

The effectiveness of telehealth in improving the knowledge, attitude, and practice of eclampsia prevention among preeclampsia mothers

Mamat Mamat,¹ Tukimin Sansuwito,² Rahayu Pertiwi,¹ Rahayu Dwikanthi¹

¹Politeknik Kesehatan Kemenkes Bandung, Indonesia; ²Lincoln University College, Petaling Jaya, Malaysia

Abstract

Despite numerous media efforts to inform the public, the understanding, attitudes, and practices for preventing eclampsia have not significantly improved, and maternal deaths due to eclampsia remain alarmingly high. This study aims to identify the socio-demographic factors related to this issue and to evaluate the effectiveness of telehealth in enhancing the knowledge, attitudes,

and practices regarding eclampsia prevention among mothers experiencing preeclampsia. A quasi-experimental design with a control group was implemented to study the effects of telehealth tools on mothers with preeclampsia. Participants were selected using purposive sampling, resulting in a sample size of 104 mothers, which was calculated using the G*Power tool. The key variables in this study included telehealth tools, socio-demographics, knowledge and attitudes, and practices for preventing preeclampsia. Data were collected before and after the intervention. The analysis used univariate and bivariate analysis: the independent t-test used Mann-Whitney and Kruskal-Wallis tests, the paired t-test (dependent t-test) used the Wilcoxon test, and the multivariate analysis used logistic regression. Our study results indicate that a mother's history of preeclampsia and her number of pregnancies (parity) significantly influenced eclampsia prevention practices. Additionally, knowledge, attitudes, and methods of prevention showed notable changes before and after the telehealth intervention, with all p-values being less than 0.05. The effects of parity on eclampsia prevention practices, as well as the role of telehealth in shaping knowledge and attitudes toward eclampsia prevention and management, were examined in relation to parity and education level. The support systems and advocacy efforts used by health officers can be integrated to improve telehealth services and encourage collaborative research involving multiple health experts.

Correspondence: Mamat Mamat, Politeknik Kesehatan Kemenkes Bandung, Padjajaran No 56, Bandung, Indonesia.
E-mail: mamat.researcher@gmail.com

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Introduction

The maternal and infant mortality rate can be used to assess a country's health level. The higher the maternal and infant mortality rates, the worse the health status will be. In 2017, the global maternal mortality rate was around 295,000 people, and an estimated 810 died every day.¹ Maternal mortality rates of 94% are found in developing countries. This high rate highlights the significant disparity between poor, rich, and developing nations. Resources such as medical expertise, facilities, and equipment are unevenly distributed, and geographical differences further exacerbate this issue.² Preventable complications of pregnancy and childbirth cause high cases of maternal mortality.^{3,4} Other causes of maternal death were classified as non-obstetric complications at 15.7%, other obstetric complications at 12.04%, obstetric bleeding at 27.03%, others at 4.51%, infection at 4%, and the highest caused by hypertension, which was 33.07%.⁵ Indonesia is one of the developing countries with a high maternal mortality rate, in which, every hour, two mothers die from complications of pregnancy, childbirth, and postpartum complications. The maternal mortality rate in Indonesia reached 305/100,000 in 2015.⁶

Many factors have been considered as the cause of maternal mortality. All elements refer to the existence of the mother as an object as well as a subject in the case of maternal knowledge and attitudes related to preeclampsia.^{7,8} Based on a previous study, 47% of pregnant women have a lack of knowledge about

preeclampsia.⁹ A lack of information and education causes a low level of knowledge.¹⁰ The level of knowledge and attitudes of mothers with preeclampsia is essential in making decisions taken as an effort to improve their health and prevent illness and death.¹¹ In addition to low awareness and attitudes regarding eclampsia cases, inadequate prevention practices among pregnant mothers with preeclampsia significantly contribute to the occurrence of eclampsia. Therefore, there are still low Antenatal Care (ANC) visits at the primary service level due to many maternal deaths, even though these maternal deaths can be prevented through regular ANC practices.¹² The wrong diet, such as eating or drinking many sweet, salty, and high-fat drinks, can increase blood pressure.¹³ Some pregnant mothers experience anxiety at the end of pregnancy; family support and the ability to control emotions and stress are vital.¹⁴ Lack of physical activity and exercise is also one of the things that contribute to eclampsia.

