

The Role of Electronic Health Tools in Unwanted Pregnancy Prevention, Abortion and Post-Abortion Follow-Up: A Systematic Review

Abstract

Background: More than 30% of women experience at least one abortion. To date, there has been no comprehensive mobile health project on the impact of technology on access to abortion, contraception, and post-abortion follow-up. The purpose of this study was to review published studies on the role of electronic health in the prevention of unwanted pregnancy, abortion, and post-abortion follow-up. **Materials and Methods:** The Web of Science, PubMed, ScienceDirect, and EMBASE databases were searched to find relevant articles published between 2008 and 2018. A systematic review study was conducted on 33 relevant articles. All studies related to the use and impact of electronic health on unwanted pregnancy prevention, abortion and post-abortion follow-up in English from January 2008 to December 2018 were included. The quality of the studies was evaluated using the PRISMA-S. **Results:** Thirty-three studies met the inclusion criteria for the review. The Studies were divided into four main groups of women's experiences on the use of mobile health and telemedicine technologies for at-home medical abortion, unwanted pregnancy prevention, abortion, and post-abortion follow-up. The results showed the significant impact of using electronic health on unwanted pregnancy prevention, abortion, and post-abortion follow-up. **Conclusions:** Health technologies have the potential to be used as a low-cost and accessible method to replace abortion services. They can facilitate remote care and quick access to information to complete the gaps in access to abortion. Therefore, it is necessary for health service providers to be aware of the possibility of the client's access to electronic health tools.

Keywords: *Induced abortion, pregnancy, technology, telemedicine*

Introduction

About 210 million pregnancies occur around the world annually, of which almost one out of every five women decides to terminate their pregnancy.^[1] More than 50% of pregnancies in the United States are unwanted. An unwanted pregnancy is a pregnancy that is at the wrong time, unplanned or unwanted at the time of conception or occurs as a result of factors associated with knowledge, access, and behavior. An unmet need for contraception can lead to unwanted pregnancy and unavoidable mortality in mothers and infants. It is estimated that the unmet need for modern contraceptive methods leads to 52 million unwanted pregnancies, 24 million abortions (more than half will be unsafe), and 70,000 maternal mortalities in women in low-income countries every year.^[2,3]

Abortion is common across the world. Globally, a quarter of all pregnancies

end with abortion. This rate is higher in countries with severe legal restrictions than the countries that provide legal safe abortion.^[1] The fourth leading cause of maternal mortality is unsafe abortion in the world.^[4] Due to the lack of access to safe legal abortion services through national official health care systems, 43,000 women die and millions more suffer from complications.^[4] One of the reasons could be a lack of awareness about abortion services, poor perception of care quality, poor knowledge about various abortion methods, and negative attitude of health care providers.^[1] Therefore, it is necessary to improve access to safe abortion services and the knowledge of the availability of such services and methods to increase or facilitate women's access through early detection of pregnancy.^[1]

Geographic challenges can affect access to abortion services, and people need to travel

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long distances to utilize the services. Telemedicine can improve the health of those who have restricted access to high-quality care due to geographical barriers. In the field of reproductive health, telemedicine has been used to help control blood sugar levels in pregnant women with diabetes, offer reproductive health education in rural areas, and improve the sexual and reproductive health of adults.^[5,6] In today's world where Internet-accessible goods and services go beyond traditional boundaries, early abortion through telemedicine could offer an alternative method.^[7]

One way to reduce unwanted pregnancies is to support evidence-based family planning programs by individuals, including those who use smartphones as a means of providing reproductive health information. Although health-related programs have expanded, there is no evidence to assess how pregnancy is prevented in these programs.^[3] A recent study in the United States showed that providing accurate and complete information on contraception using a mobile health platform could be as effective as individual counseling, allowed patients to choose an effective method, and helped with maximum use of individual counseling.^[2,8]

Follow-up visits are an integral part of all abortion protocols to end a pregnancy or identify other problems. However, a care model with multiple visits is neither feasible nor desirable for all women.^[9] The WHO Guide for 2012 stated that when women receive sufficient counseling about potential complications and symptoms of pregnancy, regular clinic follow-up is unnecessary. Women face barriers to carrying out these recurring visits, most of which include the cost, need for privacy, and family, work, or school problems.^[10]

Promising alternatives for individual follow-up visits have been reported including a self-administered symptoms questionnaire, telephone follow-up with high and low-sensitive urine pregnancy tests, and self-assessment

with a urine pregnancy test. These new methods can make the follow-up process more acceptable. A recent guide from the Royal College of Obstetricians and Gynecologists has recommended that in the absence of a routine follow-up process for termination of ongoing pregnancy, methods such as telephone follow-up and urine pregnancy tests are appropriate.^[9]

Mobile health interventions can use different approaches (such as text messages, voice messages, or smartphone applications) depending on the literacy of people and available devices. The advantage of mobile-based interventions in comparison with face-to-face interactions is that they can provide inexpensive individual interactive support wherever the person is and whenever necessary. Mobile health solutions while assuring a certain level of confidentiality provide opportunities for quick dissemination of information.^[1] This study was conducted to examine the role of electronic health tools in the prevention of unwanted pregnancy, abortion, and post-abortion follow-ups to ensure successful abortion.

Materials and Methods

A systematic review was conducted to investigate the role of electronic health in preventing unwanted pregnancy, abortion, and post-abortion follow-up. In this study, the Web of Science, PubMed, Science Direct, and EMBASE databases were searched to find relevant resources. The advanced search option was used to search these databases. These databases were searched using the “AND” and “OR” logical operators between keywords. Table 1 shows the search strategy and the use of operators and keywords.

