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The Effect of Continuity of Midwifery Care (CoMC) Based on EDUGARLIN Application and Booklet on Postpartum Fitness Quality

Pengaruh Model Pelayanan Kebidanan Berkesinambungan (CoMC) Berbasis Aplikasi "EDUGARLIN" Dan Cetak Terhadap Kualitas Nifas Bugar

Junengsih Junengsih[1]*, Rosita Syarifah[1], Ani Kusumastuti[1], Herlyssa Herlyssa[1], Elly Dwi Wahyuni[1], Yulia Ulfah Fatimah[2], Lia Nurcahyani[3], Fahmi Hafid[4]

[1]Department of Midwifery, Poltekkes Kemenkes Jakarta III, Jakarta, Indonesia
[2]Department of Midwifery, Poltekkes Kemenkes Bandung, Bandung, Indonesia
[3]Department of Midwifery, Poltekkes Kemenkes Tasikmalaya, Tasikmalaya, Indonesia
[4]Department of Nutrition, Poltekkes Kemenkes Surabaya, Surabaya, Indonesia

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Correspondent:
Junengsih Junengsih
junengsihpoltek3jkt@gmail.com

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ABSTRACT

Background: The puerperium is the period between the delivery of the placenta and the return of the uterus to its pre-pregnancy condition, which lasts for 6 weeks or 42 days. During this recovery period, mothers often experience several physiological and physical changes that cause discomfort. Several studies have shown that the discomfort experienced can lead to pathological development and complications when not treated properly. To prevent complications, information technology from smartphones with Android-based applications can be used to improve the quality of postpartum well-being.
Objectives: This study aimed to analyze the effect of utilizing EDUGARLIN (postpartum fitness education) application on the knowledge, attitudes, and quality of postpartum fitness in TPMB (Independent Midwife Practice).
Methods: The study procedures were carried out using a Quasi-experimental design with a nonequivalent posttest-only control group method. The purposive sampling was then used to select a total of 84 respondents, who were divided into 2 groups, namely EDUGARLIN application (intervention) and booklet (control). The data obtained in this study were analyzed using the Mann-Whitney test.
Results: The results showed that there were significant differences in knowledge, attitudes, and postpartum fitness quality between the intervention and control groups. In the intervention group, 36 respondents (85.7%) had good knowledge, compared to 22 respondents (52.4%) in the control group (p-value<0.05). A total of 36 respondents (85.7%) also showed positive attitudes, compared to 34 (81%) in the control group (p-value<0.05). In addition, 38 respondents (90.5%) in the intervention group had good postpartum fitness quality, compared to 26 (61.9%) in the control group (p-value<0.05).
Conclusions: The android-based EDUGARLIN application was effective in improving knowledge, attitudes, and behavior of postpartum mothers in terms of the quality of postpartum fitness.

INTRODUCTION

Postpartum period is a stage that starts after the placenta is delivered and continues until the uterus returns to its pre-pregnancy condition, generally lasting about 6 weeks or 42 days. During this period, mothers often undergo several physiological changes that may cause discomfort. Several studies have shown that understanding the nature of the discomfort as part of the body's natural healing process is essential. However, there is a high risk of developing complications when the condition is not properly managed. These complications include anemia, preeclampsia/eclampsia, postpartum bleeding, postpartum depression, and postpartum infections, which affect mothers' health status[1].

Common issues during pregnancy include postnatal weight retention, musculoskeletal problems, such as pelvic pain, low back pain, abdominal diastasis, pelvic floor disorders, as well as psychological disorders, including postpartum depression. To address these issues, medical personnel have recommended exercise during postpartum period, which aids in recovery after childbirth, helps in returning to pre-pregnancy weight, reduces the risk of developing health conditions and future chronic diseases, enhances fitness parameters,

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fosters mother-baby interaction, and encourages social engagement[2].

According to previous studies, postpartum service policy typically consists of 3 sessions. The midwife conducts the first session, namely Postpartum Visit or KF1, while the mother is still at the medical facility. The second and third sessions, KF2 and KF3, comprise follow-up or home visits according to a schedule. However, these follow-up sessions have not been carried out effectively as proposed[3]. The average coverage of initial postpartum services for KF1, KF2, and KF3 was reported by Riskesdas (*Riset Kesehatan Dasar*/Basic Health Research) 2018 statistics at 93.3%, 66.9%, and 45.2%, respectively. This indicates that Indonesian postpartum services, such as KIA (*Kesehatan Ibu dan Anak*/Mother and Child Health), are still below the country's goals. The intervention and policies of KIA program have also been reported to be erratic in operation, leading to increased infant and maternal mortality rates[4].