One of the prophylactic eclampsia occurrences WHO recommended for every pregnant woman with eclampsia is the administration of drugs such as aspirin, calcium, magnesium, and vitamin D.¹⁵ Thus, irregularities in drug consumption can increase the high risk of eclampsia. A study showed that 86.9% of pregnant women expect good service, 78.3% recommend using internet media in health services (telehealth), and 90.9% of service workers believe telehealth can improve service access.¹⁶ Internet-based information media approaches exist, such as preeclampsia-detector, preclampsia.com, preeclampsia-calculator,¹⁵ Dear Mother app,¹⁷ and SMS mother. These applications have limitations, including a lack of functional information about preeclampsia and eclampsia prevention practices, insufficient user engagement from mothers and spouses, and the requirement of an email to log in.

Telehealth is one of the solutions offered in this study to address the above problems. Telehealth is an information and educational medium that contains information on the prevention of pregnancy disorders, especially the prevention of eclampsia, as well as a communication medium between preeclampsia mothers and health workers to prevent eclampsia. Telehealth has specifically developed resources for mothers with preeclampsia. All information is presented on Android devices in an engaging, easy-to-read format that increases knowledge, attitudes, and practices for preventing eclampsia. The objective of this study is to determine the effect of socio-demographics on knowledge, attitude, and practice of eclampsia prevention intervention and to determine the effectiveness of telehealth in improving the knowledge, attitude, and practice of eclampsia prevention among preeclampsia mothers after being a controlled confounder variable.

Materials and Methods

Research design

A quasi-experimental design with a control group was implemented in this study. The control group was given an Android-based application that had gone through a user-friendliness test, while the control group did not receive any intervention. Both groups went through a homogeneity test to eliminate factor bias.

Study participant

The study participants were mothers with preeclampsia. The sample size was calculated using the Power 3.2 formula. The assumptions included a tolerance deviation (α) of 0.05, an effect size of 0.25, and a power level of 0.80 (80%). The estimated sample size was 102, to which an additional 10% (10 samples) was

added, resulting in a total of 112 samples. These samples were divided into two groups: 56 in the intervention group and 56 in the control group. The sample criteria included being pregnant, having preeclampsia, being under 20 weeks gestation, having a spouse, and being familiar with an Android mobile phone. The sampling technique used was purposive.

Variables

The variables include telehealth, socio-demographics, knowledge, attitude, and practice of eclampsia prevention. Telehealth is a tool developed through three key stages: first, identifying the need for content based on surveys; second, adjusting input from health workers, including midwifery and gynecology specialists; and third, collaborating with internet technology experts to design the interface and application. The final phase involves testing the validity and usability of the telehealth system.¹⁸ Socio-demographic variables are age group, education level, gravidity, and parity. The knowledge consists of 15-item questions, with categories of correct answer choices and accurate and wrong answers. The attitudes are a variable composed of 15 statements that describe the prevention of pregnancy disorders (eclampsia). Each report includes five categories of answer choices based on a Likert scale. For positive statements, the scoring is as follows: 5 = strongly agree, 4 = agree, 3 = neutral, 2 = disagree, and 1 = strongly disagree. For negative statements, the scoring is reversed: 1 = strongly agree, 2 = agree, 3 = neutral, 4 = disagree, and 5 = strongly disagree. Additionally, the practice of preventing preeclampsia also uses five categories of answer choices in the form of a Likert scale. For positive statements, the scoring is: 5 = always, 4 = often, 3 = sometimes, 2 = rarely, and 1 = never. For negative statements, the scoring is as follows: 1 = always, 2 = often, 3 = sometimes, 4 = rarely, and 5 = never.

