

Empowerment of pregnant women through digital health education and family support to enhance childbirth preparedness

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Submitted: 2026-09-14; Revised: 2026-09-24; Accepted: 2026-10-07

KEYWORDS:

Childbirth preparedness;
Digital education;
Family support;
Maternal health;
Pregnant women.

ABSTRACT

Background: Childbirth preparedness is an important component of maternal health care because adequate knowledge, planning, and family involvement can help pregnant women prepare physically and psychologically for childbirth. However, limited access to reliable health information and insufficient family involvement may affect women's readiness for delivery. Digital education combined with family support provides an accessible and participatory approach to strengthening maternal knowledge and encouraging active family involvement. This community service program aimed to empower pregnant women through digital education and family support to improve their preparedness for childbirth.

Methods: This community service program was conducted among pregnant women and involved their family members as key sources of support. The intervention included digital maternal health education, educational materials on childbirth preparation and danger signs, interactive discussions, family-assisted learning, and counseling. Participants' knowledge and childbirth preparedness were assessed before and after the intervention using structured evaluation instruments. Family participation and engagement during the program were also evaluated.

Results: Following the intervention, participants demonstrated improvements in knowledge related to childbirth preparation, recognition of maternal danger signs, and understanding of appropriate actions before and during labor. Family members showed greater involvement in supporting pregnant women, including participation in birth planning and preparation for maternal health needs. The program also encouraged participants to use digital health information more effectively as a source of maternal health education.

Conclusion: Digital education combined with family support represents a practical community-based approach to empowering pregnant women and strengthening childbirth preparedness. Integrating accessible digital health education with active family involvement may support maternal health promotion and could be incorporated into community-based maternal health programs.

e-ISSN: **3032-663X**

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INTRODUCTION

Pregnancy and childbirth are critical periods in the maternal health continuum that require adequate knowledge, timely preparation, and supportive decision-making. Childbirth preparedness enables pregnant women and their families to anticipate the onset of labour, identify an appropriate health facility and skilled birth attendant, arrange transportation and financial resources, recognize maternal danger signs, and establish plans for potential obstetric emergencies (Aayisha et al., 2026). Adequate preparation is therefore not limited to clinical readiness but also involves psychological, informational, social, and family dimensions that can influence women's ability to access appropriate maternal health services (Atukunda et al., 2025).

Despite improvements in maternal health services, gaps in childbirth preparedness remain an important concern at the community level. Pregnant women may receive maternal health information during antenatal care; however, the information may not always be continuously accessible, easily understood, or reinforced within the household (Bist et al., 2025). In addition, the increasing availability of health information through digital platforms creates both opportunities and challenges (Downs et al., 2025). Digital media can provide pregnant women with convenient access to pregnancy and childbirth information, but differences in digital health literacy and the variable quality of online information may limit its effective use (Dankwah et al., 2026). These conditions highlight the importance of providing structured, credible, and accessible digital education as part of community-based maternal health promotion.

Digital health education offers an opportunity to extend maternal health information beyond conventional face-to-face education. Mobile devices and digital communication platforms can facilitate repeated access to educational materials and allow pregnant women to review information according to their individual needs (Elsharkawy et al., 2024). Previous studies have indicated that digital and mobile health interventions can contribute to maternal health education, knowledge improvement, engagement with health services, and informed health-related decision-making (Giarratano et al., 2010). Nevertheless, digital education is more likely to be meaningful when it is adapted to the needs, literacy levels, and social contexts of the intended community. Therefore, technology should function as a supportive educational tool rather than as a replacement for direct communication with qualified health professionals (Haq et al., 2024).

Family involvement is another important component of childbirth preparedness. Decisions concerning maternal health care are often influenced not only by pregnant women but also by husbands and other family members. Families can provide emotional, informational, financial, and practical support, including preparing transportation, accompanying women to health facilities, arranging financial resources, and responding promptly when danger signs occur (Asprimi Angreani & Suprpto, 2026). Consequently, educational interventions focusing exclusively on pregnant women may overlook the social environment in which maternal health decisions and preparations are made. Engaging family members can transform childbirth preparedness from an individual responsibility into a shared household process (Hildingsson et al., 2026).