The 2018 Family Health Directorate's routine report showed that the coverage of postpartum visits was relatively in the good category, with scores of 77% and 97% for first postpartum and neonatal visits, respectively. However, data from several surveys, such as the 2012 Balitbangkes (*Badan Penelitian dan Pengembangan Kesehatan*/Health Research and Development Organization) showed that maternal deaths during postpartum period were 61.59%. This indicated that the quality of postnatal care for mothers and infants was still low, specifically with the current problems of access and integration of postnatal care with other health service[5].

Maternity continuum of care is a model of integrated components of maternal health service from pregnancy to the post-partum period to improve maternal, neonatal, and infant health. Healthcare systems that provide midwifery service through a continuity-of-care method have shown beneficial effects on both mothers and infants. World Health Organization (WHO) supports midwife continuity of care models, where a certified midwife trained to international standards, such as those set by the International Confederation of Midwives, or a small, familiar team of midwives, offers care in pregnancy, labor, and postpartum period. Mothers who experienced these models reported more positive pregnancy labor, and postpartum experiences, as well as reduced costs for antenatal (pregnancy) and intrapartum (labor and birth) care. Continuous care in postpartum period helps mothers feel more supported, secure, and calm while adjusting to the new role[6].

Postpartum care is essential as mothers often undergo significant physical and psychological changes to regain their health and well-being after childbirth[7]. Current principles in postpartum and breastfeeding midwifery care focus on supporting methods as healthy individuals, viewing recovery as a natural process. Midwives provide mothers-centered care, which takes a holistic method by addressing the physical, emotional, psychological, spiritual, social, and cultural needs. Postnatal care services serve as a Continuation of Midwifery Care (CoMC) model, which extends support beyond pregnancy and delivery[8].

Previous studies have shown that Indonesia does not yet have optimal awareness regarding the importance of postpartum health, as it is influenced by facilities, medical personnel, inadequate infrastructure, and education, which are not evenly distributed[5]. This gap can be addressed with a technological method and the use of information. Postpartum mothers often require quality education and health services to care for infants without disturbing their lifestyle. Providing information as an educational effort can be combined with various media in health education. At present, information technology is widely promoted, changing almost all aspects of human life in which IT plays a significant role. In addition, an Android application was developed to take the role of media by providing education to increase knowledge about psychological changes, danger signs, needs, and care[9].

A study conducted by Shorey regarding the Postnatal Education Program Mobile Health Application (Home-but not Alone) showed that it was handy as a postnatal educational medium, especially for new parents. Daehn et al. also developed the SmartMoms application, which improved awareness and provided information about postpartum depression. The results showed that 62.2% of mothers who accessed self-screening for the condition had positive results and received help more quickly. The use of app interventions in postpartum period helps to establish early diagnosis, postnatal education, and identification of infections and adverse events[10,11]. Therefore, this study aims to develop a strategy for providing educational media for postpartum fitness. A media application called EDUGARLIN was created, which utilizes Android-based smartphone technology as a more practical guide for postpartum mothers to improve postpartum fitness.

METHODS

This study was an enhancement of the 2022 application, refined based on feedback from midwives providing services and clients receiving CoMC services. Following these improvements, a quantitative study proceeded to assess the impact of EDUGARLIN application on knowledge and attitudes related to fitness in the experimental (intervention) group. This study aimed to identify cause-and-effect relationships by involving both an experimental or intervention group and a control group. The intervention group received EDUGARLIN application, while the control group was provided only the printed EDUGARLIN booklet. Both groups completed a pre-test, received their respective interventions, and then completed a post-test. However, these 2 groups were not randomly selected.

