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The use of smartphones as educational media for optimizing maternal and child health: a qualitative systematic review

Devi Maya Arista[1*], Nidya Comdeca Nurvitriana[2], Karunia Wijayanti[3], Vina Firmanty Mustofa[4]

[1,2,3,4] Faculty of Medicine, Universitas Negeri Surabaya, Indonesia
deviarista@unesa.ac.id
*Corresponding author

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ABSTRACT

Introduction: Currently, communication technology shows great potential in exchanging information, including educational interactions for health messages through smartphones. The implementation of this educational communication scope can be a strategy to enhance maternal and child health. Various approaches from different scientific articles necessitate the examination of characteristics, strengths, weaknesses, and outcomes in delivering smartphone-based health education. **Purpose:** This study aims to review the literature of smartphone uses in implementing maternal and infant care practices. **Method:** This is a qualitative systematic review was conducted in the databases PubMed, ScienceDirect, and Cochrane using a combination of Medical Subject Headings (MeSH) and relevant keywords: “maternal” OR “mother” OR “pregnant women” AND “child” OR “baby” AND “health education” AND “smartphone” OR “mobile phone” OR “mobile application. Obtained a total of 9 articles for review. **Results:** This qualitative systematic review discusses 9 articles from several countries and covers 3 main topic themes. These themes included interactive voice response (IVR), direct counseling, and applications (SMS, Social Media, Health Platforms). **Conclusion:** Based on review, text/SMS messaging on smart phones was better at improving the implementation of maternal and infant care practices

1. Introduction

Improving behavior in health practices is crucial for enhancing maternal and child health. Communication strategies aimed at behavior change have become a critical component in efforts to improve maternal and child health. However, challenges persist in the implementation of these strategies, particularly in low- and middle-income countries (Sarina et al., 2023). Currently, communication technology demonstrates significant potential for information exchange, including educational interactions related to health messages via mobile phones. In 2021, the global number of smartphone users was estimated to reach 6.4 billion, representing a 73.9% increase from 2016. This growth rate is projected to result in more than half of the world's population owning a smartphone by 202 (Deave et al., 2022). However, the utilization of smartphones as educational media for enhancing maternal and child health still requires strengthening, necessitating further evaluation.

Maternal Mortality Rate (MMR) and Infant Mortality Rate (IMR) continue to face challenges in reduction. Of the 810 maternal deaths per 100,000 live births per day due to preventable causes related to pregnancy and childbirth, 94% of these deaths occur in developing and low-income countries (Gilano et al., 2024). This issue is a significant concern in efforts to meet the Sustainable Development Goals (SDGs), specifically the target of reducing the global Maternal Mortality Rate (MMR) to 70 per 100,000 live births by 2030. There is optimism that the use of smartphone technology will help address barriers within maternal and child health systems by integrating components of digital health.

Enhancing knowledge through the use of text messages (SMS) and voice calls via smartphones has the potential to be a significant instrument in altering health behaviors (Mustopa et al., 2021; Venkataramanan et al., 2022). Research has demonstrated that the use of smartphones is effective in disseminating health messages to the public. Several studies indicate a positive perception of smartphone use for health purposes (Isinkaye et al., 2017; Porte, Kim, et al., 2020). However, before designing and implementing such programs, several factors need to be considered, including user preferences regarding the messages received, message frequency, as well as privacy and confidentiality needs (Osinowo et al., 2021).

The implementation within the scope of educational communication provides a foundation for utilizing smartphones as a strategy to enhance maternal and child health. Furthermore, the presence of varied approaches across different scholarly articles underscores the necessity to examine the characteristics, strengths, limitations, and outcomes of smartphone-based health education delivery. This study aims to review the literature of smartphone uses in implementing maternal and infant care practices.

2. Methods

2.1. Study Design and Search Strategy

The study conducted in this research is qualitative systematic review. The article is written according to the PRISMA flowchart guidelines. The PCC (Population, Concept and Context) framework was also employed in this study. The search was conducted in the databases PubMed, ScienceDirect, and Cochrane using a combination of Medical Subject Headings (MeSH) and relevant keywords, specifically: “maternal” OR “mother” OR “pregnant women” AND “child” OR “baby” AND “health education” AND “smartphone” OR “mobile phone” OR “mobile application”.