As for the inclusion criteria, all studies in the field of application and impact of mobile health and telemedicine on the prevention of unwanted pregnancy, abortion, and post-abortion follow-up were included in this systematic review. Since the majority of the studies in this field

Table 1: Strategy search

| Database | PubMed | Web of science | Embase | Science Direct |
|-------------------|--|--|--|---|
| Search Strategy | (abortion[Title/Abstract]) AND ((mobile[Title/Abstract] OR mhealth[Title/Abstract] OR telehealth[Title/Abstract] OR eHealth[Title/Abstract] OR telemedicine[Title/Abstract] OR “mobile health”)[Title/Abstract]) OR Followup[Title/Abstract] | (TI=(abortion AND mobile OR “mobile health” OR mhealth OR telehealth OR telemedicine OR followup)) | ('abortion'/exp OR abortion) AND ('telehealth'/exp OR telehealth OR 'telemedicine'/exp OR telemedicine OR 'ehealth'/exp OR ehealth OR 'mhealth'/exp OR mhealth OR mobile) AND ('health'/exp OR health) AND ([article]/lim OR [article in press]/lim) AND [english]/lim AND ([embase]/lim OR [medline]/lim OR [pubmed-not-medline]/lim) AND [2008-2018]/py AND [medline]/lim AND ([english]/lim | abortion[Title/Abstract]) AND ((mobile[Title/Abstract] OR mhealth[Title/Abstract] OR telehealth[Title/Abstract] OR eHealth[Title/Abstract] OR telemedicine[Title/Abstract] OR “mobile health”)[Title/Abstract]) OR followup[Title/Abstract] |
| Total articles | 80 | 26 | 218 | 27 |
| Search date | 2018.12.6 | 2018.12.10 | 2018.12.12 | 2018.12.9 |
| Time | 2008-2018 | 2008-2018 | 2008-2018 | 2008-2018 |
| After duplication | 31 | 23 | 197 | 7 |
| language | English | English | English | English |

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were conducted from 2010 onwards due to technological advances in the last 10 years, this study was performed between 2008 and 2018. Only studies published in English were included. As for the exclusion criteria, studies that were published in the form of editorials, website content, guidelines, booklets, magazines, news, conference papers, and letters were excluded (Conference papers: 77, letters to the editor: 10, letters: 4 and article abstracts: 10). Irrelevant studies in terms of content were also removed. The questions and inclusion criteria were predefined according to the Population, Intervention, Control, and Outcome (PICO) statement. PICO is a framework that facilitates literature search and formulates of scientific questions. The target population was women with contraception use, abortion, and follow-up issues. The intervention was electronic health (including mobile health and telemedicine). The outcome was the positive impact of using electronic health tools on unwanted pregnancy prevention, abortion, and post-abortion follow-up.

A total of 351 studies were retrieved in total, which was reduced to 258 studies after removing duplicates (93 items). Then, after examining the titles and abstracts of the remaining articles and removing irrelevant studies, including studies related to lifestyle during pregnancy, Pap tests in women with gynecological diseases, infertility, menstruation, sexual health, post-transplant pregnancy, mobile harmful effects on the fetus, polycystic ovaries, nutrition, and exercise during pregnancy, etc., and the studies with unavailable full texts, 45 articles remained for further evaluation. The full texts of the remaining articles were first to read separately by two reviewers (N SHA, H SLM) and each reviewer independently performed an assessment to determine whether the article was related to the purpose of the review. Then, the disagreements between the two reviewers were resolved through consultation with a third reviewer (M AHM). The

quality of all studies was evaluated using the PRISMA-S, an extension to the PRISMA Statement for Reporting Literature Searches in Systematic Reviews [Table 2]. Finally, 33 articles were selected. Figure 1 shows the steps involved in the search and selection of resources. The interventions of all studies were evaluated using TIDieR (Template for Intervention Description and Replication) checklist [Table 3].

A preliminary data extraction form was developed and the following data were retrieved and analyzed [Table 4]: first author, publication year, intervention tool, data collection method, dependent variables, sample size, and outcome. The final articles were categorized into four main categories based on their titles and contents, including women’s experiences and opinions about the use of mobile health and telemedicine for at-home medical abortion, unwanted pregnancy prevention, abortion, and post-abortion follow-up. Each of these groups was evaluated independently. Different types of biases including selection bias, information bias, etc., were investigated [Table 5].

Ethical considerations

In writing the manuscript, the researchers avoided plagiarism in any form. The results of the analysis were quite honest. The researchers avoided data fabrication. They never manipulated the data for their benefit.

Results

Study characteristics

The final articles were categorized into four categories based on their titles and contents, including women’s experiences and opinions about using mobile health and telemedicine for at-home medicine abortion, unwanted pregnancy prevention, abortion, and post-abortion follow-up. About 40% of the studies were related to

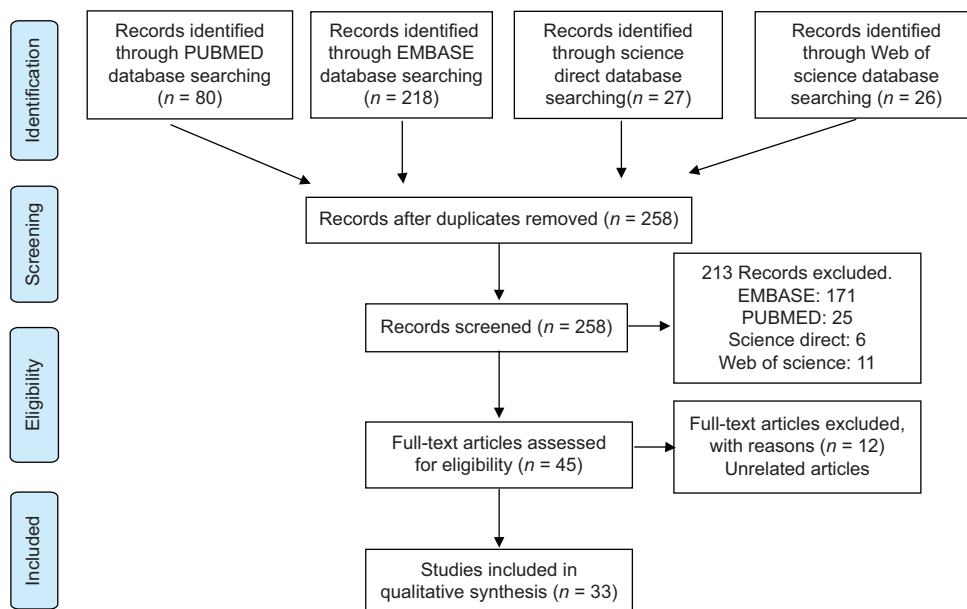


Figure 1: Search and selection of studies

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Table 2: Quality assessment of literature reviews included in systematic review