Data collection

The intervention group was given a telehealth intervention delivered directly, while the control group received no intervention during the study but was given telehealth afterward. This study was conducted at ten public health centers (PHCs), with the most referral cases being preeclampsia mothers. A pre-test was carried out regarding knowledge, attitudes, and prevention practices based on data collected in the initial stage. The data analysis involved both univariate and bivariate analyses. Prior to conducting the bivariate analysis, several statistical methods were applied to assess the data. These included normality tests, such as the Kolmogorov-Smirnov test and the Shapiro-Wilk test, as well as visualizations using histograms and distribution curves to identify trends in data distribution. For comparisons between two groups, the Mann-Whitney analysis was utilized, while the Kruskal-Wallis test was used for groups consisting of more than two categories. The research process is explained in Figure 1.

Results

The socio-demographic categorical data in the intervention and control groups

The characteristics and age of the two categories of respondents—namely, the intervention group and the control group—are nearly identical. The primary differences lie in the age distribution; in both groups, 90% of the participants are over 25 years old. Additionally, the mothers with preeclampsia in the sample do not have jobs or independent sources of income. The proportion of

primigravida mothers is higher in the intervention group, accounting for 36% of the sample (Table 1).

The effect of socio-demographic factors on the practice of eclampsia prevention after telehealth intervention

The impact of demographic factors on the practice of eclampsia prevention among mothers with preeclampsia includes age group, education level, gravidity, and parity. The Mann-Whitney test is utilized for independent group data, focusing on the following categories: age group and education level, as well as gravidity and occupation. Meanwhile, the Kruskal-Wallis test is employed to analyze differences among three or more groups for the category of parity. The results of the Mann-Whitney test indicate the effect of group age on eclampsia prevention practices. The mean rank (average rank) for the group aged 25 and older was 54.06, which is higher than the mean rank of the younger group, which was 48.65. The p-value is 0.206 (>0.05), indicating that there is no significant difference in mean positioning based on the ages of the two groups when it comes to the practice of preventing eclampsia. This suggests that the age of mothers with preeclampsia does not have an impact on their practices for preventing eclampsia. Likewise, the results of the Mann-Whitney test indicate that the mean rank for the practice of eclampsia prevention is higher for individuals with lower education, scoring 55.33, compared to those with higher education, who scored 49.56. The p-value obtained is 0.137, which is greater than 0.05. This indicates that there is no significant difference in the mean ranks of the two education groups regarding the practice of eclampsia prevention. Then, the H_a hypothesis test was rejected, which means there is no effect on preeclampsia mothers' education level towards practicing prevention of eclampsia. Other test results indicate that the impact of gravidity on the practice of preventing eclampsia shows a mean rank for grand multigravida of over 41.00, compared to 35.54 for multigravida. The p-value of 0.392 (>0.05) suggests that there is no significant difference in the mean rank between grand multigravida and multigravida regarding the practice of preventing eclampsia. This implies that the gravidity of mothers with preeclampsia does

not significantly affect their practices in preventing eclampsia. In contrast to the previous hypothesis results, the findings of the Kruskal-Wallis test indicate that the effect of exercise on preventing eclampsia shows a mean rank of 66.25, which is higher than that of multigravida at 34.71, and also greater than that of primigravida at 34.47. The p-value obtained is 0.010 (<0.05), indicating a significant difference in mean ranks among grande, multi, and primiparous mothers regarding eclampsia prevention practices. This suggests that a higher parity is associated with better practices in preventing eclampsia. Therefore, parity appears to have an effect on the eclampsia prevention methods employed by mothers with preeclampsia (Table 2).