2.2. Article Selection

Inclusion criteria applied include qualitative studies, written in English, providing full text, and research published from 2017 to 2024. The selected themes were articles that examined the use of smartphones to find health information, counseling media with health workers, and educational media to improve maternal and child health.

2.3. Data Extraction

The authors independently screened the titles and/or abstracts of the included articles using a standardized Microsoft Excel form. The research team independently conducted a formal assessment of the article quality using the Joanna Briggs Institute (JBI) instrument for qualitative studies. Each systematic review encompasses procedures for critiquing or evaluating research evidence. Based on a comprehensive evaluation of the literature, the analysis is grounded in the findings and recommendations of each study. To identify subthemes and themes, relevant results were extracted, organized, and examined. All authors contributed to the synthesis of the findings. The data are presented in Table 1.

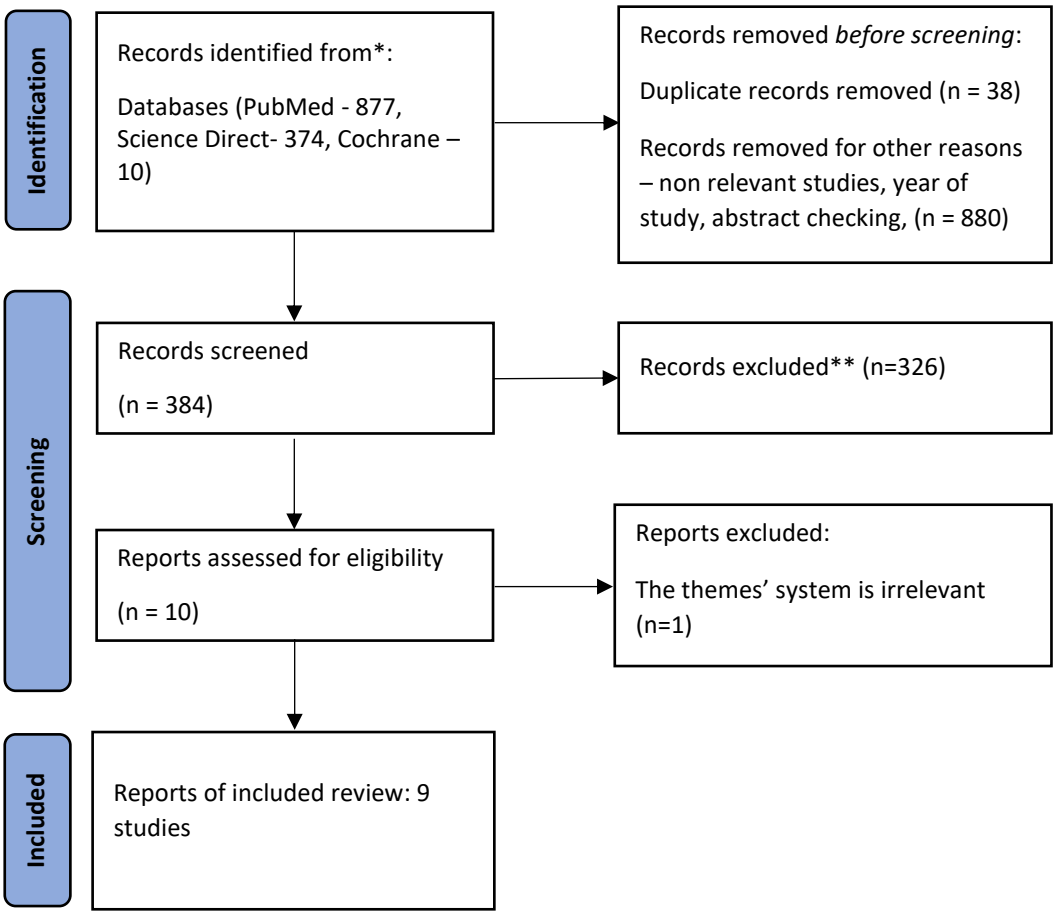

Fig. 1. PRISMA Flowchat

3. Results

The systematic review was conducted in several stages. There were 877 articles in the PubMed database, 374 articles in the ScienceDirect database, 10 articles in the Cochrane database that discussed the use of technology with smartphones on maternal and child health. Screening the suitability of the topics and themes used resulted in 58 articles discussing the effectiveness of smartphone applications in improving maternal and child health services. A total of 9 articles were included in the inclusion criteria covering three main topics from the 384 articles screened. The types of articles included 7 qualitative studies, 1 qualitative mix method study, and 1 quasi-experimental qualitative mix. The articles were thoroughly reviewed, and a summary has been presented in Table1.

