e-ISSN : 2987-0836 DOI : https://doi.org/10.59585/ijhs

Publish : Association of Indonesian Teachers and Lecturers
International Journal of Health Sciences (IJHS)
Journal Homepage : https://jurnal.agdosi.com/index.php/IJHS/index
Volume 1 | Number 4 | Desember 2023 |

Preeclampsia Screening Using The Smartphone Method: Literature Review

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Abstract

Introduction: Indonesian maternal mortality in 2012, 32.5% was caused by hypertension, preeclampsia, and eclampsia, while 24.22% in 2015 and 26% in 2016. Currently, there is no method of screening for preeclampsia based on maternal characteristics that were carried out during the first visit antenatal. The use of technology has great potential to improve health care at the community, especially in low-middle income countries. It is necessary to make a breakthrough in the form of developing a screening model for preeclampsia by utilizing information technology. **Material and Methods:** This type of research uses literature study method sourced from journals and publications results. Population in This research is all journals and article obtained from Pubmed, Clinical Key, Science direct, Google scholar with PRISMA design. **Results:**. As a result of the 5 articles found, it was stated that there was an effect of testing an Android-based preeclampsia screening application that could detect it effectively The early risk of preeclampsia was shown by all midwives who were part of the application trial sample stated that an Android-based preeclampsia screening application for pregnant women ≤ 20 weeks was feasible to use. **Conclusion:**. The use of the application is quite good for community-based preeclampsia screening.

Keywords: Pregnant Women, Android Based, Pregnancy Risk Detection, Pre-Eclamsia

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e-ISSN : 2987-0836 DOI : https://doi.org/10.59585/ijhs

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1. Introduction

Maternal death rate due to complications eclampsia in the past fourteen years is 19.6% - 46% and while fetal death is around 65%.(Akbari et al., 2023) Low awareness of mothers about signs and symptoms symptoms of hypertension in pregnancy and its low Socioeconomic level contributes to low level of mother's understanding of danger hypertension in pregnancy. (Berhe et al., 2020) (Savage & Hoho, 2016) This lack of understanding results in delays seeking services and delays in treatment in mothers with preeclampsia(Mekie et al., 2022). The low understanding of hypertension in pregnancy, exacerbated by failure to identify risks during ANC, and its lack of adequacy monitoring at 20 weeks of gestation causes high maternal and infant mortality(Bokslag et al., 2020). Efforts to prevent preeclampsia have been made implemented as part of the effort reduce maternal mortality rates. Factor screening Early risk is before 20 gestational age week, became global and followed in Indonesia thanks to the maternal and infant health manual at the service basic health. Health workers at service Basic health such as general practitioners, midwives and nurses must be able to identify factors the risk of preeclampsia (Kemenkes RI, 2020).

Application of screening and treatment models preeclampsia is a step which is important for reducing deaths and maternal and perinatal disabilities. The model is in the form of early detection of high risk of preeclampsia and pregnancy outcomes, providing care emergencies and facilitate referrals. Matter this can increase community engagement in monitoring for preeclampsia. Community involvement has been shown to reduce misperceptions about the danger signs of preeclampsia, so that it can improve maternal and infant outcomes newborn (Bone et al., 2021).

Early detection of preeclampsia is carried out at Indonesia is with pressure checks blood and urine protein. Currently there are none preeclampsia screening method based on maternal characteristics carried out at the initial visit. Inspection blood pressure was taken at each visit antenatal care and urine protein examination were carried out on second trimester. Efforts to improve health at the level community can be done through use

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Volume 1 | Number 4 | Desember 2023 |

information technology. Currently mobile phone users quite a lot and has become a mainstay of communication tools daily, can be used for improvement community empowerment in the health sector. (Lim et al., 2015)

This technology can provide the means to patients to receive education health, and facilitate follow-up maintenance. Currently there is great potential in the use of technology to improve health care and service delivery health to society, especially to the state poor and developing. You can currently use Android applications used as a screening method by midwives in community level.(Feroz et al., 2022) This application was built with include maternal factors predisposition to preeclampsia. Midwives can use the application when pregnant women make the first visit. Initial screening preeclampsia that occurred before the age of 16 week is important to facilitate monitoring during pregnancy. The earlier the screening If done, the better the action will be prevention of the risk of complications preeclampsia. (Lim et al., 2015)

2. Research Method

This type of research uses literature study method sourced from journals and publications results. Population in This research is all journals and article obtained from Pubmed, Clinical Key, Science direct, Google scholar with PRISMA design. The inclusion criteria are as follows:

a) The patient comes for the first visit at age pregnancy ≤ 16 weeks
b) Willing to be a respondent