| Section/topic | # | Checklist item | Location (s) Reported |
|--|----|--|---|
| Information sources and methods | | | |
| Database name | 1 | Name each individual database searched, stating the platform for each. | Stated in line 2 of materials and methods section |
| Multi-database searching | 2 | If databases were searched simultaneously on a single platform, state the name of the platform, listing all of the databases searched. | Stated in line 2 of materials and methods section |
| Study registries | 3 | List any study registries searched. | Not applicable |
| Online resources and browsing | 4 | Describe any online or print source purposefully searched or browsed (e.g., tables of contents, print conference proceedings, web sites), and how this was done. | Not applicable |
| Citation searching | 5 | Indicate whether cited references or citing references were examined, and describe any methods used for locating cited/citing references (e.g., browsing reference lists, using a citation index, setting up email alerts for references citing included studies). | Not applicable |
| Contacts | 6 | Indicate whether additional studies or data were sought by contacting authors, experts, manufacturers, or others. | Not applicable |
| Other methods | 7 | Describe any additional information sources or search methods used. | Not applicable |
| Search strategies | | | |
| Full search strategies | 8 | Include the search strategies for each database and information source, copied and pasted exactly as run. | Stated in table 1 at the end of study |
| Limits and restrictions | 9 | Specify that no limits were used, or describe any limits or restrictions applied to a search (e.g., date or time period, language, study design) and provide justification for their use. | Stated in line 13 of materials and methods section |
| Search filters | 10 | Indicate whether published search filters were used (as originally designed or modified), and if so, cite the filter (s) used. | Stated in line 1 of paragraph 2 of materials and methods section |
| Prior work | 11 | Indicate when search strategies from other literature reviews were adapted or reused for a substantive part or all of the search, citing the previous review (s). | Not applicable |
| Updates | 12 | Report the methods used to update the search (es) (e.g., rerunning searches, email alerts). | The update has not been done because this study has been under review by this journal for about three years |
| Dates of searches | 13 | For each search strategy, provide the date when the last search occurred. | Stated in table 1 |
| Peer review | | | |
| Peer review | 14 | Describe any search peer review process. | Stated in line 7 of paragraph 3 of materials and methods section |
| Managing records | | | |
| Total Records | 15 | Document the total number of records identified from each database and other information sources. | Stated in Figure 1 |
| Deduplication | 16 | Describe the processes and any software used to deduplicate records from multiple database searches and other information sources. | Stated in line 2 of paragraph 3 of materials and methods section |

PRISMA-S: An Extension to the PRISMA Statement for Reporting Literature Searches in Systematic Reviews

experiences, comments, and characteristics of people who use cell phones and telemedicine to perform an abortion, 31% of the studies discussed unwanted pregnancy prevention, 40% were related to abortion and 11% were related to post-abortion follow-up. Three publications discussed the safety and acceptability of abortion through telemedicine, seven studies were related to the provision of abortion through telemedicine, and four articles

investigated mobile applications for unwanted pregnancy prevention.

Women's experiences and opinions on the use of electronic health for abortion at home

Women often reported severe symptoms of pregnancy-induced mental stress and their inability to pay for foreign travel to end their pregnancy as the main reasons

Table 3: Tidier Checklist Items

| Checklist Items | n (%) | Confidence Interval (95%) |
|-----------------------|-------------|---------------------------|
| Name | 33 (100.00) | — |
| Rationale | 33 (100.00) | — |
| Materials | 18 (54.55) | 42.37-68.64 |
| Procedures | 25 (75.76) | 63.45-89.80 |
| Intervention Provider | 7 (21.21) | 10.14-34.55 |
| Mode of Delivery | 33 (100.00) | — |
| Intervention Location | 28 (84.85) | 72.23-95.37 |
| Timing | 24 (72.73) | 60.24-85.77 |
| Tailoring | 0 (0.00) | — |
| Modifications | 3 (9.09) | 0.00-14.72 |
| Fidelity | 5 (15.15) | 6.36-26.64 |
| Fidelity reported | 10 (30.30) | 20.41-42.35 |

for medical abortion.^[11-12] A comparison of the women who chose at-home medical abortion through telemedicine and women who traveled abroad for an abortion showed that at-home medical abortion was superior to traveling abroad to receive abortion services.^[13]

The patients' positive views of visiting a doctor through telemedicine, reduced needs of the patients and doctors to travel, and improved access to abortion services from different locations at different times was such that most patients felt that they had safer and more private visits through telemedicine compared to in-person visits. In addition, the results showed that patients could receive abortion services faster using the telemedicine method compared to the face-to-face approach, which is associated with long waiting times for an appointment. Furthermore, some women chose the telemedicine method because of their shame and embarrassment during the visit.^[14] The level of satisfaction with the complete and clear oral and written information provided for post-abortion follow-up was 82%.^[15]

As for m-health support for post-abortion contraception, most of the women reported that understanding voice messages were simple and helped them acquire sufficient knowledge about different prevention methods, and telephone calls provided an opportunity to ask questions about prevention methods.^[16]

Use of electronic health for prevention of unwanted pregnancies

The results showed that after using mobile phones to increase women's acceptance, the use of preventive pills had the highest acceptability among contraceptive methods followed by injectable methods, IUDs, and contraceptive implants.^[17] In addition, the results of text and voice message interventions with telephone counseling to promote the use of contraceptive methods showed that mobile health interventions as a low-cost intervention had a huge impact on increasing the acceptance and use of effective preventive methods among women.^[18,20]