Community empowerment approaches provide an appropriate framework for integrating digital education and family participation. Rather than positioning pregnant women and their families solely as recipients of health information, community engagement encourages them to actively identify their informational needs, discuss childbirth-related concerns, participate in educational activities, and translate acquired knowledge into practical birth-preparedness plans

(Kitil et al., 2026). Interaction between participants, families, and facilitators also creates opportunities for clarification, dialogue, and reflection. This participatory process is particularly important because childbirth preparedness requires both knowledge acquisition and the ability to apply that knowledge within everyday family and community contexts (Lazarou et al., 2025).

Previous maternal health promotion initiatives have employed antenatal classes, counseling, printed educational materials, mobile health applications, text messaging, and other digital interventions. Although these approaches demonstrate the potential of health education to strengthen maternal knowledge and preparedness, integrating digital education with structured family involvement remains particularly relevant for community engagement programs. Conceptually, the present program is based on an empowerment pathway in which accessible digital education strengthens maternal knowledge and awareness, family participation reinforces emotional and practical support, and the interaction between these components facilitates informed planning and preparedness for childbirth (Levett et al., 2023).

Based on these considerations, a community engagement program integrating digital maternal health education and family support was implemented to address the informational and practical needs of pregnant women in the target community. Pregnant women participated directly in educational sessions, discussions, and childbirth-preparedness activities, while family members were engaged as partners in supporting preparation and maternal health decision-making. Facilitators interacted with participants through educational communication, discussion, clarification of maternal health information, and assistance in translating health knowledge into practical preparations for childbirth.

This community engagement program aimed to empower pregnant women through digital education and family support to improve childbirth preparedness. Specifically, the program sought to strengthen pregnant women's knowledge of childbirth preparation and maternal danger signs, encourage appropriate use of digital maternal health information, enhance family participation in birth preparedness, and support pregnant women and their families in developing practical plans for safe childbirth. Through this integrated approach, the program was expected to provide a feasible model for strengthening community-based maternal health promotion and family engagement.

METHOD

This community engagement program employed a participatory health education approach integrating digital education and family support to improve childbirth preparedness among pregnant women. The program was organized by the Department of Nursing, STIKes Bala Keselamatan Palu, and implemented among pregnant women and their families in communities in Palu City, Central Sulawesi, Indonesia. Before implementation, an initial assessment was conducted to identify participants' knowledge of childbirth preparation, recognition of maternal danger signs, access to digital maternal health information, and existing family involvement in pregnancy and childbirth preparation. The initial assessment indicated the need for accessible maternal health education combined with stronger family participation.

The program was conducted in Palu City, Central Sulawesi, Indonesia, over a structured series of community-based educational activities. Pregnant women living in the target communities were recruited using purposive sampling. Eligibility criteria included being pregnant at the time of the program, residing in the target area, being willing to participate in the activities, and having a family member who could participate in the family-support component.

Participation was voluntary, and the purpose and procedures of the program were explained to participants before implementation.

The program consisted of four main stages: initial assessment, digital health education, family-assisted childbirth preparation, and evaluation. During the initial assessment, participants completed a pre-intervention assessment to determine their baseline knowledge and preparedness for childbirth. The assessment covered knowledge of pregnancy and childbirth, signs of labour, maternal danger signs, selection of a health facility and skilled birth attendant, transportation arrangements, financial preparation, and appropriate actions in the event of an obstetric emergency.

Digital education was delivered using accessible communication media, particularly WhatsApp-based educational materials, digital posters, and short educational videos. The educational content covered healthy pregnancy, signs of labour, maternal danger signs, preparation for childbirth, appropriate health-seeking behaviour, and the importance of giving birth with skilled health professionals. Interactive discussions accompanied the digital materials, allowing participants to ask questions, clarify information, share experiences, and discuss concerns related to pregnancy and childbirth. Participants were also encouraged to critically evaluate digital health information and prioritize information from credible health professionals and official health sources.