The effect of telehealth on the knowledge, attitude, and practice of eclampsia prevention

The impact of telehealth on the knowledge of eclampsia prevention among mothers with preeclampsia was evaluated using the Mann-Whitney test. The results indicated that mothers who received telehealth intervention had a mean rank of 68.79, significantly higher than the mean rank of 36.21 for mothers who did not receive the intervention. This demonstrates the positive effect of telehealth on their understanding of eclampsia prevention. A significant p-value of 0.0001 (<0.05) indicates a meaningful difference in the mean rank of knowledge about eclampsia prevention among mothers with preeclampsia who received telehealth interventions compared to those who did not. The hypothesis H_a . Accepted, indicating that the telehealth intervention has a significant effect on the knowledge of eclampsia prevention among mothers with preeclampsia. In contrast, the Mann-Whitney test revealed that the impact of telehealth on attitudes toward eclampsia prevention was notable. The mean rank of preeclampsia mothers who received the telehealth intervention was 72.69, significantly higher than the mean rank of those who did not receive the intervention, which was 32.31. There is a considerable difference mark in p-value of 0.0001 (<0.05), which means there is a significant mean rank between those who get preeclampsia telehealth interventions and those who have no telehealth intervention toward attitude prevention of eclampsia. In examining the dependent variable, which is the



Figure 1. Research flow diagram.

Table 1. Socio-demographic factors in intervention and control group.

Socio-demographic data	Intervention (f%)	Group Control (f%)
Group age		
≥ 25 years	34 (65.4)	40 (76.9)
< 25 years	18 (34.6)	10 (23.1)
Education		
Elementary schools	8 (15.4)	13 (25)
Junior high schools	14 (26.9)	18 (34.6)
Senior high schools	28 (53.8)	16 (30.8)
College	2 (3.8)	5 (9.6)
Gravidity		
Grande	1 (1.9)	5 (9.6)
Multi	32 (61.5)	33 (63.5)
Primi	19 (36.5)	14 (26.9)
Parity levels		
Grande	15 (28.8)	2 (3.8)
Multi	18 (34.6)	21 (40.4)
Primi	19 (36.5)	14 (26.9)
Nuli		15 (28.8)

impact of telehealth on the prevention of eclampsia, we found that the mean rank for preeclampsia mothers who received telehealth interventions was significantly higher at 65.59. In contrast, the mean rank for preeclampsia mothers who did not receive any telehealth interventions was 39.41, resulting in a difference of 26.18. There is enough significance depicted by a p-value of 0.0001 (<0.05), which means there is a difference in the significant mean rank among preeclampsia mothers who got telehealth interventions with no-telehealth ones toward mark practice prevention of eclampsia. The hypothesis showed that H_a . Accepted, suggesting that telehealth interventions have a positive effect on the prevention of eclampsia in mothers with preeclampsia (Table 3).

The effect of telehealth on the practice of eclampsia prevention after control by the confounding variable

The telehealth intervention variable has an OR of 25.010, so preeclampsia mothers who receive telehealth intervention (code one of the independent variable) have a greater opportunity of increasing eclampsia prevention practices (code 1 dependent variable) by 25.010 times compared to preeclampsia mothers who do not receive health intervention after controlling for the parity covariate variable (Table 4).

Table 2. The effect of socio-demographic factors on the practice of eclampsia prevention.

Socio-demographic variable	N	Mean rank	Score	p
Age group				
>25	74	54.06		0.206*
<25	30	48.65		
Level of education				
High	51	49.56		0.137*
Low	53	55.33		
Gravity				
Grande	6	41.00		0.392*
Multi	65	35.54		
Parity				
Grande	2	66.25		0.010**
Multi	36	34.71		
Primi	32	34.47		

*Kruskal-Wallis test statistics; **Mann-Whitney test statistics.

Table 3. Effect of telehealth on the knowledge, attitude, and practice of eclampsia prevention.

Variable	n	Mean rank	Preeclampsia mothers	p
Age group				
>25	74	54.06		0.206*
<25	30	48.65		
Level of education				
High	51	49.56		0.137*
Low	53	55.33		
Gravity				
Grande	6	41.00		0.392*
Multi	65	35.54		
Parity				
Grande	2	66.25		0.010**
Multi	36	34.71		
Primi	32	34.47		

*Kruskal-Wallis test statistics; **Mann-Whitney test statistics.