In a study investigating contraceptive applications, these programs were grouped into nine categories, including fertility tracking, centers and resources, birth control reminders, genital and sexual general information, sexual and reproductive health information for young adults, contraceptive information, services or condom substitutes, pregnancy tests, and games. According to the results, 41% of these programs did not mention any modern preventive methods, and 23% mentioned only one method. Less than 50% of the applications provided information on how to use a modern prevention method. Sexual and reproductive health information applications had the largest effect on contraception, and fertility tracking programs, birth control reminders, and pregnancy tests had had the least impact on contraception. The most common contraceptive methods included fertility awareness (44%), preventive pills (43%), and female and male condoms (34%).^[1]

Findings showed that sending educational text reminders increased the use of contraceptive pills in young women. Furthermore, voice messages and communication with counselors could increase the use of effective contraceptive methods.^[2,19,21]

Use of electronic health in abortion

The patients had positive experiences with using telemedicine. The physicians believed that their interaction with patients using telemedicine was quite similar to face-to-face visits, this approach was more patient-centered than face-to-face approaches, and the benefits of telemedicine outweighed the disadvantages associated with the lack of face-to-face communication.^[22] Moreover, physicians can also provide better care because of timely visits to patients at the right time.^[23]

The results also showed that the rate of medical abortion increased from 33% to 45% after the introduction of telemedicine compared to other abortion methods.^[24] Furthermore, after the introduction of telemedicine, the proportion of patients who traveled long distances to reach the nearest clinic decreased slightly.^[25] In a study in Australia, 96% of women completed their abortion using telemedicine without surgical intervention or making in-person visits to clinics after abortion. Almost all the women were satisfied with their abortions.^[26]

A study investigating eligibility for early medical abortion using m-Health to calculate gestational age in South Africa showed that most women considered the use of this tool easy and useful for abortion and that the results of this calculation were correct. This study found that the use of preventive pills had the least effect on contraception compared to other prevention methods. Of 91% of the women who performed the pregnancy test, 65% performed the test at home.^[1] Women who receive educational messages during abortion medication use experience lower levels of stress and anxiety and are more likely to

Table 4: Summary characteristics of articles included

| Author | Publication year | Sample size | Objective | Intervention tool | Collection method | Dependent variables | Result | Reference number |
|------------|------------------|-------------|---|---|--------------------------|--|--|------------------|
| 1 Aiken | 2017 | 1023 | to examine the characteristic and experiences of women seeking at home medical abortion using online telemedicine | Website | Study and self-reporting | Age and pregnancy conditions, reasons for seeking an abortion at home, and post-abortion feeling | The majority of women were satisfied with the choice. Severe symptoms of mental stress from pregnancy and their inability to pay for travel abroad to terminate pregnancy were reported as the most important reasons for seeking an abortion. | [11] |
| 2 Les | 2017 | 136 | to analyze the characteristics and experiences of women living in Hungary who accessed a medical abortion through the telemedical service Women on Web | Website | Study and self-reporting | Women's acceptance and satisfaction with online abortion | More than half of the women had used this method in their first pregnancy | [12] |
| 3 Aiken | 2018 | 38 | To examine the impact of the law on women's options for accessing abortion, their decision-making regarding which pathway to follow, and their experiences with their chosen approach | Telephone call | interview | Experiences and reasons for choosing in-person abortion or remote abortion | Abortion at home through telemedicine has a higher advantage than traveling abroad to obtain abortion services. | [13] |
| 4 Grindlay | 2013 | 40 | to evaluate patients' and providers' experiences with telemedicine provision of medical abortion | Video conference | interview | Acceptance of Remote Service | Patients through telemedicine have a more private and secure visit than a face-to-face visit with a physician. | [14] |
| 5 McKay | 2013 | 127 | to assess women's satisfaction with the home medical abortion service | Phone call to track abortion completion | questionnaire | The Satisfaction of women and abortion care providers of telemedicine method | 82% of subjects were satisfied with the completeness and clarity of oral and written information provided for post abortion follow-up. | [15] |
| 6 Smith | 2017 | 15 | To assess women's views and experiences of receiving the MOTIF intervention, gain insights into the mechanism of action of the intervention and to seek recommendations for improvements. | Telephone counseling and voice messages | interview | The amount of mobile health support in post-abortion contraception | Individuals have acquired sufficient knowledge of the various methods of prevention, and telephone contact has provided an opportunity to ask questions about the methods of prevention. | [16] |

Contd...

Table 4: Contd...

| Author | Publication year | Sample size | Objective | Intervention tool | Collection method | Dependent variables | Result | Reference number |
|-------------|------------------|-------------|--|--|---|---|--|------------------|
| 7 Aiken | 2017 | 1636 | To assess self-reported outcomes and adverse events after self-sourced medical abortion through online telemedicine | Abortion Service Website | Self-reporting | Abortion success rate, side effects | 94% of women experienced the end of pregnancy successfully without any side effects. | [4] |
| 8 Bracken | 2014 | 999 | To test the effectiveness and feasibility of remote communication technologies to increase follow-up after early medical abortion | An Online questionnaire, phone call, SMS | Questionnaire-Interview | Acceptability and Feasibility | Among telecommunications, telephone (73%) and SMS (75%) were the most used and online methods (46%) the least used. Most people reported that they would prefer telecommunication and SMS remote tracking in the future. | [9] |
| 9 Cameron | 2012 | 619 | to evaluate the service of a telephone follow-up in terms of providing a description of the numbers of women choosing to be followed up in this way, follow-up rates, efficacy for detecting ongoing pregnancies and women's satisfaction with this approach | Phone call | Laboratory Questionnaire -Evidence | The Satisfaction of participating women | At the end of follow-up, abortion success rates were negative for 15% and positive for 85%. | [17] |
| 10 Constant | 2015 | 469 | to determine whether women could complete an accurate self assessment of the outcome of medical abortion on their mobile phones while at home and to assess the accuracy of the mobile assessment in predicting the provider's assessment of the need for manual vacuum aspiration or additional misoprostol at follow-up; and also comparing these results to results using the same self-assessment done on paper at the women's follow-up clinic visit. | SMS | Mobile-based questionnaire- paper questionnaire | Rate of use of mobile evaluation tool | Completeness of medical abortion can be assessed using a mobile phone, but it should be followed by a suitable pregnancy test after ten days of abortion. | [10] |

Contd...

