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Economic evaluation of medical versus surgical strategies for first trimester therapeutic abortion: A systematic review

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Abstract:

Pregnancy termination and abortion-related complications are well-established problems among women at reproductive age and resulted in significant morbidity and mortality. Accordingly, a systematic study was performed to investigate the economic evaluation studies results on costs and benefits of medical and surgical abortion methods. PubMed, Web of Science, Scopus, Embase, Cochrane library, ProQuest, and ScienceDirect databases as well as Google scholar were searched through June 2021. Original full-text English language studies that performed an economic evaluation analysis comparing medical and surgical methods of pregnancy termination were included in this review. A critical quality assessment was conducted utilizing the Consolidated Health Economic Evaluation Standards checklist. The latest web-based tool adjusted the estimates of costs expressed in one specific currency and price year into a specific target currency (the year 2020 \$US). Overall, 538 records were retrieved, and 20 studies were deemed eligible for qualitative synthesis. Among the reviewed studies, three studies investigated cost-minimization analysis, three studies investigated cost-utility analysis, and 14 studies investigated cost-effectiveness analysis. The directly comparison of medical with surgical abortion was most frequently studied. Medical abortion saved US\$ 6 to US\$ 2373 per patient's costs. Medical abortion was cost-effective and cost-saving option in compare to the surgical abortion across all perspectives (the incremental cost effectiveness ratio ranged from US\$ 419 to US\$ 4,044). Quality scores of included studies ranged from 54% to 100%, and 70% of studies received a score of above 85% and had "excellent" quality. According to the results, based on various economic and clinical effectiveness decision-making criteria used in different studies of health economic evaluation, the majority of research provided evidence on the advantage of pharmaceutical methods compared to surgical methods, as well as the advantages of using combinations therapy compared to single therapeutic interventions.

Keywords:

Cost-benefit analysis, first trimester, systematic review, therapeutic abortion

Introduction

Significant global efforts have been made to improve the coverage, quality, and range of maternal services for women. Information on the economic evaluation of alternative strategies to improve maternal care can serve as one important policy input to guide decisions on how to achieve newly ratified Sustainable Development

Goals of reducing the maternal mortality and morbidity.^[1] Notwithstanding promotions in contraceptive methods, pregnancy termination and abortion related complications remain as potentially health concern and result in significant morbidity and mortality.^[2]

Abortion and its nonfatal complications contribute significantly to the global burden of pregnancy termination. Women pay

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heavily not only with their health and their lives but also financially. Postabortion care imposes a substantial economic burden on society, annual costs of abortion, and postabortion cares ranged from 189,000 \$US to 134 million \$US and \$23 to \$564 per patient costs worldwide.^[3-5] Pregnancy termination management includes a wide range of conditions as follows; induced abortion, managing incomplete evacuation, control postpartum hemorrhage, treatment of spontaneous abortion, miscarriage management, treatment of early pregnancy failure, management of nonviable early pregnancy, and management of early pregnancy loss.^[6]

Current abortion intervention options are classified as surgical (uterine curettage aspiration) or medical (the use of medications to induce uterine contractions and tissue expulsion). These options differ in treatment efficacy, costs, and patient experience. Although the traditional treatment option of pregnancy termination and induced abortion has been a surgical evacuation of the uterus, medical abortion has been gaining popularity as a noninvasive alternative in recent years.^[7,8] Medical management of abortion plays a crucial role in providing access to safe, effective, and acceptable abortion and postabortion cares and encompass either a combination regimen of mifepristone and misoprostol or a misoprostol-only regimen. These medical interventions reduce the need for skilled surgical abortion providers and offer a noninvasive and highly acceptable option for pregnant women. Both surgical and medical options are currently acceptable in practice, but deciding what the best regimen is not always clear.^[9,10]

Economic evaluations are defined as the comparative analysis of alternative courses of action in terms of both their costs and consequences and provide clinicians, patients, policymakers, and health-care planners with important information on the available alternatives in the context of limited resources.^[11,12] The aim of this study was to review previous research to determine the economic efficacy of medical and surgical strategies for women seeking pregnancy termination. This research is the first attempt to examine previous research with economic evaluation methods, including cost-effectiveness, cost-utility, cost-benefit, and cost minimization of pregnancy termination interventions. It would provide important insight to relevant stakeholders to create awareness and to implement an effective strategy to reduce the burden associated with these cares.

Materials and Methods

Literature search

PubMed, Web of Science, Scopus, Embase, Cochrane library, ProQuest and ScienceDirect databases were searched through June 2021 to obtain the required data. Key words or medical subject heading terms (MeSH)

used in the search strategy were as follows: “Cost and cost analysis” or “Cost-benefit Analysis” and “Induced Abortion” or “Vacuum Curettage” or “Mifepristone” or “Misoprostol” or “Pregnancy Trimesters”. Furthermore, the search strategy developed using Boolean operators [Appendix 1]. The Google scholar search engine, World Health Organization website as well as the Cochrane library protocols were searched manually for probable records that falls outside the mainstream of published journal. Furthermore, in order to maximize the comprehensiveness of the search, a reference list of the identified articles was manually explored to retrieve probably related articles.