Family engagement constituted an integral component of the intervention. Husbands or other family members were encouraged to participate in educational activities and childbirth-preparedness discussions. Family members were guided to provide emotional and practical support, assist in selecting an appropriate health facility, prepare transportation and financial resources, recognize maternal danger signs, and develop an emergency plan. Pregnant women and their families jointly discussed their respective roles and responsibilities, thereby positioning childbirth preparedness as a shared family responsibility.

Program outcomes were evaluated using pre- and post-intervention assessments. Participants' knowledge was assessed using a structured questionnaire covering maternal health, danger signs, and childbirth preparedness. The questionnaire was reviewed for content relevance and clarity before implementation. Childbirth preparedness and family involvement were additionally assessed using structured observation and evaluation checklists. Facilitator observations were used to document participant engagement, interaction during educational sessions, family participation, and the ability of participants to apply the information provided during the program.

Quantitative data obtained from the pre- and post-intervention assessments were analyzed descriptively using frequencies, percentages, and mean scores. Changes between baseline and post-intervention scores were used to describe improvements following the program. Information obtained from facilitator observations, discussions, and participant feedback was summarized descriptively to provide additional information regarding participant engagement, family participation, and the practical implementation of childbirth-preparedness activities.

Before the program, the main conditions addressed were limited understanding of comprehensive childbirth preparation, difficulties in identifying reliable digital maternal health information, and insufficient family involvement in birth planning. The expected outcomes were improved maternal knowledge of childbirth preparation and danger signs, more appropriate use of digital maternal health information, increased family participation, and improved practical preparedness for childbirth.

RESULT AND DISCUSSION

Implementation of the community engagement program

The community engagement program was implemented among pregnant women and their family members in Palu City, Central Sulawesi, Indonesia. The activities integrated digital maternal health education, interactive discussion, family engagement, and practical childbirth-preparedness planning. Rather than positioning pregnant women as passive recipients of health information, the program encouraged participants and their families to actively discuss maternal health concerns, identify their preparedness needs, and develop practical plans for childbirth.

The initial assessment showed that participants had varying levels of understanding regarding childbirth preparation. Although participants were generally familiar with routine pregnancy care, several aspects of comprehensive childbirth preparedness required further reinforcement, particularly recognition of maternal danger signs, emergency planning, preparation of transportation and financial resources, and identification of reliable sources of digital maternal health information. Family involvement also varied, with some family members providing general support without being actively involved in specific birth-preparedness planning. The educational activities were therefore designed to respond directly to these identified needs. Digital posters, short educational videos, and WhatsApp-based materials were used to reinforce information provided during interactive educational sessions. Participants were encouraged to discuss the materials, ask questions, share their experiences, and clarify information with facilitators. This combination created a two-way educational process rather than conventional one-directional health education.

Changes in maternal knowledge and childbirth preparedness

Comparison between the initial and final assessments demonstrated improvement in participants' understanding of childbirth preparedness following the program. Improvements were particularly evident in participants' ability to recognize signs of labour and maternal danger signs, identify preparations required before delivery, and explain appropriate actions when complications or emergency situations occur. Participants also demonstrated a more comprehensive understanding of childbirth preparedness after the intervention. Preparation was no longer perceived only as preparing items needed for delivery. Participants increasingly recognized the importance of determining the place of delivery, identifying skilled health personnel, arranging transportation, preparing financial resources, identifying accompanying family members, and establishing an emergency plan. The main changes observed before and after the community engagement activities are summarized in Table 1.