Table 4: Contd...

| Author | Publication year | Sample size | Objective | Intervention tool | Collection method | Dependent variables | Result | Reference number |
|-------------|------------------|-------------|--|-------------------------------|------------------------------|---|---|------------------|
| 11 Dunn | 2015 | 129 | Comparison of adherence to follow-up and clinical outcomes between standard in-clinic and remote follow-up after methotrexate/misoprostol abortion. | Clinical Trial-Phone Call | checklist | The rate of using remote and in-person follow-up | In comparing telephone and in-person post-abortion follow-up, 67% of patients chose telephone follow-up. Three-quarters of those in the telephone follow-up group completed the abortion without an in-person visit | [18] |
| 12 Smith | 2017 | 759 | to assess factors associated with loss to follow-up in the MOBILE Technology for Improved Family Planning (MOTIF) trial in Cambodia and compare how the result might have varied using different analytical methods. | Phone call | Self-reporting | Factors related to the lack of follow-up to use contraceptives | Factors include young age, poor socioeconomic status, lack of planning for contraception after abortion, and not providing a second contact number. | [19] |
| 13 Reiss | 2017 | 960 | to examine the effects of an intervention delivered by mobile phone designed to support contraceptive use among public and private sector menstrual regulations clients in three divisions of Bangladesh | Voice message-phone call | Questionnaire-self-reporting | rate of usage long-term effectiveness of effective prevention methods | Mobile health interventions as a low-cost intervention have a great impact on increasing acceptance and use of effective prevention methods among women. | [20] |
| 14 McCarthy | 2017 | 570 | evaluating an intervention delivered by mobile phone that is designed to increase the acceptability of effective contraception in Palestine | Text messages | Self-reporting | Acceptance of at least one preventive method, the use of effective prevention, the rate of unwanted pregnancies and abortions | This intervention increased the acceptability of contraceptive methods and changed women's attitudes towards using contraceptive methods. | [21] |
| 15 McCarthy | 2018 | 573 | to evaluate a contraceptive behavioural intervention delivered by mobile phone in Tajikistan | Messaging with the mobile app | questionnaire | The acceptability of each of the effective prevention methods | The use of birth control pills is the most accepted method of contraception. | [22] |

Contd...

Table 4: Contd...

| Author | Publication year | Sample size | Objective | Intervention tool | Collection method | Dependent variables | Result | Reference number |
|------------|------------------|-------------|---|--|---|--|--|------------------|
| 16 Smith | 2013 | 500 | to outline the formative research process used to develop the MOTIF mobile phone-based (mHealth) intervention to support post-abortion family planning in Cambodia. | Voice messages | Self-reporting-questionnaire | The amount of effective prevention, the abortion recurrence rate | This technology has increased the use of long-effect prevention methods. | [23] |
| 17 Mangone | 2016 | 218 | to identify, describe, and evaluate mobile phone apps that purport to help users prevent unintended pregnancy | Mobile apps | review related studies and applications | Contraceptive methods, user interface features | Sexual and reproductive health applications have the highest percentage of contraceptives. 56 percent of applications were created for women, two percent for men, and 41 percent for both | [3] |
| 18 Smith | 2017 | 249 | to assess participants' interaction with the intervention from a service provider perspective. | Voice messages | - | Interaction with intervention, the relationship between intervention and use of prevention methods | Receiving reminder messages made women continue using contraceptive methods continuously | [24] |
| 19 Smith | 2015 | 5 | to assess the effects of mobile phone-based interventions for improving contraception use | Voice messages, text messages and telephone counseling | Review related studies | Rate of use of a particular method of prevention, change of method of prevention, discontinuation of contraceptives | Most people tend to use long-term contraceptives such as IUDs rather than short-term methods. | [25] |
| 20 Smith | 2015 | 249 | To assess the effect of a mobile phone-based intervention (mHealth) on post-abortion contraception use by women in Cambodia | Voice message - Telephone counseling | Phone Call - Self-Reporting | The rate of using a contraceptive method, the number of pregnancies and abortion, discontinuation of contraceptives, the rate of non-follow-up | Following an intervention by sending educational text messages on contraceptive pills the use of contraceptive pills increased over the six months by participants. | [2] |

Contd...

Table 4: Contd...

| Author | Publication year | Sample size | Objective | Intervention tool | Collection method | Dependent variables | Result | Reference number |
|--------------|------------------|-------------|--|----------------------------------|-------------------------------|--|--|------------------|
| 21 Smith | 2016 | - | to outline the formative research process used to develop the MOTIF mobile phone-based (mHealth) intervention to support post-abortion family planning in Cambodia | Voice messages | Review of Studies - Interview | The main reasons for not using prevention methods concerns, including side effects, were the most common reason for not using preventive methods | The use of prevention methods increases with the increase in literacy and well-being. Health concerns, including side effects, were the most common reason for not using preventive methods | [26] |
| 22 Aiken | 2018 | 108 | To examine reasons for seeking abortion services outside the formal healthcare system in Great Britain, where abortion is legally available | Remote Abortion Services Website | Self-reporting | Reasons for seeking an abortion, conditions, and age of the pregnancy | The most important reasons for abortion outside of formal health care organizations fall into three general categories: 1- Barriers to access 2- Privacy concerns 3- Controlling conditions (such as domestic violence) | [27] |
| 23 De Tolly | 2014 | 226 | To assess the feasibility and efficacy of information and follow-up provided via mobile phone after medical abortion in a randomized controlled trial | Short Message-Questionnaire | Self-reporting | Participants' response to messages and questionnaires, assessing the feasibility and efficiency of information and post abortion follow-up using mobile phones | The women's response to the SMS was very positive and defined it as a guiding tool that provided a sense of support and comfort. Most people found the questionnaire easy to complete | [28] |
| 24 Steinberg | 2018 | - | to understand the patterns of use of the app's search functionality | Mobile applications | observation | The extent of the search for prevention methods and places of access to services | This app can help users get the services they need by providing location information and service descriptions. The most common method of prevention sought in this program was condoms and tablets | [29] |
| 25 Endler | 2018 | 615 | to assess the safety and acceptability of abortion through telemedicine >9 gestational weeks | Remote Abortion Services Website | Self-reporting | Participants' concerns about abortion, severe bleeding, excessive pain and bleeding, satisfaction | Abortion through telemedicine in women over nine weeks leads to more emergency visits, surgeries, and medications than women with gestational age less than nine weeks, which increases with increasing gestational age. | [30] |