Table 4. Effect of telehealth on the practice of eclampsia prevention after controlled by confounding variable.

Variable	B	Wald	Sig.	Exp(B)*	95% C.I. for EXP(B)	
					Lower	Upper
Telehealth intervention	3.219	9.160	.002	25.010	3.110	201.148
Parity level 2	.230	.127	.721	1.259	.355	4.464
Constant	-5.590	5.623	.018	.004		

*Last model for analysis of full logistic regression.

Discussion

The research findings indicate that socio-demographic factors and medical history significantly influence pregnant women's knowledge about preeclampsia. A study conducted among mothers who experienced preeclampsia revealed an association between respondent characteristics—such as age, education level, income, and Body Mass Index (BMI)—and the occurrence of preeclampsia. Additionally, antenatal care practices were found to reduce the risk of complications, particularly in the age group of 20–34 years.¹⁹ A pregnant woman's understanding of the relationship between preeclampsia and a history of the disease has evolved significantly over time. Moreover, a history of hypertension and factors such as sodium intake further contribute to its occurrence.²⁰ Research findings indicate that multiparous women (those with multiple pregnancies) who have a history of preeclampsia and receive adequate treatment are less likely to experience recurrence. The characteristics of an individual, including their parity status, significantly influence their exposure to information and health-related decision-making. Greater parity often correlates with increased exposure to information about pregnancy-related complications, enabling women to better understand potential risks, make informed decisions about their health, and prevent complications such as eclampsia. Antenatal care (ANC) visits play a critical role in providing health information and education. Health professionals can disseminate knowledge about preeclampsia and other pregnancy-related conditions, helping expectant mothers understand prevention strategies and manage their health effectively. Parity also has a profound impact on eclampsia prevention practices. Biological changes and experiences differ between a woman's first pregnancy and subsequent pregnancies. First pregnancies are often associated with a higher risk of complications, including eclampsia, as the body is less accustomed to the hormonal and physiological changes of pregnancy. In contrast, women in subsequent pregnancies are more likely to recognize early signs and symptoms of eclampsia and adopt preventive measures, such as regular medical check-ups, adhering to nutritional guidelines, taking sufficient rest, and following medical advice regarding supplements. Health practitioners emphasize the importance of these experiences, as they increase women's awareness of eclampsia risks and encourage proactive measures to minimize complications during pregnancy.^{21,22} Other studies have found significant differences in knowledge, attitudes, and practices related to preventing eclampsia among preeclamptic mothers and their spouses before and after telehealth interventions. A similar difference was observed when comparing the effects of telehealth interventions to cases where no telehealth was utilized. These findings align with research demonstrating a significant improvement in knowledge and attitudes following the use of mHealth applications to prevent complications during the third trimester of pregnancy. Knowledge acquired during pregnancy serves as a critical foundation for adopting positive health behaviors. For mothers with preeclampsia, adequate knowledge acts as a key motivating factor for engaging in ANC and other preventive practices. Health education provided during ANC visits is essential and should cover the symptoms, risk factors, and complications associated with preeclampsia. Ensuring that this information is clearly communicated can empower mothers to make informed decisions and take proactive measures to safeguard their health and that of their unborn child.⁷ During these ANC visits, healthcare providers can offer tailored education on various aspects of care, such as appropriate physical activity, adequate nutrition to support fetal development, and

avoiding foods that may exacerbate preeclampsia. Additional guidance includes ensuring sufficient rest and managing stress effectively. Improvements in the knowledge and attitudes of pregnant women through these educational interventions can significantly enhance their self-care and self-management practices. These behavioral changes contribute to a reduction in the risk of pregnancy-related complications and childbirth disorders, ultimately promoting better maternal and fetal health outcomes.²³ Studies involving mothers with previous postpartum experience highlight the importance of counseling in enhancing knowledge about preeclampsia through provider-based services. Social media platforms have increasingly become not only a source of information but also a powerful tool to capture individuals' attention and provide social support.²⁴