Table 1. Changes in childbirth preparedness before and after the community engagement program

Indicator	Before the program	After the program
Understanding of childbirth preparation	Knowledge varied and preparation tended to focus on immediate delivery needs	More comprehensive understanding of physical, informational, and practical preparation
Recognition of maternal danger signs	Some danger signs were not consistently recognized	Improved ability to identify important maternal danger signs
Birth planning	Planning was not consistently structured	Participants developed more structured childbirth-preparedness plans

Emergency preparedness	Emergency arrangements were not always discussed in advance	Greater awareness of transportation, financial, referral, and emergency arrangements
Use of digital health information	Digital information was accessed without consistent consideration of source credibility	Greater awareness of the importance of credible and professional health information
Family participation	Support was primarily general or responsive	Families became more actively involved in planning and preparation
Interaction with health information	Participants mainly received information	Participants actively discussed, clarified, and applied maternal health information

The changes presented in Table 1 indicate that the program contributed not only to increasing participants' understanding but also to translating maternal health information into practical preparedness. This distinction is important in community empowerment because knowledge alone may not result in preparedness unless participants are able to apply the information within their household circumstances.

Family participation in childbirth preparedness

An important finding from the program was the increased involvement of family members in childbirth preparation. During the activities, family members were encouraged to discuss practical responsibilities with pregnant women rather than merely accompany them during educational sessions. These discussions included decisions regarding the intended place of delivery, transportation, financial preparation, accompaniment during labour, and actions to be taken when maternal danger signs occur. Family participation provided an opportunity to transform childbirth preparedness into a shared responsibility. Pregnant women could communicate their needs directly, while family members gained a clearer understanding of the practical support expected from them. This interaction was particularly relevant because decisions regarding transportation, finances, and access to health facilities frequently require cooperation among household members.

The findings are consistent with contemporary maternal health approaches emphasizing the importance of supportive social environments during pregnancy. Family support can facilitate maternal health service utilization and birth preparedness by providing emotional, informational, financial, and practical assistance. The contribution of the present program lies in integrating family support directly into digital maternal health education rather than treating family participation as a separate component of maternal health promotion.

Adoption of digital education for maternal health

The digital component provided participants with educational resources that could be accessed beyond face-to-face sessions. The use of familiar communication platforms, particularly WhatsApp, allowed participants to revisit educational messages, digital posters, and short videos after the community activities. This increased the continuity of education and created opportunities for maternal health information to be discussed within the family. An important aspect of the intervention was that participants were not simply encouraged to access more online information. They were encouraged to distinguish between credible and potentially unreliable maternal health information and to seek clarification from health professionals when uncertain. This approach is relevant because increased access to digital information does not automatically result in improved health literacy.

The potential adoption of digital education by the community represents an important aspect of program sustainability. Educational materials that can be retained and shared through

commonly used communication platforms require relatively limited resources and can complement routine face-to-face maternal health education. Nevertheless, digital education should remain complementary to professional maternal health services rather than replacing antenatal consultations or direct clinical assessment.

Community empowerment and program impact

The principal impact of the program was the transition from passive receipt of maternal health information toward greater participation in childbirth preparation. Pregnant women were involved in identifying information needs, discussing concerns, evaluating health information, and developing practical preparations with their families. Family members simultaneously moved from providing predominantly general support toward participating more explicitly in birth and emergency planning.

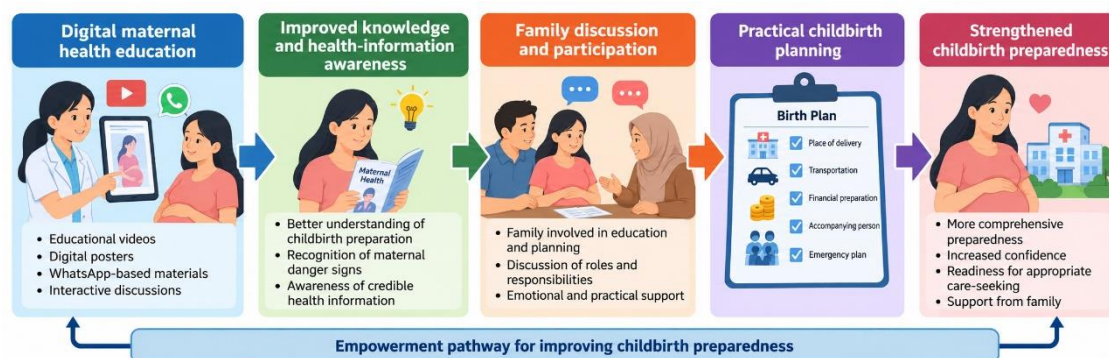


Figure 1. Empowerment pathway integrating digital maternal health education and family participation to strengthen childbirth preparedness.