Contd...

Table 4: Contd...

| Author | Publication year | Sample size | Objective | Intervention tool | Collection method | Dependent variables | Result | Reference number |
|--------------|------------------|-------------|--|---|-------------------------|---|---|------------------|
| 26 Gomperts | 2014 | 307 | to evaluate the need for and outcome of self-administered medical abortion with mifepristone and misoprostol in Brazil | Abortion Services Website (Online Consultation, Email, Follow-up Questionnaire) | Self-reporting | Prevention failure rates, prior knowledge of medical abortion | All women who used telemedicine for abortion found this method acceptable | [31] |
| 27 Messinger | 2017 | 58 | to investigate the knowledge, attitudes and practices regarding mHealth of both MR clients and formal and informal sexual and reproductive healthcare providers in urban and rural low-income settlements in Bangladesh | Remote consultation by mobile | interview | Awareness, opinions, and activities related to mobile health for abortion | People in low-income countries do not have enough understanding of how to use a cell phone to access abortion services. Overall, women's views on the use of mobile health were positive in this regard. | [32] |
| 28 Grindlay | 2017 | 8 | to evaluate providers' experiences with telemedicine provision of medical abortion in Alaska using qualitative methods and in particular to learn more about the impacts of telemedicine on patients, staff, and clinic operations and potential lessons for other service delivery settings | video teleconference | interview | Providers' experiences of using telemedicine in delivering abortion services, the impact of telemedicine on patients, staff, and clinic performance | Patients' experiences of using telemedicine were assessed positively. Telemedicine also makes doctors available in various clinics, thereby alleviating the problem of lack of physician presence. | [33] |
| 29 Grossman | 2011 | 578 | To estimate the effectiveness and acceptability of telemedicine provision of early medical abortion compared with provision with a face-to-face physician visit at a Planned Parenthood affiliate in Iowa | video teleconference | questionnaire | Satisfaction, clinical data, acceptability and effectiveness of telemedicine | The success rate of telemedicine use was 99% and in abortion 97%. Overall, 91 percent of women were satisfied with their abortion method, but women who chose the telemedicine method were more likely than others to recommend their method to another person. | [35] |
| 30 Grossman | 2013 | - | To assess the effect of a telemedicine model providing medical abortion on service delivery in a clinic system in Iowa | video teleconference | Review statistical data | Comparison of births and abortions | After the introduction of telemedicine medical abortion rates increased from 33% to 45% compared to other types of abortion. | [36] |

Contd...

Table 4: Contd...

| Author | Publication year | Sample size | Objective | Intervention tool | Collection method | Dependent variables | Result | Reference number |
|-------------|------------------|-------------|--|---|--------------------------------|---|---|------------------|
| 31 Hyland | 2018 | 1010 | to describe results from the first 18 months of a nationwide direct-to- patient telemedicine service | Remote abortion services site | Study the data in the database | The rate of remote abortion success | Almost all women had a complete medical abortion through telemedicine without surgical intervention and had no in-person visits to clinics after abortion. | [37] |
| 32 Momberg | 2016 | 78 | To determine women's acceptability and ability to self-assess eligibility for early medical abortion using an online gestational age calculator | Mobile health technology to calculate gestational age | Self-assessment form | Feasibility and acceptability | Most women found it easy to use. Eighty-six percent reported the calculation was correct and 94% evaluated it was a useful tool for abortion. | [1] |
| 33 Constant | 2014 | 235 | To evaluate whether automated text messages to women undergoing medical abortion can reduce anxiety and emotional discomfort, and whether the messages can better prepare women for symptoms they experience | Text messages | interviews | Stress and concerns of participants in medical abortion, experiences, and acceptance of remote abortion by participants | Women who receive educational texts during abortion medications are less likely to experience anxiety and stress and are more prepared for the bleeding, pain, and other side effects they may encounter. | [38] |