The exclusion criteria for pregnant women are:

a) Pregnant women who have cancer, heart
b) Pregnant women who do not do K1 with a midwife local village

The drop out criteria for pregnant women respondents are:

a) If the mother changes her domicile permanently after screening
b) The mother experienced an abortion before the age 20 weeks pregnant
c) Mother died before 20 gestational age
d) The mother cannot be monitored appropriately with model recommendations

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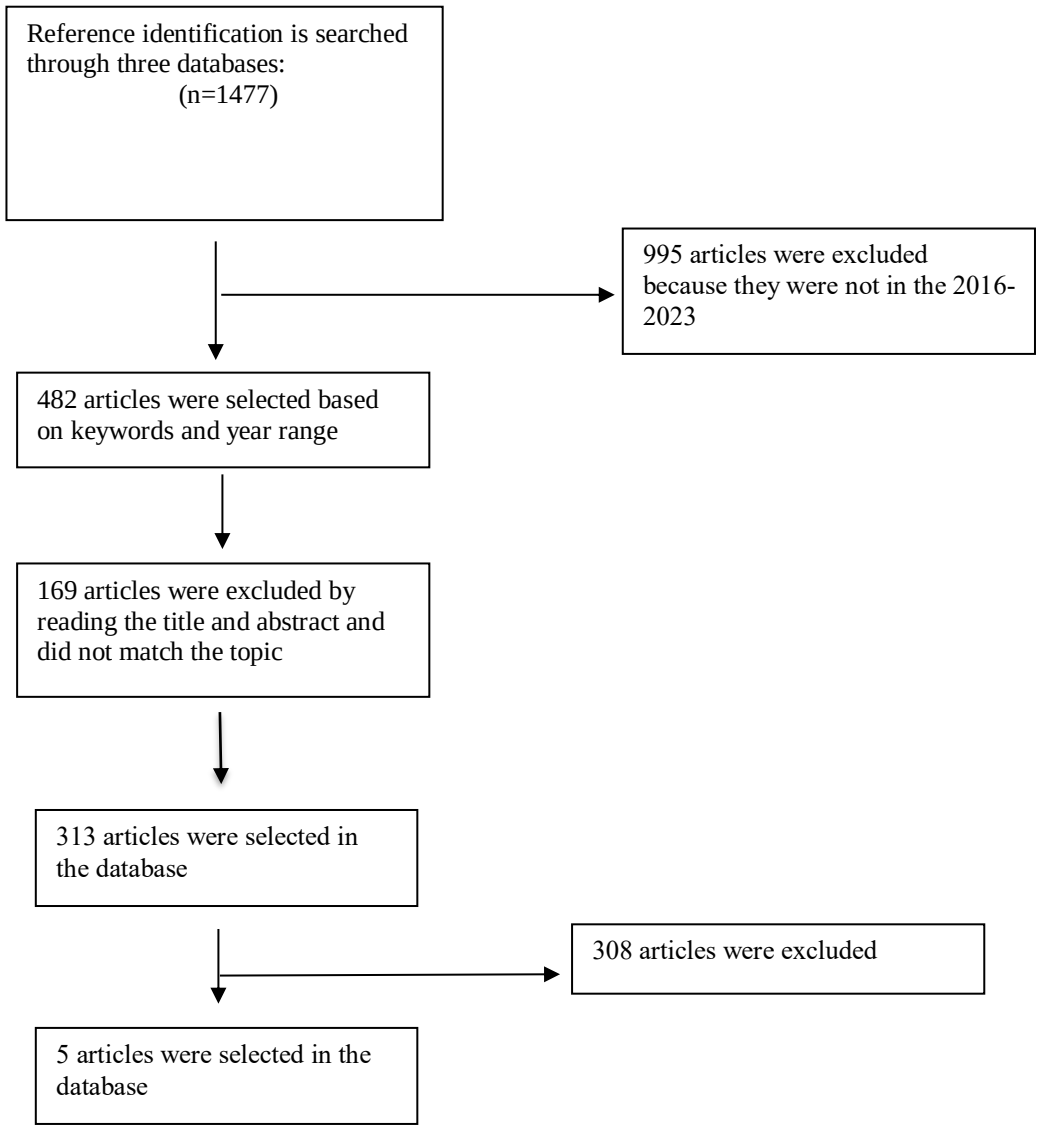
There are 5 articles obtained based on the inclusion criteria, library publication year 2016-2023, and speak Indonesian and English.