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Table 1. The Main Characteristics of the Articles Included

Title, Author, Year	Country	Method	Aims	Theme	Results
An investigation of users' attitudes, requirements and willingness to use mobile phone-based interactive voice response systems for seeking healthcare in Ghana: a qualitative study (Brinkel et al., 2017)	Ghana	Qualitative	Define the requirements for using IVR in seeking healthcare services. This includes: 1) investigation of attitudes towards mobile phone use and user experience; 2) assessment of facilitators and challenges in using IVR systems.	IVR	1) Provide new insights into the need to use IVR technology for health service needs. 2) The effectiveness of interactive voice technology acceptance is divided into 4, namely: a. effective performance can be seen how people believe in the use of a system that will help benefit in individual health services b. the effort to use this is seen from the level of ease associated with using the system c. social influence that sees the importance of an IVR in making it easier to provide information related to health services d. conditions that facilitate that organizational and technical infrastructure exists to support the use of the system
Mobile-Based Nutrition Counseling and Unconditional Cash Transfers for Improving Maternal and Child Nutrition in Bangladesh: Pilot Study (Huda et al., 2018)	Bangladesh	Pilot study qualitative	Assess the feasibility, acceptability, and perceived appropriateness of an intervention consisting of voicemail, in-person counseling to change perceptions regarding nutrition during pregnancy and the first year of a child's life in a poor rural community in Bangladesh.	1) Interactive voice messages 2) Live counseling	1) "Aponjon" is a term for IVR-based healthcare communication. The IVR works in collaboration with a sponsor in Bangladesh, sending 2 voice messages per week to each participant for 24 weeks with themes that are in line with the scope of maternal and infant health in terms of nutrition and the message prepared for each message is 40 - 55 seconds in Bangla language. 2) Counselors provided support by providing nutrition education information through a call center established by the sponsor. This counseling directly focused on proper nutrition, and finding health services during pregnancy that were appropriate to the needs and relevant topics.

A Short Message Service Intervention for Improving Infant Feeding Practices in Shanghai, China: Planning, Implementation, and Process Evaluation (Jiang et al., 2018)	Tiongkok, Shanghai	Qualitative	To demonstrate the planning, implementation and evaluation process of a computer-based platform as a medium for the dissemination of short messages (SMS).	Short message platform (SMS)	The process that has been carried out by the intervention obtained: 1) Building a supportive environment for pregnant women and young mothers in preparing to provide nutrition for their children through short message-based communication media. 2) Significant changes in behavior to manage information needs in providing nutrition 3) Builds trust in health workers because they are very flexible in providing comprehensive education to the community and can be directly consulted. The disadvantage of short messages is the limited information provided in short words. However, it can be overcome with a message that if it is not clear, you can directly call the officer's number according to the complaint.
How can mobile phones be used to improve nutrition service delivery in rural Bangladesh? (Hantsoo et al., 2018)	Bangladesh	Qualitative	To see the mobile phone-based health information system can work optimally in the community according to needs.	1) Direct counseling 2) Dissemination of education through social media posters	1) Health education conducted by health workers provides reliable health service information and becomes a bridge of information for the community in the form of counseling that can directly call the health worker. 2) There is a policy to provide nutritional health information services for mothers and children supported by more specific services, namely directly distributing digital-based brochures to the community through social media.
Mobile Phone Messaging to Husbands to Improve Maternal and Child Health Behavior in India (Hazra et al., 2018)	India	Quasi experiment mix qualitative	To prove that mobile messaging can increase knowledge and trigger discussions in the field of maternal and child health, families and change healthy living behaviors.	Targeted voice messages with 5 health behavior themes/topics: antenatal check-ups, postnatal check-ups for mothers and newborns, early	Mobile phones can be an effective medium to reach out to family roles. Given the short duration of the study and the limited number of repetitions of the messages, it is evident that the chances of correct practice are significantly increased. It also shows that behavior change is stronger when discussions about correct practices are conducted within the family.