EDUGARLIN application and the booklet addressed topics pertinent to all mothers and their infants, such as recognition of danger signs in labor, nutritional needs, physical adjustments during childbirth, and feeding mothers. In addition, it also covered the journey through motherhood, acclimatizing to parental lifestyle, healthful living behaviors, postpartum illness, and complications prevention, as well as maternal role acceptance for family planning and exclusive breastfeeding experiences in different socioeconomic backgrounds across regions. Videos were provided to

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improve the nurturing abilities of a mother after birth. After completing a knowledge and attitude questionnaire, new mothers had access to several videos covering postnatal yoga, the parenting transition period, baby massage, and feeding methods (i.e. breastfeeding). Developing EDUGARLIN application included a structured process that ensured the final products function efficiently, starting with defining the application's purpose. The design phase included creating wireframes and prototypes to visualize the user experience. An appropriate technology stack was selected in development, and clean code was written to implement the design. Ongoing maintenance and updates were crucial for optimal performance and user satisfaction.

A quasi-experimental method was used in this study, specifically applying a Nonequivalent Control Group Design. In this design, neither the experimental group nor the control group was selected randomly. Both groups were subjected to an initial pre-test. In this method, the experimental and control groups are compared, although the samples were selected and assigned without randomization. Both groups received a pre-test, then an intervention, followed by a post-test. The groups received different treatments, with the experimental group using EDUGARLIN application and the control group using a printed version in booklet form, and concluded with a final test for each group. This study's population included all postpartum mothers who had postpartum visits at the 2 midwife practices namely TPMB (Independent Midwife Practice), a key healthcare provider in the Jakarta and South Tangerang areas. Participants were determined based on inclusion and exclusion criteria, and selected under specific conditions to ensure study relevance and accuracy. Eligibility criteria included the absence of postpartum complications, ownership of an Android phone capable of installing EDUGARLIN application, and willingness to partake in the study. These criteria were meticulously designed to ensure that only those who could genuinely benefit from and contribute to the study were included. The selective method guaranteed that the results were valid and pertinent to the targeted population, the sample size included in the study criteria was calculated using the Raosoft formula application http://www.raosoft.com/samplesize.html. A margin of error of 5% was considered and a confidence level of 95% from a total population of 120 postpartum mothers. The sampling method used purposive sampling with a total sample of 42 participants using EDUGARLIN application and 42 participants using the booklet. The treatment and a control group comprised 42 participants each. The leading inpatient clinic in Jakarta was selected as the treatment group because all participants in this group owned Android phones. Meanwhile, TPMB in South Tangerang was selected as the control group. A nonprobability sampling was used with a purposive sampling method. This method enabled the study teams to select a sample that best represented the characteristics of the population.

Primary data were used to collect information on postpartum fitness, with a questionnaire as the data collection instrument. This questionnaire, administered during the pre-test and post-test phases, comprised 20 items on knowledge and 20 items on attitudes toward postpartum fitness. In addition, it covered topics such as recognition of postpartum danger signs, adherence to nutritional guidelines, physical adaptation of postpartum and breastfeeding mothers, the maternal role attainment process, adaptation to parenting, health promotion for healthy behavior, prevention of postpartum disease and complications, family planning, and the success of exclusive breastfeeding. A validity test was performed on the instruments to ensure accuracy and reliability, confirming that both questionnaires, namely 1 for knowledge and 1 for attitudes were valid, with correlation values exceeding the table thresholds. The study aimed for precise measurement of these variables, with significant correlations indicated by asterisks (1 for 95% and 2 for 99% significance levels). Reliability was measured using Cronbach's Alpha, yielding a score of 0.80, which confirmed high reliability. After securing study permissions, conducting a preliminary study, and completing sampling, the study teams informed participants of the study's objectives, procedures, benefits, and potential risks, obtaining informed consent before proceeding with the pre-test.

Data collection commenced by explaining the study procedures to participants, and those willing to participate signed a consent form. In addition, a pre-test questionnaire was administered to both groups. For the treatment group, study teams provided an intervention using EDUGARLIN application, which included information on postpartum care. Participants were encouraged to download and use the application, which focused on postpartum fitness. For 2 weeks, participants in the treatment group were asked to engage with the application for a minimum of 15 to 30 minutes every day during rest periods, exploring educational content and videos on improving postpartum fitness.

The control group received a printed fitness booklet and was asked to read it during their free time, with no time constraints. After 2 weeks, both groups completed a post-test questionnaire. As a follow-up, the control group was also provided access to EDUGARLIN application after the post-test.