Inclusion and exclusion criteria

In this systematic review study, the research questions were determined based on population, intervention, comparison, and outcomes. The inclusion criteria were as follows: Original studies that performed an economic evaluation (including cost-effectiveness analysis, cost-utility analysis, cost-benefit analysis as well as cost-minimization analysis); Studies performed on medical or surgical methods of pregnancy termination management; studies which measured outcomes such as quality-adjusted life years (QALYs), disability adjusted life years or Incremental cost-effectiveness ratio or clinical outcomes such as pelvic infection, bleeding, infertility, complete or failed evacuation rate, mortality, and anemia rate. Studies with available full texts, and written only in English. There was no restriction on the year of the publication of the studies. The exclusion criteria were as follows: Studies related to neoplasms, abnormal pregnancies, maternal mortality interventions, gestational trophoblastic or contraception interventions; studies with a full-text written in languages other than English; and studies published as a review articles, conference abstracts, editorials, commentaries were excluded from this review.

Study selection and data extraction

The duplicated articles were removed. Study selection was initially based on study titles and abstracts. Then, the full texts of the selected studies were evaluated for final inclusion. Two independent reviewers performed the entire selection process, and any discrepancy between reviewer was resolved by discussion, and when consensus was not reached, a third reviewer resolved. A data extraction form (including participants, intervention, comparator condition, outcomes, perspective, and time horizon) was designed for this systematic review [Table 1]. First, one reviewer extracted characteristics of the included studies and then, the rest of the reviewers refined it.

Risk of bias and quality appraisal

A critical quality assessment was conducted utilizing the Consolidated Health Economic Evaluation Reporting

Table 1: General characteristics of included studies

Author	Country	Sample size	Intervention and alternatives	Perspective and time horizon	ICER/cost per outcome or cost saving	EPPI* (US\$ 2020)	Quality appraisal (%)
Berkley <i>et al.</i> , 2020 ^[13]	United states	300	Combination therapy versus misoprostol alone	Societal, 30 days	Combination therapy saved US\$190–\$217 per patient	US\$ 190 to US\$ 217	79
Bradley <i>et al.</i> , 2007 ^[14]	United states	10,000	Misoprostol versus standard approach	Medical sector, 1 year	Misoprostol saved US\$ 115,336	US\$ 146,870	86
Cubo <i>et al.</i> , 2019 ^[15]	Spain	547	Misoprostol versus curettage	Medical sector, 7 days	Misoprostol saved >€1,500 per patient	US\$ 2,373	90
Goranitis <i>et al.</i> , 2019 ^[16]	Malawi, Pakistan, Tanzania, Uganda	3412	Antibiotic prophylaxis versus no antibiotics	Health-care provider, 2 weeks	Routinely using antibiotic prophylaxis saved 1.4 million US\$	1.4 million US\$	91
Graziosi <i>et al.</i> , 2005 ^[17]	Netherlands	154	Misoprostol versus curettage	Societal, 2–6 weeks	€ 915 for misoprostol group and € 1,107 for curettage group	US\$ 1396 and US\$ 1689	78
Hu <i>et al.</i> , 2010 ^[18]	Nigeria and Ghana	100,000	Unsafe abortion versus misoprostol	Societal, lifetime (3% discount rate)	Misoprostol save 2.7–3.1 million US\$ per 100,000 procedures	3.2–3.7 million US\$	91
Hu <i>et al.</i> , 2009 ^[1]	Mexico	100,000	Hospital-based D and C versus MVA and misoprostol	Societal, lifetime (3% discount rate)	MVA was least costly and most effective strategy (89 US\$)	US\$ 107	100
Hunter <i>et al.</i> , 2021 ^[19]	Canada	306	Mifepristone/ misoprostol versus misoprostol and vacuum aspiration	Health system, ≤9 weeks	ICER for mifepristone/ misoprostol relative to MVA/ misoprostol US\$ 3585	US\$ 3585	86
Lemmers <i>et al.</i> , 2018 ^[20]	Netherlands	256	Curettage versus expectant management	Societal, 6 weeks	ICER for curettage versus expectant management was US\$ 8586	US\$ 8921	87
Lince <i>et al.</i> , 2017 ^[21]	South Africa	1129	Medical abortion versus MVA	Health system, 10-21 days	Cost per medication abortion was US\$ 63.91 and \$69.60 for MVA	US\$ 67.9 and US\$ 73.9	91
Lubinga <i>et al.</i> , 2015 ^[22]	Uganda	NA	Misoprostol versus no misoprostol	Societal, NA	ICER was US\$ 73 per DALY averted	US\$ 80	87
Nagendra <i>et al.</i> , 2020 ^[7]	United states	300	Mifepristone plus misoprostol versus misoprostol alone	Societal, 30 days	ICER was US\$ 4225 per QALY gained	US\$ 4225	95
Niinimäki <i>et al.</i> , 2009 ^[23]	Finland	98	Medical versus surgical abortion	Provider, NA	Incremental cost was €1688	US\$ 2262	86
Nwafor <i>et al.</i> , 2020 ^[24]	Nigeria	100	Misoprostol versus MVA	Provider, 1 week	Incremental cost was US\$419 for MVA over misoprostol	US\$ 419	82
Petrou <i>et al.</i> , 2006 ^[25]	England	1200	Expectant management versus medical and surgical	Societal, 8 weeks	WTP threshold of 10,000 pounds for preventing one infection	US\$ 18,566	79
Rausch <i>et al.</i> , 2012 ^[9]	United states	652	Medical versus surgical abortion	Provider, 30 days	Cost effectiveness ratio of \$3526 per successful treatment	US\$ 4044	86
Sutherland <i>et al.</i> , 2010 ^[26]	United states	10,000	Community based misoprostol versus Standard cares	Provider, NA	ICER was US\$ 6 per DALY averted	US\$ 7	75
Vlassoff <i>et al.</i> , 2016 ^[27]	Senegal	150,000	Misoprostol versus oxytocin as standard care	Health system, 48 h	Cost per postpartum hemorrhage averted was US\$ 38.96 for misoprostol and US\$ 119.15 for oxytocin	US\$ 42 and US\$ 129	95
Xia <i>et al.</i> , 2011 ^[28]	China	430	Mifepristone and misoprostol versus MVA	Third-party payer, 2 weeks	Mean costs of Surgical 367 Medical 279	US\$ 122 versus US\$ 93	54
Okeke Ogwulu <i>et al.</i> , 2021 ^[29]	England	711	Mifepristone and misoprostol versus misoprostol alone	UK's NHS, less than a year	Combination therapy saved ≤ 182 per successfully managed miscarriage	US\$ 256	100