				breastfeeding, cord care, and personal hygiene. Delivered 2x a week for a period of 4 months.	A limitation of this study is that the "do not disturb" feature prevented any voice messages from being delivered, thus reducing the final results of this study.
The role of mHealth intervention to improve maternal and child health: A provider-based qualitative study in Southern Ethiopia (Gilano et al., 2024)	Southern Euthopia	Qualitative	To examine the role of health apps in improving maternal and child health among health professionals.	Dissemination of information from mobile phones and mhealth apps available in Euthopia.	The use of mobile phones is now very easy as a bridge in sharing information related to community needs, especially maternal and child health. The results of the in-depth interview findings are: 1) Acceptance of the mhealth health education application 2) Changes in awareness that increase in the use of the m health application 3) Benefits of using the mhealth application 4) Challenges in applying mhealth 5) Possible solutions in using mhealth
First-time Mothers' Understanding and Use of a Pregnancy and Parenting Mobile App (The Baby Buddy App): Qualitative Study Using Appreciative Inquiry (Deave et al., 2022)	England	Qualitative mix method	To understand first-time moms using the Baby Buddy app and their perceived benefits and challenges.	Use of nationally developed apps for maternal and child health in the UK region	The successful interaction between the app and the exploration of the pregnant women involved with the specific app approved and designed in enhancing women's empowerment through access to information that can be used as needed.
Supporting Factors in Using a Smartphone to Support Access	Indonesia	Qualitative	To determine the factors supporting the use of smart phones as a health service delivery	Use of mobile phones in finding health information	There are 4 factors supporting the use of mobile phones: ease of finding the information needed, a good understanding of the benefits and functions of mobile phones in finding health service information and educational information as needed, a

Maternal Health Services in Rural Indonesia: A Qualitative Study (Mustopa et al., 2021)			medium for pregnant women in rural Indonesia		good internet connection can support success in disseminating health information according to the target or target. Improve strategic programs for maternal and child health using mobile phones and access to health services in rural Indonesia.
Barriers and Facilitators for the Use of a Medical Mobile App to Prevent Work-Related Risks in Pregnancy: A Qualitative Analysis (Velu et al., 2017)	Netherlands	Qualitative	To develop a thematic overview of facilitators and barriers perceived by pregnant women, medical professionals, in the use of mobile apps related to obstetric care to prevent work-related pregnancy complications.	Mobile app	Have identified clear facilitators and barriers in the use of maternal and child health apps. Appropriate content and dosage of interaction with end users are complex aspects that need to be considered in app development. 1) There is a focus on the content of the app that contains the information and advice provided. 2) Practical aspects that are easier and faster to find information and are always available. 3) Technical aspects with limited access in terms of time, information can be read at any time and can be downloaded in pdf form and specific advice according to the needs of the accesser 4) The existence of external factors, namely direct services aimed at health workers or health worker assistants, must be able to respond well so that the application is successful according to the target.

Here are some excerpts from the qualitative research articles we reviewed:

Perceived Appropriateness of Voice Messaging and Direct Counseling

"I loved to listen to the messages, they spoke in such a nice language." [A pregnant woman]

"I liked the direct one (call), I could talk to Pushti Apa and ask for her advice if I have any problem with my child." [A lactating woman]

Positive reflections on short message service (SMS) text messaging intervention

"I feel the weekly message is good. I feel this frequency can cover all information of my needs during the week." [EBF, 5 months postpartum]

"I made an inquiry of what to do with inadequate breast milk after returning to work through the message. I felt the response was very helpful." [EBF, 5 months postpartum]

Benefit of mobile application

"It can increase utilization better than that we have previously" [II,MW, F, 42].

"If it continues, it can be more effective and be more important than the previous way of service provision" [II, Nurse, M, 28].

"It is helpful to also send information which is not appropriate in person" [KII, HO, F, 32].

After analyzing the articles, 3 themes were obtained that were in accordance with the method of providing education through smartphones to improve maternal and child health as shown in Fig. 2.