The study teams performed editing, coding, scoring, and statistical analysis to examine the data. Subsequently, the data was processed and analyzed using SPSS version 26.0 to assess changes in knowledge and attitudes between the control and treatment groups. The Wilcoxon Signed-Rank Test was used to evaluate the comparative correlation between the 2 samples for each dependent variable in ordinal data, with a significance threshold set at p-value=0.05. To compare 2 independent samples from different populations, the Mann-Whitney U Test was applied. When the results yielded a p-value <0.05, the null hypothesis (Ho) was rejected, and the alternative hypothesis (H1) was accepted, indicating a significant difference in knowledge and attitudes between the control and treatment groups.

Ethical approval was granted by the Study Ethics Commission of University Respati Indonesia, with the number 532/SK.KEPK/UNR/VIII/2024 issued on 2 April 2024. All participants provided their informed consent before their involvement in the study. In addition, their rights, including the ability to withdraw from the learning

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without facing any repercussions were properly stated. The study process upheld confidentiality and anonymity, safeguarding participants' identities and personal information.

RESULTS AND DISCUSSIONS

Univariate analysis was used to obtain an overview of the distribution of participants according to several characteristics, according to the independent variable and the dependent variable. In this study, univariate analysis was used to determine the frequency distribution of knowledge, attitudes, and behavior of fit postpartum quality after providing interventions using EDUGARLIN application and booklets.

Table 1. Frequency distribution of post-test knowledge, attitudes, and behavior of the quality of postpartum fitness at TPMB

Variable	Group	
	Intervention (n=42)	Control (n=42)
Knowledge		
Good	36 (85.7%)	22 (52.4 %)
Fair	6 (14.3%)	15 (35.7%)
Less	0 (0 %)	5 (11.9%)
Attitude		
Positive	36 (85.7%)	34 (81%)
Negative	6 (14.3%)	8 (19%)
Postpartum Quality Fit		
Fit	38 (90.5%)	26 (61.9%)
Not Fit	4 (9.5%)	16 (38.1%)

Based on Table 1, it was found that after receiving treatment, participants with good knowledge were more common in the intervention group (85.7%) compared to the control group (52.4%). In addition, those with a positive attitude were more common in the intervention group (85.7%) than in the control group (81%). Regarding actions, those in the intervention group were more adherent (90.5%) than those in the control group (61.9%).

Table 2. The influence of EDUGARLIN application on knowledge of the quality of postpartum fitness

Participants	Knowledge			p-value
	Good	Fair	Less	
Intervention Group (EDUGARLIN Application)	36 (62.1%)	6 (28.6%)	0 (0%)	0.000*
Control Group (Booklet)	22 (37.9%)	15 (71.4%)	5 (100%)	
Total	58 (100%)	21 (100%)	5 (100%)	

*Mann –Whitney Test, significant if p-value <0.05

Based on Table 2, the results of knowledge about postpartum mother care revealed that among 58 participants with good knowledge, the majority (62.1%) were in the intervention group, while 37.9% were in the control group. Among 21 participants with sufficient knowledge, the majority (71.4%) were in the control group, compared to 28.6% in the intervention group. All 5 participants with less knowledge were in the control group. The statistical test results showed a p-value of less than 0.05, indicating a significant difference in knowledge of postpartum health quality between the intervention and control groups. This analysis suggested that EDUGARLIN application had a positive effect on increasing knowledge about the quality of postpartum care in TPMB.

Table 3. The influence of EDUGARLIN application on attitudes of the quality of postpartum fitness

Respondent	Attitudes		p-value
	Positive	Negative	
Intervention Group (EDUGARLIN Application)	36 (51.4%)	6 (42.9%)	0.000*
Control Group (Booklet)	34 (48.6%)	8 (57.1%)	
Total	70 (100%)	14 (100%)	

*Mann –Whitney Test, significant if p-value <0.05

The results of attitudes regarding the puerperium quality in postpartum mothers, based on Table 3, show that of the 70 participants with positive attitudes, the majority were in the intervention group (51.4%), compared to the control group (48.6%). Among the 14 participants with negative attitudes, the majority were in the control group (57.1%) compared to the intervention group (42.9%). The statistical test results revealed a p-value <0.05, indicating a significant difference in attitudes toward the quality of postpartum health between the intervention and control groups. This demonstrates that the application positively impacts attitudes to enhance the quality of postpartum health.