Figure 1 illustrates the empowerment pathway from digital maternal health education to strengthened childbirth preparedness. Digital education supports improved knowledge and health-information awareness, which is reinforced through family discussion and participation and translated into practical childbirth planning. This pathway represents the observed empowerment process rather than a causal relationship.

The approach offers several advantages for the Palu community context. Digital educational materials can be accessed repeatedly, family participation can reinforce information outside formal health encounters, and interactive sessions provide opportunities to correct misunderstanding. The intervention is also relatively feasible for community-based implementation because it combines commonly available digital communication with direct interpersonal engagement. However, several limitations should be considered. Participants may differ in access to smartphones, internet connectivity, digital literacy, educational background, and level of family support. The intensity of family participation may also vary according to household circumstances. Furthermore, improvements observed immediately after educational activities do not necessarily indicate sustained behavioural change. Longer-term follow-up would therefore be needed to determine whether digital education and family-assisted birth planning remain integrated into participants' practices throughout pregnancy and childbirth.

Despite these limitations, the program demonstrates the practical value of combining digital health education with family engagement in community-based maternal health promotion. Its distinctive feature is the integration of three components accessible digital education, active participation of pregnant women, and structured family involvement within a single childbirth-preparedness strategy. This approach may be adaptable to other communities with similar

maternal health education needs, provided that educational content, digital delivery methods, and family-engagement strategies are adjusted to local social, cultural, and technological conditions.

The community engagement program demonstrates the practical value of integrating digital maternal health education with family participation to strengthen childbirth preparedness among pregnant women in Palu City, Central Sulawesi. The observed changes suggest that community-based maternal health education can extend beyond the transfer of information by encouraging pregnant women and their families to translate knowledge into practical preparation for childbirth. This is particularly important because childbirth preparedness involves not only recognizing signs of labour and maternal danger signs but also making timely decisions regarding the place of delivery, transportation, financial resources, accompanying persons, and emergency arrangements.

Digital education was an important component of the program because it provided participants with maternal health information that could be accessed repeatedly beyond face-to-face educational sessions. The use of familiar digital platforms, educational videos, and digital materials enabled participants to review information according to their needs and discuss it with family members. Recent developments in maternal health promotion indicate that digital health interventions can complement conventional antenatal education by increasing access to health information and supporting communication between women and health professionals. However, access to digital information alone does not necessarily improve preparedness (Lindermaier et al., 2025). Pregnant women may encounter information of varying quality, including content that is incomplete, misleading, or inconsistent with professional recommendations (Liu et al., 2025). Therefore, the program emphasized not only access to information but also awareness of source credibility and the importance of consulting qualified health professionals when uncertainty arises (Lor et al., 2026).

Another important feature was the active involvement of family members. Childbirth preparation is often influenced by household-level decisions, particularly those concerning transportation, finances, accompaniment, and access to health facilities. Consequently, interventions directed only at pregnant women may have limited practical effects when important resources and decisions depend on other family members (Mkhonta et al., 2026). By involving families in educational activities and birth-planning discussions, the program encouraged childbirth preparedness to become a shared responsibility. Family members were encouraged to understand maternal danger signs, discuss their respective roles, and participate in practical preparation for both normal delivery and possible emergencies (Onilude et al., 2026).

This family-centred approach also strengthens the community empowerment dimension of the program. Empowerment differs from conventional health education because participants are not positioned merely as recipients of information. Instead, they are encouraged to identify needs, ask questions, discuss available options, make informed decisions, and apply knowledge within their own social context (Pardini et al., 2026). During the program, interaction between facilitators, pregnant women, and family members created opportunities for clarification and reflection. Such interaction is particularly relevant to maternal health because preparedness requires coordinated action between women, families, communities, and healthcare providers (Pascuzzi et al., 2025).