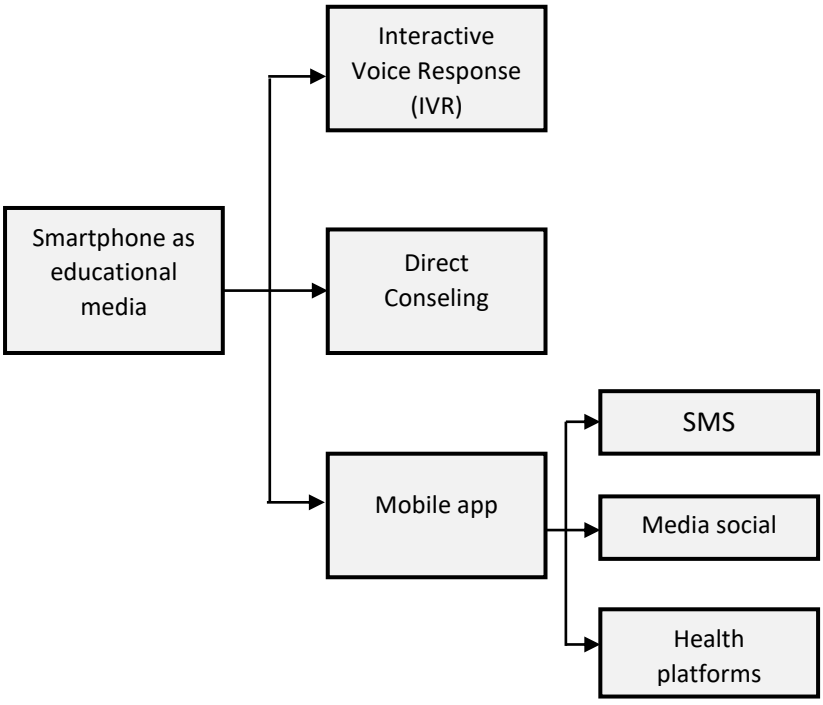

Fig. 2. Mapping Review

4. Discussion

In this review, there are several elements that are reviewed related to the use of smartphones as educational media in improving maternal and child health, including through IVR (interactive voice response) lines, direct counseling, and the use of applications on smartphones. All designs for communication-related interventions in behavior change related to educational media must be adapted to the context, so that both the delivery method and the content of the information are appropriate for the target audience. The pathways identified differ significantly from each other in some core elements of implementation that are likely to influence service delivery practices related to maternal and child health. These include how often communication occurs, the length and complexity of the content delivered, and potentially other personalized ways of communicating to mothers (Costantino et al., 2022).

Interactive media in this review is in the form of IVR (interactive voice response). From this review, it is known that IVR is able to provide new insights into the needs in the use of technology for healthcare needs. The results reported that IVR requires components to support its effectiveness including effective system performance, ease of use, social influence, and infrastructure. There is potential for the use of interactive media as a delivery channel in supporting maternal and child health as smartphone and internet access increases (Costantino et al., 2022). Interactive media in the form of IVR provides an opportunity to engage deeply and diversely with health content. To optimize the output, new approaches to engagement, quality assurance, and evaluation are needed to take advantage of the new opportunities provided by interactive media, and to reduce the risk of inappropriate content for the public.

Studies have shown evidence of effectiveness in improving maternal healthcare access, infant care, child immunization and exclusive breastfeeding practices. An evaluation study of Bangladesh's "Aponjon" healthcare communication showed improvements in some maternal healthcare practices, but limited impact on infant care and feeding practices (Phommachanh et al., 2019; Sarina et al., 2023; Sullivan et al., 2021). From the results of this study, further evaluation is needed to improve the messaging service so that it can cover a large scale including infant care and child health. SMS messaging services may be more effective for ongoing care such as antenatal check-ups and immunizations. However, for more complex contexts such as infant nutrition and exclusive breastfeeding, more intense and varied educational media services are needed.

In addition, the direct counseling approach has the advantage of providing interpersonal support to increase the intensity of communication. Thus, the combination of voicemail and counseling may strengthen the effectiveness of maternal and infant care practices. Counseling has also been shown to improve maternal knowledge (Nainggolan et al., 2021; Simarmata et al., 2024). Along with the development of smartphones, apps have emerged that aim to improve maternal and child health. In this review, research on apps showed known success from the exploration of pregnant women engaging with apps on smartphones (Adelekan et al., 2021; Isinkaye et al., 2017; Porte, La, et al., 2020). It aims to increase women's empowerment through access to information through smartphone apps. It should be noted that the involvement of family members also plays a role in health behavior change. The content of information in the content and the duration of message delivery are also important aspects of app use (Edmonds et al., 2011; Ekramzadeh et al., 2020; Hastuty & Ariska, 2022). Nowadays, smartphones are widely available at affordable prices. Thus, pregnant women owning smartphones is an important factor that should be considered in the development of smartphone app-based pregnancy health services (Gabriela et al., 2021). Consideration is also needed regarding information settings and potential opportunities to implement behavior change techniques to improve maternal and child health (Loretta et al., 2021).