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Table 4. The influence of EDUGARLIN application on the behavior of the quality of postpartum fitness

Group	Postpartum Fitness		p-value
	Fit	Not Fit	
Intervention Group (EDUGARLIN Application)	38 (59.4%)	4 (20.0%)	0.002*
Control Group (Booklet)	26 (40.6%)	16 (80.0%)	
Total	58 (100%)	21 (100%)	

*Mann –Whitney Test, significant when p-value <0.05

The results of postpartum fitness quality behavior in postpartum mothers, as shown in Table 4, revealed that 59.4% of the 64 participants who exhibited postpartum fitness were in the intervention group, compared to 40.6% in the control group. Meanwhile, among the 20 participants categorized as unfit, the majority were in the control group (80.0%) while only 20.0% belonged to the intervention group. The statistical test results showed a p-value <0.05, indicating a significant difference in behavior that indicated the quality of a fit postpartum between the intervention group and the control group. This revealed that EDUGARLIN application had an impact on improving the care of postpartum mothers at TPMB.

This study was conducted at TPMB in the Jakarta and South Tangerang areas for 7 months. In addition, it started with validity and reliability tests on 28 March 2024. After that, the study teams divided 84 postpartum mothers into 2 groups and gave each group a questionnaire on knowledge, attitudes, and behavior regarding the quality of postpartum health. A total of 42 mothers participated in the intervention group, which used EDUGARLIN application, while 42 mothers, as controls, received the booklet. Compared with the control group, the intervention group had more mothers with excellent knowledge, according to the study results in Table 1. Knowledge was the result of perception or sensation, which occurred after gaining understanding.

Age, education, environment, information, experience, society, culture, and economy were all variables that influenced knowledge[12]. This study's findings were consistent with theories that explained these elements in detail. In this study, participants received information through EDUGARLIN application and booklet media, significantly enhancing their understanding. Using digital applications and printed materials as educational tools successfully integrated traditional and modern methods to improve health literacy. Most participants showed good knowledge, indicating that these methods effectively conveyed essential health information. In addition, combining multiple sources of information ensured that the educational content was accessible and comprehensible to a broader audience, thereby fostering an informed and educated community[13].

Each individual had a different ability to perceive and understand information through their senses because the more often the senses were engaged, the easier it was to understand. According to Janah and Timiyatun, health education depended on the level of an individual's sensory grasp, the more frequently it was used, the better the understanding. Consequently, the benefits of using audio-visual media were very effective and influential in receiving information from leaflet media regarding health education[14].

Since it appealed to all senses, disseminating knowledge through the media made acceptance, which was previously challenging, much more accessible. Smartphones were one of the types of electronic media that could be used for marketing[15], proving to be convenient to transport, useful everywhere, resistant to damage, and had numerous uses. These benefits, along with their appealing animations, made cell phones popular. According to Putri's study, "The Effect of the 'Mommy Postpartum' Application on Increased Mother's Knowledge and Skills", after completing the Mommy Postpartum application, the treatment group gained significantly more knowledge about postpartum care. Similar studies had shown that the Nifasku application improved maternal knowledge of postnatal care for newborns[16].

Previous studies on using the "Bidanku" application also found similar results. Of the 22 participants, the majority (73.3%) experienced high academic scores. There were considerable differences in improvement between the control and intervention groups, with a p-value less than 0.05 and an RR of 2.2. This proved that using "Bidanku" significantly increased knowledge, up to 2.2 times compared to the control group[17].

The results from Table 3 indicated that of the 70 participants with positive attitudes, the majority (51.4%) were in the intervention group compared to 48.6% in the control group. Meanwhile, among the 14 participants with negative attitudes, the majority (57.1%) were in the control group, compared to 42.9% in the intervention group. Statistical tests revealed a significant difference in attitudes towards the quality of postpartum fit between the intervention and control groups, with a p-value <0.05. This analysis indicated that EDUGARLIN application positively impacted improving attitudes toward the quality of postpartum fit at TPMB.

Attitudes were influenced by previously acquired knowledge and based on an individual's tendency to act toward objects or stimuli. In addition, attitudes were reflected in their reactions or behaviors toward an object. For example, a person could practice breast care more diligently after learning their importance and methods. This transformation in behavior depicted how gaining information positively impacted one's attitudes and actions. The dynamic between knowledge and attitude was crucial, as it could lead to better health outcomes and proactive health behaviors. By educating individuals effectively, it was possible to foster positive attitudes and

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encourage beneficial practices, thereby enhancing overall well-being[12,18].