Table 5: Biases of articles included

| Title | Bias |
|--|---|
| Experiences and characteristics of women seeking and completing at-home medical termination of pregnancy through online telemedicine in Ireland and Northern Ireland: a population-based analysis | To assessing only the variables included in the online consultation and evaluation forms. The sample was a self-selected group and some groups of women may be more likely than others to provide information :Selection bias (attrition bias) and (participation bias) |
| Experiences of women living in Hungary seeking a medical abortion online | Reliance on self-report and small sample size. Selection bias (participation bias) |
| Experiences of women in Ireland who accessed abortion by travelling abroad or by using abortion medication at home: a qualitative study | The sample is self-selected and women in Ireland may obtain abortions by other routes not represented in our sample: selection bias (participation bias) |
| Women's and Providers' Experiences with Medical Abortion Provided Through | Sample that did not draw from all clinics and may not be representative of all women's and providers' experiences and participants might have associated the interviewer with the clinic. Selection bias (Participation bias) |
| Telemedicine: A Qualitative Study | Central tendency bias and social desirability bias: Selection bias (non-response bias) |
| Women's satisfaction with early home medical abortion with telephone follow-up: A questionnaire-based study in the UK | The study did not document if any women refused to participate. Reporting bias |
| Women's views and experiences of a mobile phone-based intervention to support post-abortion contraception in Cambodia | Most of the women interviewed were using a contraceptive method and hence the study was unable to assess differences in accounts between contraception users and nonusers. information bias (detection bias) |
| Self reported outcomes and adverse events after medical abortion through online telemedicine: population based study in the Republic of Ireland and Northern Ireland | As in the trial, most of the women interviewed were married, and single women and entertainment workers were under-represented. The interviews may have been prone to social desirability (response bias) |
| RU OK? The acceptability and feasibility of remote technologies for follow-up after early medical abortion | Self-reporting could be subject to recall or social desirability. Information bias (recall bias) |
| Telephone follow-up and self-performed urine pregnancy testing after early medical abortion: a service evaluation | The study was unable to assess what characteristics of the follow-up modalities impacted acceptability and preference or to understand what, if any, impact the use of non-clinical staff to undertake follow-up had on these outcomes or on inter-clinic variations in follow-up completion. Information bias (detection bias) |
| Assessment of completion of early medical abortion using a text questionnaire on mobile phones compared to a self-administered paper questionnaire among women attending four clinics, Cape Town, South Africa | has not been stated |
| Comparison of remote and in-clinic follow-up after methotrexate/misoprostol abortion | Has not been stated |
| Assessing loss to follow-up in the Mobile Technology for Improved Family Planning (MOTIF) randomised controlled trial | This study's main weakness was the small sample size. Selection bias (participation bias) |
| Using automated voice messages linked to telephone counselling to increase postmenstrual regulation contraceptive uptake and continuation in Bangladesh: study protocol for a randomised controlled trial | The study was restricted to participants with available follow-up data, may produce a biased estimation of the true effect. Selection bias (attrition bias) |
| An intervention delivered by text message to increase the acceptability of effective contraception among young women in Palestine: study protocol for a randomised controlled trial | This study had a relatively small sample size. Selection bias (participation bias) |
| | Has not been stated |
| | Self-reporting. Selection bias (participation bias) |

Contd...

Table 5: Contd...

| Title | Bias |
|--|---|
| A randomized controlled trial of an intervention delivered by mobile phone app instant messaging to increase the acceptability of effective contraception among young people in Tajikistan | Self-reporting. Selection bias (participation bias) |
| MOBILE Technology for Improved Family Planning Services (MOTIF): study protocol for a randomised controlled trial | Self-reported data on contraception use are considered less reliable, and prone to social desirability bias. Selection bias (non-response and participation bias) |
| Mobile Phone Apps for the Prevention of Unintended Pregnancy | There is no way to distinguish who is using the apps or for what purpose. Information bias (detection bias) |
| Process evaluation of a mobile phonebased intervention to support postabortion contraception in Cambodia | Small sample size. The findings might not be applicable to other settings. Selection bias (participation bias) |
| Mobile phone-based interventions for improving contraception use | Random sequence generation (selection bias) Allocation concealment (selection bias) Blinding of participants and personnel (performance bias) Blinding of outcome assessment (detection bias) Incomplete outcome data (attrition bias) Selective reporting (reporting bias) |
| Effect of a mobile phone-based intervention on post-abortion contraception: a randomized controlled trial in Cambodia | Self-report measures. Information bias (Detection bias) Blinding of participants and personnel (performance bias) time and resource constraints (selection bias) |
| Mobile Technology for Improved Family Planning (MOTIF): the development of a mobile phone-based (mHealth) intervention to support post-abortion family planning (PAFP) in Cambodia | Analysis of the interviews was not undertaken by a second coder. Information bias (detection bias) |
| Barriers to accessing abortion services and perspectives on using mifepristone and misoprostol at home in Great Britain | Not representing all British women who experience difficulty accessing abortion services. Selection bias (attrition bias) |
| Integrating Mobile Phones into Medical Abortion Provision: Intervention Development, Use, and Lessons Learned From a Randomized Controlled Trial | Has not been stated |
| Evaluation of a Mobile Phone App for Providing Adolescents With Sexual and Reproductive Health Information, New York City | Unable to use a more robust app analytics software package. As a result, the study could not collect data on individual users, and it was unable to group searches by individual user or to evaluate common metrics through the app. Information bias (detection bias) |
| Provision of medical abortion using telemedicine in Brazil | A large number of women did not provide any information about the outcome of the medical abortion and that all the analyses and results are based on self-reported data. Selection bias (participation bias) |
| Safety and acceptability of medical abortion by telemedicine above nine gestational weeks: a population-based cohort study | Gestational age at abortion in this study is the minimum gestational age is at which the abortion could have been initiated. Theoretically gestational age specific adverse outcomes may therefore be overestimated and some women in the lower gestational group may be misclassified which might underestimate relative differences between groups. Selection bias (participation bias) |
| Utilization of mobile phones for accessing menstrual regulation services among low income women in Bangladesh: a qualitative analysis | Has not been stated |
| Telemedicine provision of medical abortion in Alaska: Through the provider's lens | This research was conducted with a small convenience sample and, as a qualitative study, is not intended to be representative of all provider experiences. Additionally, the results may not be generalizable to other settings where telemedicine is used for medical abortion provision. Selection bias (participation bias) |

Contd...