The empowerment pathway presented in Figure 1 summarizes this process. Digital maternal health education was used as an entry point for improving knowledge and awareness of reliable health information. Improved understanding subsequently provided a basis for discussion between pregnant women and their families (Patnaik & Thadani, 2026). Family participation

supported the translation of knowledge into practical planning, including decisions concerning the place of delivery, transportation, financial preparation, accompanying persons, and emergency responses. Collectively, these processes contributed to strengthened childbirth preparedness. This pathway should be interpreted as a conceptual representation of the program implementation rather than evidence of a causal mechanism.

The program also has implications for the sustainability of community-based maternal health promotion. Digital educational materials can be retained, revisited, and shared with family members, potentially extending educational exposure beyond scheduled community activities. The use of commonly accessible communication platforms may also make the approach relatively feasible for integration into routine maternal health promotion (Schulte et al., 2025). Community health workers, nurses, midwives, and other healthcare providers could potentially use similar digital resources to complement antenatal education and reinforce key messages between healthcare visits (Wainaina et al., 2025). Nevertheless, digital education should complement rather than replace direct interaction with health professionals, particularly when clinical assessment or individualized advice is required.

Several practical challenges should also be acknowledged (Shartyanie et al., 2025). Differences in smartphone ownership, internet connectivity, digital literacy, educational background, and family engagement may affect participants' ability to benefit equally from digital interventions (Yu et al., 2026). Furthermore, immediate improvements following educational activities do not necessarily indicate sustained behavioural change or improved maternal outcomes (Thompson et al., 2025). Follow-up across pregnancy and the postpartum period would provide stronger evidence regarding whether childbirth-preparedness practices are maintained and translated into timely use of appropriate maternal health services.

The main contribution of this community engagement program lies in integrating digital education, active maternal participation, and structured family support within a single empowerment strategy. Rather than focusing exclusively on increasing knowledge, the approach connects information with family communication and practical action. This integrated model is relevant to community-based maternal health promotion in Palu City and may be adaptable to other settings with similar needs. Future implementation should maintain participatory interaction, strengthen digital health literacy, involve families from the beginning of the educational process, and establish follow-up mechanisms to support the sustainability of childbirth preparedness.

CONCLUSION

The community engagement program integrating digital maternal health education and family support provided an appropriate approach to strengthening childbirth preparedness among pregnant women in Palu City, Central Sulawesi. The program achieved its empowerment objectives by improving participants' understanding of childbirth preparation and maternal danger signs, promoting greater awareness of credible digital health information, encouraging active family participation, and facilitating practical birth planning. The participatory approach was relevant to the identified community needs because it combined accessible digital education with direct discussion, family engagement, and practical preparation for childbirth. The integration of digital education and family involvement enabled maternal health information to be translated into shared and practical actions within the household. This approach has potential for continued application as part of community-based maternal health promotion. Future programs should strengthen follow-up activities, maintain family participation, and integrate

digital educational materials with routine maternal health services to support the sustainability of childbirth preparedness and maternal health empowerment.

Acknowledgements

The authors sincerely thank STIKes Bala Keselamatan Palu for supporting this community engagement program. We also express our appreciation to the pregnant women, family members, community representatives, and health professionals in Palu City, Central Sulawesi, for their participation, cooperation, and valuable contributions throughout the program. Their active involvement was essential to the successful implementation of the digital maternal health education and family-support activities.

Conflict of Interest

The authors declare that there are no conflicts of interest related to the implementation of this community engagement program or the publication of this article.

Declaration of Generative AI Use

The authors used generative artificial intelligence tools solely to assist with language editing, grammatical improvement, and refinement of the manuscript. The authors reviewed and verified all AI-assisted content and take full responsibility for the accuracy, integrity, and final content of the manuscript. Generative AI was not used to generate, modify, or fabricate research data, results, or conclusions.

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