In the context of maternal and child health, smartphone-based approaches such as IVR, SMS, and mobile applications each have their unique contributions. IVR, for instance, facilitates two-way communication through interactive voice calls, making it particularly effective for reaching populations with low literacy levels or in remote areas where internet access is limited. Through IVR, pregnant women and parents can access vital health information via voice, which is often easier to comprehend than text (Agarwal et al., 2019). Conversely, SMS provides a fast and efficient method for sending reminders and important information, which has been shown to enhance adherence to prenatal check-ups and vaccinations (Lund et al., 2020). Meanwhile, mobile applications can offer a

more interactive platform with features such as health tracking, reminders, and support forums, which are highly beneficial for delivering information and facilitating real-time health management (Huang et al., 2021).

Family support is a crucial factor that can enhance engagement in smartphone-based health interventions. The involvement of family members can increase the effectiveness of these interventions by providing emotional and practical support to mothers and children. For instance, when families participate in health education processes, they can assist mothers in remembering medical appointments, managing medications, and discussing health concerns (Souza et al., 2021). Furthermore, by utilizing application features that facilitate communication among family members, such as group chats for sharing health information, families can create a supportive environment for better health decision-making. This involvement can also encourage proactive behaviors in maintaining the health of mothers and children, ultimately leading to improved overall health outcomes.

Although smartphone-based approaches provide numerous benefits, there are several challenges and limitations that must be addressed. One of the primary barriers is access to technology, particularly in rural areas or communities with limited resources. Many individuals still lack adequate access to smartphones or reliable networks, which can hinder participation in technology-based health programs. Furthermore, digital literacy presents a significant issue, as not all users feel confident or possess the necessary skills to effectively utilize applications or SMS services. This can diminish the positive impact of interventions designed to enhance maternal and child health. Therefore, it is crucial to develop strategies that can overcome these barriers, such as providing digital skills training and improving access to technology.

In addressing these challenges, policy support is essential for enhancing access to and the effectiveness of smartphone-based health interventions. Policies that promote the development of technological infrastructure in remote areas and provide digital literacy training can help bridge access gaps. Moreover, collaboration among government entities, non-governmental organizations, and the private sector is necessary to allocate sufficient resources and ensure that these interventions are accessible to all segments of society, particularly those most in need (Sullivan et al., 2021). By improving access to and skills in technology, we can optimize the benefits of mobile-based interventions in enhancing maternal and child health.

This study collected and analyzed data from multiple sources, thus providing a more comprehensive picture of the effectiveness of smartphone use. The findings from this study may provide guidance for policymakers and health practitioners in designing programs that utilize smartphone technology to improve maternal and child health. This study was limited to reviewing qualitative research only; the lack of quantitative data may limit the ability to measure impact statistically. This study may not be able to provide information on the scale and size of intervention effectiveness more broadly.

5. Conclusion

Providing education through text messaging/SMS was found to be most effective in improving the quality of maternal and infant care because there are automatic reminders when it is time to visit or direct text messages related to the care needed periodically according to the time. Information through IVR can be optimized by increasing the duration of message delivery. Providing education through direct counseling has the advantage of being able to know the reaction directly, but requires the availability of time for health workers and personal in conducting direct counseling.

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References

Adelekan, B., Goldson, E., Abubakar, Z., Mueller, U., Alayande, A., Ojogun, T., Ntoimo, L., Williams, B., Muhammed, I., & Okonofua, F. (2021). Effect of COVID-19 pandemic on provision of sexual and reproductive health services in primary health facilities in Nigeria: a cross-sectional study. *Reproductive Health*, *18*(1), 1–12. https://doi.org/10.1186/s12978-021-01217-5

Agarwal, Pahl, & Adams. (2019). The impact of mobile health interventions on maternal health outcomes: A systematic review. *Journal of Global Health*, *9*(1), 010401.