Table 5: Contd...

| Title | Bias |
|---|---|
| Effectiveness and Acceptability of Medical Abortion Provided Through Telemedicine | Participants were not randomized and instead selected the treatment they received which might have introduced selection bias. Also participants were somewhat more educated and less likely to be Latina than the general medical abortion clinic population. This might have introduced selection bias. results are specific to the provision models offered in this clinic system, and we cannot generalize our findings to other service delivery settings. Selection bias (participation bias) |
| Changes in Service Delivery Patterns After Introduction Of Telemedicine Provision of Medical Abortion in Iowa | The study only examined the first 2 years after telemedicine Introduction. Selection bias (follow up bias) Findings are specific to the service delivery model implemented in this clinic system and cannot be generalized to other models in other settings. Selection bias (participation bias) |
| A direct-to-patient telemedicine abortion service in Australia: Retrospective analysis of the first 18 months | Only 76% of the women who were sent medications either had full follow-up. Selection bias (follow up bias) Dataset lacked some information of potential interest. Information bias |
| Self-assessment of eligibility for early medical abortion using m-Health to calculate gestational age in Cape Town, South Africa: a feasibility pilot study | The study sample size was relatively small, and all participants were recruited from health care facilities providing abortions. Selection bias (participation bias) Women who were recruited from the government facility already knew their GA prior to being recruited into the study. Performance bias Findings might not be generalizable to other populations. The usability of the online gestational calculator was only tested on the electronic tablet provided by the study team and its use may therefore vary on devices with smaller screens. Selection bias (participation bias) |
| Mobile phone messages to provide support to women during the home phase of medical abortion in South Africa: a randomised controlled trial | differential loss to follow-up with more nonreturnees. It is possible this could have introduced bias into our results. Selection bias (follow up bias) there was a bias towards a better-resourced population than the national average: study participants had a higher level of education and employment than the general population and all study clinics were in an urban setting. Selection bias (participation bias) |

be prepared for bleeding, pain, and other side effects of abortion that they might encounter.^[27]

Use of electronic health in post-abortion follow-up

A comparison of in-person and telephone post-abortion follow-ups showed that 67% of the patients chose telephone follow-up. The number of emergency visits was 3% for the phone follow-up group and 9% for the in-person follow-up group. Three-quarters of abortions were completed without an in-person visit, and the rest of the patients presented to the hospital for various reasons, including incomplete abortion or complications such as pelvic infections, pain, and bleeding. Moreover, 94% of the women in both groups reported having the desire to reuse the phone follow-up method in the future.^[28]

Discussion

Mobile phones are increasingly used to provide health services. Mobile phone interventions are often less expensive than face-to-face support services.^[20,29] Achieving the goal of reducing global mortality before 2030 requires a reduction in the number of unsafe abortions.^[30] In the most

inaccessible parts of the world, increased access to and reliability of mobile phones have made mobile messaging a valuable tool for communicating with the populations residing in these areas.^[31-33] Providing medical abortion through telemedicine is an effective and acceptable method for women, which is associated with fewer side effects compared to face-to-face services.^[7]

The present study found that in general, mobile health was most commonly used for abortion followed by unwanted pregnancy prevention and post-abortion follow-up. The results showed that almost all women were completely satisfied with the use of telemedicine and mobile health methods for abortion, contraception, or post-abortion follow-up.^[12,13,34,35] The most important reason for remote abortions was geographical and legal barriers to accessing abortion services.^[36] Furthermore, the results of the studies showed that telemedicine, with the availability of doctors in different clinics, resolved the problem of the lack of physicians.^[37] Among the technologies, telephone and messaging were the most widely used services and telephone follow-up with the self-performed pregnancy test was the most popular method.^[9,38] The results showed that

it is possible to evaluate the completeness of abortion using a cell phone 10 days after abortion in combination with a suitable pregnancy test.^[10,39] The most common reason for not using prevention methods was health concerns, including side effects.^[40] The results of this review showed that sending text-based educational reminders could increase the use of contraceptive pills in young women. In addition, voice messages and communication with a counselor could promote the use of effective contraceptive methods.^[2,21]

McCarthy *et al.*^[17] used a mobile messaging intervention to increase the acceptance of contraceptive methods and found that the use of prevention pills had the highest acceptability among contraceptive methods.^[17] However, a systematic review of mobile-based interventions to improve the use of contraceptive methods by Smith *et al.*^[21] showed most people tended to use long-term contraceptive pills, such as IUDs, rather than using contraceptive methods with short-term effects. The reason for this difference could be differences in the study population. The study population in the first study only included women of a very young age; this population generally tends to use contraceptive pills. The study population of the second study included women and men of reproductive age, which can tend to choose preventive methods with long-term effects.

In a similar study that examined the role of mobile health in preventing unwanted pregnancy, applications for unwanted pregnancy prevention available in Google Play and iTunes were evaluated. This study classified applications into several categories and identified and introduced the most useful programs.^[3] Another study reviewed controlled trials to determine the role of mobile health in preventing unwanted pregnancy.^[21] The role of telemedicine in abortion was investigated in a review study conducted in the United States. In this study, the challenges of access to legal abortion were discussed and two models of abortions using telemedicine were examined.^[7] In the present study, in addition to the role of mobile health in preventing unwanted pregnancy, a review of different studies showed its effect on abortion and post-abortion follow-up. In addition, the role of telemedicine in contraception, abortion, and post-abortion follow-up was evaluated. Therefore, this study reviewed remote technologies for abortion and pregnancy prevention. This systematic review had three limitations. First, the study was limited to articles published from 2008 to 2018. Second, the articles were extracted only from four main databases and other types of publications such as editorials, websites, booklets, news, conference papers, and letters were excluded.

Conclusion

The results of the present systematic review showed the positive impact of the use of electronic health services on the prevention of unwanted pregnancy, abortion, follow-up throughout abortion, and training of patients or

therapists. The results showed that e-health could have a positive effect on increasing knowledge about abortion, planning to prevent unwanted pregnancy, monitoring, and evaluation. These tools have significant positive effects, especially in underdeveloped areas, cost less, and are less time-consuming for patients and organizations. In addition, studies have shown that electronic health tools play an important role in reducing unwanted pregnancies and abortion complications. Electronic health has the potential to improve access to early medical abortion. The results showed that almost all women had complete satisfaction at the end of the use of telemedicine and mobile health methods for abortion, contraception, or post-abortion follow-up. Therefore, considering the ever-increasing use of mobile phones and applications, it is suggested that health systems develop the technologies required for providing electronic health services and evaluate the results of implementing these services.

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Conflicts of interest

Nothing to declare.

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