Figure 1. Prisma Flow Diagram



3. Results

This research get 5 literature that has gone through data reduction proces according to the criteria inclusions.

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Name, years	Research Design	Objective	Sample	Result
(Surya et al., 2021)	This research method is observational with a cross design sectional. The research was conducted in the working area of the Campalagian Community Health Center, West Sulawesi in 2018 January to May 2022.	The aim of this research is to create Preeclampsia screening application for pregnant women to detect preclampsia early and make it easier midwives in decision making	30 pregnant women	The results of statistical tests are that there is a significant/meaningful influence from systolic blood pressure, MAP, anamnesis results (high and medium risk) to screening results with p value <0.05. The trial results of an Android-based preeclampsia screening application can detect it The early risk of preeclampsia was shown by all midwives who were part of the application trial sample stated that an Android-based preeclampsia screening application for pregnant women ≤ 20 weeks was feasible to use.
(Suparni et al., 2021)	This type of research is research and development with four steps to designing a Pregnancy Risk Detection Application Android based	This study aims to determine the effectiveness of the SiBumil application, which is an application to detect the risk of independent pregnancy.	The population in this study were pregnant women with high risk in the Kramatsari Public Health Center, Pekalongan City as many as 103 as samples using the Krejcie and Morgan tables based on an error of 5%. Primary data collection methods are carried out by direct assistance to pregnant women	The results of the analysis using the alpha test with the Black box technique showed that the functions of all the menus in SiBumil were successfully executed. For the feasibility test using the usability test, an average of 84% was obtained, indicating that this application is very feasible to use. For differences in knowledge using the Wilcoxon test, p value was obtained 0.000 < α (0.05) so it was concluded that there was a difference in knowledge before and after the use of SiBumil

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			and distributing questionnaires	
(Johariyah et al., 2023)	This study was conducted by cohort study	This study aims to determine the detection rate of the application of preeclampsia.com as a community-based preeclampsia screening tool.	549 pregnant women who had their first antenatal visit before 16 weeks followed up to delivery.	The results of the analysis showed that the sensitivity value of the "Preeclampsia.com" application was 64.1% and the specificity value was 85.5% (95% CI). The Positive Predictive Value (PPV) from the "preeclampsia.com" application is 25.3% and the Negative Predictive Value (NPV) from the "preeclampsia.com" application is 96.9%. Based on the results of multilevel logistic regression analysis, it was found that the ability of the model to predict the incidence of preeclampsia was 96.4%. The use of the Preeclampsia.com application is quite good for community-based preeclampsia screening
(Oknalita Simbolon, 2020)	This research goes through stages which include data collection methods and program development / system design methods using ensemble learning and content based methods	Generate programs from artificial intelligence systems to detect preeclampsia early and provide recommendations to Android-based pregnant women.	We obtained a cohort of 402 pregnant women in 2015-2019 in Nganjuk Community Health Center, Banget Ayu Community Health Center, Community Health Center Tambakaji and Gayamsa	Researcher developed a mobile application, which has two unique contributions, namely (1) preeclampsia prediction using soft voting-based ensemble learning, and (2) recommendation system for the women who is at high risk of preeclampsia. We employ the soft voting technique on the preeclampsia prediction, and the results produce a higher accuracy value of 98.51% ± 0.0186 compared to the six individual classifiers (k-Nearest Neighbors, Linear SVM,

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				RBF SVM, Gaussian Process, MultiLayer Perceptron, and AdaBoost). Where as our proposed recommender system also produces a higher accuracy value of 96.66% ± 0.0229.
(Jonas et al., 2016)	As previously outlined, the CRD test has two parts.15 The "wet part" of the test consists of the preparation of the urine-Congo Red mixture, spotting the mixture as dots on a nitrocellulose sheet (CRD sheet xray)	The Congo Red Dot (CRD) test, a simple modality to assess the presence of misfolded proteins in urine, shows promise as a diagnostic and prognostic tool for pre-eclampsia. We propose an innovative mobile health (mHealth) solution that enables the quantification of the CRD test as a batch laboratory test, with minimal cost and equipment.	In the first stage, the basic image processing algorithms and supporting test standardizations were developed using urine samples from 218 patients. In the second stage, the standardized procedure was evaluated on 328 urine specimens from 273 women. In the third stage, the application was tested for robustness using four different operators and 94 altered samples.	In the first stage, the image processing chain was set up with high correlation to manual analysis (z-test P < 0.001). In the second stage, a high agreement between manual and automated processing was calculated (Lin's concordance coefficient qc ¼ 0.968). In the last stage, sources of error were identified and remedies were developed accordingly. Altered samples resulted in an acceptable concordance with the manual gold-standard (Lin's qc ¼ 0.914).