Brinkel, Dako-Gyeke, Krämer, May, & Fobil. (2017). An investigation of users' attitudes, requirements and willingness to use mobile phone-based interactive voice response systems for seeking healthcare in Ghana: a qualitative study. *Public Health*, *14*(4), 125–133. https://doi.org/10.1016/j.puhe.2016.11.017

Costantino, Mazzucco, Bonaccorso, Sciortino, Cimino, Pizzo, Conforto, Calò, & Giliberti. (2022). A cross-sectional study on smartphone uses among pregnant women attending childbirth classes in the Metropolitan Area of Palermo, Italy: The Stop-Phone study. *Annali Di Igiene Medicina Preventiva e Di Comunita*, *35*(3), 319–330.

Deave, Kendal, Lingam, Day, Goodenough, Bailey, Ginja, Nightingale, & Coad. (2022). A study to evaluate the effectiveness of Best Beginnings' Baby Buddy phone app in England: A protocol paper. In *Primary Health Care Research and Development*.

Edmonds, J. K., Paul, M., & Sibley, L. M. (2011). Type, content, and source of social support perceived by women during pregnancy: Evidence from Matlab, Bangladesh. *Journal of Health, Population and Nutrition*, *29*(2), 163–173. https://doi.org/10.3329/jhpn.v29i2.7859

Ekramzadeh, M., Hajivandi, L., Noroozi, M., & Mostafavi, F. (2020). Psychological experiences of adolescent girls with polycystic ovary syndrome: A qualitative study. *Iranian Journal of Nursing and Midwifery Research*, *25*(4), 341–347. https://doi.org/10.4103/ijnmr.IJNMR_276_19

Gabriela, Frid, Kelly, Bogaert, Katherine, & Chen. (2021). . Mobile Health Apps for Pregnant Women: Systematic Search, Evaluation, and Analysis of Features. *Journal of Medical Internet Research*, *23*(10).

Gilano, Dekker, & Fijten. (2024). The role of mHealth intervention to improve maternal and child health: A provider-based qualitative study in Southern Ethiopia. *PLoS ONE*, *19*(2).

Hantsoo, L., Criniti, S., Khan, A., Moseley, M., Kincler, N., Faherty, L. J., Epperson, C. N., & Bennett, I. M. (2018). Mobile application for monitoring and management of depressed mood in a vulnerable pregnant population. *Psychiatr Serv*, *69*(1), 104–107. https://doi.org/10.1176/appi.ps.201600582.Mobile

Hastuty, Y. D., & Ariska, M. (2022). Literature Review: Utilization of Binanong Leaves and Red Betel Leaves for Healing Perineal Wounds. *Journal of Midwifery and Nursing*, *4*(2), 63–68. https://doi.org/10.35335/jmn.v4i2.2186

Hazra, Khan, & Mondal. (2018). Mobile Phone Messaging to Husbands to Improve Maternal and Child Health Behavior in India. *Journal of Health Communication*, *23*(6), 542–549. https://doi.org/10.1080/10810730.2018.1483444

Huang, Yan, & Zhang. (2021). Mobile health applications for improving maternal and child health: A systematic review. *Journal of Medical Internet Research*, *23*(5), e23036.

Huda, Alam, Tahsina, Hasan, Khan, Rahman, & Siddique. (2018). Mobile-based nutrition counseling and unconditional cash transfers for improving maternal and child nutrition in Bangladesh: Pilot study. *JMIR MHealth and UHealth*, *6*(7).

Isinkaye, F. O., Awosupin, S. O., & Soyemi, J. (2017). A Mobile based expert system for disease diagnosis and medical advice provisioning. *International Journal of Computer Science and Information Security (IJCSIS)*, *15*(1), 568–572.

Jiang, Li, Wen, Baur, He, Ma, & Qian. (2018). A short message service intervention for improving infant feeding practices in Shanghai, China: Planning, implementation, and process evaluation. *JMIR MHealth and UHealth*, *6*(10). https://doi.org/10.2196/11039

Loretta, Musgrave, Nathalie, Kizirian, Caroline, Adrienne, & Gordon. (2021). Mobile Phone Apps in Australia for Improving Pregnancy Outcomes: Systematic Search on App Stores. *JMIR MHealth and UHealth*, *8*(11), e22340.