According to Bem's Self-Perception Theory, an individual's positive or negative attitude toward an object was formed by observing their behavior[19]. This theory suggested that people developed their attitudes by reflecting on their actions and the context in which it occurred. During postpartum period, mothers with positive attitudes were particularly motivated to engage in self-care practices[20]. In addition, these practices included regular exercise, balanced nutrition, and seeking support when needed. In addition, their positive attitudes were reinforced these health-promoting behaviors were consistently performed. This, in turn, could significantly improve their postpartum fitness and overall well-being[21]. The self-perception mechanism emphasized the importance of fostering positive behaviors and attitudes, because of their interconnectivity, which could lead to sustained health benefits[22,23].

Action was a critical aspect of practice, specifically in midwifery. In this study, midwives' knowledge and positive attitudes were fundamental to their ability to provide high-quality care. According to the Health Belief Model theory, knowledge heavily influenced a person's practice. This model suggested that individuals' actions toward health were determined by their understanding of health issues and the perceived benefits of taking action. For midwives, possessing comprehensive knowledge and maintaining a positive outlook made it easy to execute their effective care strategies, educate patients, and promote healthy behaviors. By being well-informed and fostering a supportive environment, midwives could significantly enhance the health outcomes for mothers and newborns[24].

The period following childbirth was crucial for both mother and infant. Postpartum hemorrhage was responsible for approximately 60% of maternal deaths, with 50% occurring in 24 hours after birth[2]. In Bogor, maternal mortality had shifted from complications during pregnancy and childbirth to an increase in postnatal deaths. This study exhibited some limitations, in addition to the requirement to assess fitness history starting from pregnancy to track participants' fitness from that period through postpartum phase. The fitness assessment in this study relied on self-reported questionnaires, whereas direct observation could provide a more accurate measurement of postpartum fitness. However, the study's strengths was in EDUGARLIN application, which evaluated maternal fitness during the puerperium and provided valuable educational resources for participants. Some limitations of this study included that not all postpartum mothers had adequate access to devices or internet connections, which could limit participation and reduce optimal use of the application. In addition, differences in technological mastery were an obstacle, specifically for mothers who were less familiar with applications or digital devices, which could affect their understanding of the content provided. Some mothers faced difficulties in following guidelines or instructions provided through the app without direct support. Applications could not detect physical or emotional changes that required quick intervention. As the app relied on inputs from the user, the data obtained did not reflect the true condition when the user did not report their progress consistently or was not completely honest. The app also lacked personal interaction compared to face-to-face services, which could make mothers feel less emotionally or psychologically supported, which was a very important aspect of postpartum care. Each mother had different health needs during postpartum period, therefore, the application struggled to tailor its content to individual needs, which could affect its effectiveness with each mother. In addition, the application included education on mental health for postpartum mothers, enhancing their overall well-being.

CONCLUSIONS

EDUGARLIN application enhanced maternal knowledge, improved their attitudes, and positively influenced their behavior, ultimately boosting the quality of postpartum fitness. Health workers, specifically midwives, could use EDUGARLIN application as an additional educational tool to improve knowledge, attitudes, and postpartum fitness. Future study teams must assess maternal fitness from pregnancy through postpartum, with direct observation recommended for more accurate fitness assessments. The application was hoped to evolve to enable seamless online communication between midwives and postpartum mothers.

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CONFLICT OF INTEREST AND FUNDING DISCLOSURE

The authors declare no conflict of interest relevant to this article. This research is the result of research from a collaborative research scheme between universities organized by the Health Polytechnic, Ministry of Health, Jakarta III, and the Health Polytechnic of the Ministry of Health, Bandung, Health Polytechnic of the Ministry of Health, Tasikmalaya, with the number of the cooperation agreement letter: 024A/PK/PKJ3/II/2024.

AUTHOR CONTRIBUTIONS

SS: Conceptualization, methodology and writing—original draft; Study design and educational interventions. DW: Formal analysis – supervised and writing—review & editing (ensured the integrity of research process; contributed to critical revisions of manuscript) LN: Data curation, investigation and methodology; helped with data collection and analysis, implementation of Emo Demo method. JJ: Writing—original draft, and data collection (research interview) —contributed to writing the original paper AK: Oversaw project logistics, organized what is needed to do the research, and facilitated collaboration. Writing—original draft, writing—review & editing, visualization; helped

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analyze results and refine data presentation within the manuscript.

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