspectives*, *11*(3), 307–315. https://doi.org/10.34172/hpp.2021.39
13. Prayitno, W. (2022). Synthesis of indonesian health law progressivism: medical cases paradigmatic therapy in judicial process. *South Florida Journal of Development*, *3*(3), 3817–3859. https://doi.org/10.46932/sfjdv3n3-061
14. Siedlecki, S. L. (2020). Quasi-Experimental Research Designs. *Clinical Nurse Specialist*, *34*(5), 198–202. https://doi.org/10.1097/NUR.0000000000000540
15. World Health Organization. (2023). Pregnancy and Childrearing. In P. Skinner (Ed.), *Yearbook of the United Nations 1991* (pp. 40–42). Brill | Nijhoff. https://doi.org/10.1163/9789004636774_048
16. Wulandari, R. D., Laksono, A. D., & Matahari, R. (2022). Does Husband's Education Level Matter to Antenatal Care Visits? A Study on Poor Households in Indonesia. *Indian Journal of Community Medicine*, *47*(2), 192–195. https://doi.org/10.4103/ijcm.ijcm_981_21
17. Wulandari, R. D., Laksono, A. D., Rachmawati, T., & Rukmini, R. (2021). Barriers to Antenatal Care Utilization in Indonesia. *Medico-Legal Update*, *21*(1), 828–834. https://doi.org/10.37506/mlu.v21i1.2419