Lund, Nielsen, & Hemed. (2020). MS reminders for vaccination in low- and middle-income countries: A systematic review and meta-analysis. *International Journal of Epidemiology*, *49*(5), 1477–1488.

Mustopa, Noh, & Hafizurrachman. (2021). Supporting Factors in Using a Smartphone to Support Access Maternal Health Services in Rural Indonesia: A Qualitative Study. *In Malaysian Journal of Medicine and Health Sciences*, *17*(11).

Nainggolan, Rochadi, & Lubis. (2021). The Effectiveness of Integrated Counseling on Pregnant Mothers to Improve Knowledge on Pregnant Mothers in Pematangsiantar City. Budapest International Research and Critics Institute (BIRCI-Journal). *Humanities and Social Sciences*, *3*(3), 2277–2286. https://doi.org/10.33258/birci.v3i3.1161

Osinowo, K., Sambo-Donga, F., Ojomo, O., Ibitoye, S. E., Oluwayemi, P., Okunfulure, M., Ladipo, O. A., & Ekholuenetale, M. (2021). Resilient and Accelerated Scale-Up of Subcutaneously Administered Depot–Medroxyprogesterone Acetate in Nigeria (RASuDiN): A Mid-Line Study in COVID-19 Era. *Open Access Journal of Contraception*, *Volume 12*(December), 187–199. https://doi.org/10.2147/oajc.s326106

Phommachanh, S., Essink, D. R., Jansen, M., Broerse, J. E. W., Wright, P., & Mayxay, M. (2019). Improvement of Quality of Antenatal Care (ANC) Service Provision at the Public Health Facilities in Lao PDR: Perspective and Experiences of Supply and Demand Sides. *BMC Pregnancy and Childbirth*, *19*(1), 1–14. https://doi.org/10.1186/s12884-019-2345-0

Porte, La, Kim, Adams, Zagorsky, Gibbons, & Silver. (2020). Feasibility of perinatal mood screening and text messaging on patients ' personal smartphones. *Archives of Women's Mental Health*, *23*(1), 181–188. https://doi.org/10.1007/s00737-019-00981-5

Porte, L. M. La, Kim, J. J., Adams, M. G., Zagorsky, B. M., Gibbons, R., & Silver, R. K. (2020). Feasibility of perinatal mood screening and text messaging on patients ' personal smartphones. *Archives of Women's Mental Health*, *23*, 181–188. https://doi.org/10.1007/s00737-019-00981-5

Sarina, Mkhize, M., Farao, J., Deborah, L., Shandu, Livhuwani, Muthelo, & Lauren. (2023). Digital Health Technologies for Maternal and Child Health in Africa and Other Low- and Middle-Income Countries: Cross-disciplinary Scoping Review With Stakeholder Consultation. *Journal of Medical Internet Research*, *25*(1), e42161.

Simarmata, Marlina, Luhulima, Udjung, & Langi. (2024). Antenatal Care Counseling for Pregnant Women as an Effort to Prevent Stunting. *Asian Journal of Community Services*, *3*(4), 385–392. https://doi.org/10.55927/ajcs.v3i4.8787

Souza, Santos, D., Santos, da C., & Silva, D. (2021). *Effectiveness of mobile applications in pregnant women's adherence to prenatal consultations: randomized clinical trial. Revista Brasileira de Enfermagem,*. *74*(5), 1–8. https://doi.org/10.1590/0034-7167-2019-0599

Sullivan, Ahmed, & Mappin-Kasirer. (2021). Policy frameworks for mobile health interventions in maternal and child health: A global perspective. *Ealth Policy and Planning*, *36*(8), 1080–1090.

Velu, Beukering, V., Schaafsma, Frings-Dresen, Mol, Post, van der, & Kok. (2017). Barriers and facilitators for the use of a medical mobile app to prevent work-related risks in pregnancy: A qualitative analysis. *JMIR Research Protocols*, *6*(8). https://doi.org/10.2196/resprot.7224

Venkataramanan, Subramanian, Alajlani, & Arvanitis. (2022). . Effect of mobile health interventions in increasing utilization of Maternal and Child Health care services in developing countries: A scoping review. *In Digital Health. SAGE Publications Inc.*, *8*(1). https://doi.org/10.1177/20552076221143236