4. Discussions

The magnitude of the model's capabilities predicting the incidence of preeclampsia was tested using the Multilevel Logistic Regression test. Test this is done for factors: parity, history families with preeclampsia, diabetes mellitus, hypertension and history of preeclampsia in pregnancy previously, with p-value < 0.05). Assess the sensitivity and specificity of the application 64.1% and the specificity value was 86.3%. This matter shows

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this model is able to predict 64.1% of pregnant women are at high risk for really had preeclampsia, and was able to predicts that 86.3% of pregnant women will not have a low risk/risk of preeclampsia for did not experience preeclampsia. (Surya et al., 2021)

The Positive Predictive Value (PPV) of the application "preeclampsia.com" was 25.3% and Negative Predictive Value (NPV) applications "preeclampsia.com" was 96.9%. This matter indicates that using this application, if a mother has a high risk of preeclampsia, then the probability of experiencing preeclampsia is 25.3% and if the mother is pregnant it is not have a low risk of preeclampsia preeclampsia, then this model can predict probability of not experiencing preeclampsia is 96.9%. (Surya et al., 2021)

Sensitivity value in predicting preeclampsia more useful than value specificity, due to consideration of benefits, dangers, and costs indicate many things greater preference for minimizing false negatives rather than false positives. (Jonas et al., 2016) (Surya et al., 2021) Results research shows that screening is based risks can be considered considering complexity and unpredictability of clinical signs preeclampsia. (Stasiak et al., 2023)

The sensitivity of this application is lower if compared with the results of predictive research preeclampsia using Doppler which has sensitivity rate of 78%.(Oknalita Simbolon, 2020) Research result indicates that if the mother's characteristics combined with MAP and Doppler will increased the sensitivity to 71.4%. (Johariyah et al., 2023) Preeclampsia screening uses maternal factors has a lower detection rate if compared with preeclampsia screening using a combination of maternal and maternal factors other methods such as doppler, MAP, UtA-PI and PlGF. However, the use of a screening model This cannot be done at all levels communities, especially in poor countries and develop. So the use of screening preeclampsia with maternal risk factors can become one solution to carry out screening early in pregnant women. This is what finally happened In 2020, the Indonesian Ministry of Health has created preeclampsia screening guidelines performed on every pregnant woman before age 20 weeks pregnant. Through this action, mother Pregnant women are screened based on maternal factors by the doctor, who then distributes it whether it is high risk or not, and referrals are made to mothers at high risk. This program is also in accordance with the quantity policy antenala care which is now a provision is 6

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times, where 2 times antenatal care was carried out by a doctor specialist. So monitoring and prevention mothers at high risk of preeclampsia can well done.

To accompany the new molecular test, we have created a data processing chain suitable for a smartphone's processor and memory and have reduced the mHealth imaging system to the smartphone as a standalone device, without requiring internet connectivity. Thus, we have not only eliminated the need for a separate handheld imaging device or other hardware, but have created a smartphone-based diagnostic tool that is also independent of communication data rate, quality of service, and data transfer security. (Wang et al., 2023) Recently, these issues have been emphasized as some of the main limitations of mHealth applications. As applied to preeclampsia, our mHealth solution brings an objective element into the clinical work-up for preeclampsia which especially in low resource settings relies heavily on subjective interpretation of signs and symptoms by healthcare providers. Ease of use is enhanced, because the test readout is a percentage that is proportional to disease severity. Hence, the proposed method is in line with cutting edge technologies in mHealth.

5. Conclusion

The trial results of an Android-based preeclampsia screening application can detect it early The risk of preeclampsia was shown by all midwives in the application trial sample stated that the Android-based preeclampsia screening application for pregnant women ≤ 20 weeks worth using. Factors that influence preeclampsia screening results the results of statistical tests are that there is a significant/meaningful influence of systolic blood pressure, MAP, anamnesis results (high and medium risk) against screening results with a p value <0.05.

6. Compliance with ethical standards

Acknowledgements

The authors would like to express their gratitude to everyone who participated in this piece of research. Institutional leadership in the facilitation of research assistance for the advancement of health research for the benefit of the general public.

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Disclosure of conflict of interest

There is no potential for any stakeholder to have a conflict of interest in this research.

Statement of informed consent

In our capacity as writers, every action we perform constitutes a joint agreement or consent.

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