Telehealth systems are designed to improve healthcare delivery, with the expectation of demonstrating a high level of effectiveness compared to traditional methods. One key objective of telehealth is to facilitate ease of use and encourage the adoption of positive health behaviors. For example, a study on the prevention of dental caries in children demonstrated that habit formation could significantly improve health outcomes, such as encouraging children to practice good oral hygiene. Similarly, telehealth applications can be efficient in fostering healthy behaviors and providing effective healthcare services.²⁵ Applications require effective media engagement, and the information provided within most applications needs to be enhanced to ensure user understanding. To ensure their effectiveness, scientific evidence is essential to support the implementation of health technologies, such as telehealth. Application technologies offer various tools that simplify processes and improve user experience, ultimately making healthcare more accessible and efficient.²⁶ For an Android-based application to be effective, user-friendly, and well-received, it is essential to incorporate engaging and relevant visual media. The application should feature visually appealing images with attractive colors and simple and easy-to-navigate menus. Additionally, the design should prioritize efficiency, ensuring that users can easily access information and perform tasks.²⁶

Technology will continue to evolve, and human interaction with technology will remain integral to daily life. One notable advancement is the use of the Internet through Android devices. This change has transformed the way individuals access and respond to information, thereby influencing their communication behaviors. The internet has significantly influenced lifestyle changes, primarily due to continuous technological advancements.²⁷ This statement highlights how the progress in information and communication technology, along with the widespread effects of globalization, has transformed the ways people live, interact, learn, and redefine their cultural identities. The advent of the Internet has rendered traditional concepts of space, time, and distance irrelevant, enabling individuals to connect at any time and from any location. This technological shift addresses challenges such as language diversity, cost barriers, and internet access limitations. Furthermore, the new application offers a range of features, including intuitive icons and customizable options, ensuring that users can easily navigate and understand the platform.²⁸ The use of application-based communication, information, and education, or application-based telehealth, is particularly relevant in the digital age. As of recent reports, 196.7 million people, or 73.7% of Indonesia's population, are internet literate. This widespread digital access enables individuals to avoid in-person interactions, a key advantage during the COVID-19 pandemic, which has significantly affected prenatal care. A study showed a 16.1% decrease in the volume of weekly prenatal visits, from 898

to 761 visits on average. This decline has impacted the monitoring of pregnant women, especially those with preeclampsia, increasing the risk of pregnancy complications, including eclampsia.

In this study, telehealth delivers information, education, and communication through an Android-based application designed to prevent pregnancy complications, including eclampsia. By leveraging technology, the application ensures that preeclamptic mothers and their spouses have continuous and consistent access to critical health information.²⁹ The use of advanced information technology, such as telehealth, has certain limitations in providing comprehensive exposure to information about eclampsia prevention. However, Android-based health information systems are available, and most mothers and spouses of preeclamptic patients possess mobile phones. Telehealth offers not only educational content but also the advantage of rapid information delivery, enabling users to quickly adopt appropriate attitudes and behaviors based on their needs.

Telehealth platforms are designed to be user-friendly and engaging, incorporating features that facilitate ease of use and maintain user interest. These systems go beyond merely disseminating information; they also include communication and coordination tools that foster collaboration between healthcare providers, preeclamptic mothers, and their spouses. This collaborative approach promotes harmony and alignment, enabling the development of shared strategies for managing preeclampsia and preventing complications during pregnancy. By leveraging these features, telehealth enhances the effectiveness of health interventions and supports better outcomes, even in cases where preeclampsia is already present.

Conclusions

Parity and telehealth interventions significantly influence the improvement of preeclamptic mothers' attitudes and knowledge regarding eclampsia prevention. After adjusting for parity and educational attainment, telehealth interventions have been found to be 25 times more effective in preventing eclampsia. To further enhance these outcomes, additional research involving multidisciplinary collaboration—encompassing gynecology, cardiology, neurology, and other relevant fields—is needed to develop a comprehensive telehealth-based strategy for eclampsia prevention.

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