*The "CCEMG: EPPI-Centre Cost Converter" (v. 1.6 last update: April 29, 2019) is a free web-based tool for adjusting estimates of cost expressed in one currency and price year to a specific target currency and price year. ICER=Incremental cost effectiveness ratio, EPPI=Evidence for policy and practice information, CCEMG=Campbell and Cochrane economics methods group, MVA=Manual vacuum aspiration, D and C=Dilation and curettage, DALY=Disability-adjusted life year, QALY=Quality-adjusted life year, WTP=Willingness to pay, NHS=National health service

Standards checklist.^[30] This tool has 24 questions that are used to assess the economic evaluation studies. Two researchers independently conducted the quality assessment. Studies with a score of above 85%, between 85% and 75%, between 75 and 55%, and below 55%, were categorized as “excellent,” “very good,” “good,” and “poor” quality, respectively [Table 1 and Appendix 2].

Data analysis

Endnote 8 software was used to organize studies and remove duplication. Required data were extracted based on key feature using a standard electronic form. The key features included the following: Study population, alternative options for comparison, time horizon, country and year of study, perspective, cost per QALY, cost saving, and incremental cost effectiveness ratio (ICER). Articles that met all of the inclusion criteria were retained for full-text review. The latest web-based tool adjusted the estimates of costs expressed in one specific currency and price year into a specific target currency (the year 2020 US\$).

Heterogeneity and subgroup analysis

In order to make sensible decisions or making particular comparisons, the clinical and methodological variation across studies associated with the participants, interventions, outcomes, and study design were taken into consideration in discussion section. Furthermore, we preferred not to pooling the studies result as a meta-analysis study. To ensure provide a clinically meaningful answer, the similar enough studies subgrouped and qualitatively investigated.

Results

Description of identified articles

Overall, 538 records were retrieved (PubMed: 144, Scopus: 74, Web of Science: 91, Embase: 47, Cochrane library: 20, ProQuest: 14, ScienceDirect: 34, Google Scholar: 114). Totally, 538 articles were initially identified by designated electronic databases search. About 196 articles were duplicated and were removed. Of the remaining 342 articles, 294 records as well as additional 6 records were excluded given the irrelevant titles and abstracts, leaving 42 articles eligible for full-text review. Another 22 studies were further excluded after reviewing the full text of the retrieved articles with reasons (studies were related to abnormal pregnancies, gestational trophoblastic, contraception, like IUD interventions, neoplasm, not economic evaluation studies). Finally, 20 articles were included in this systematic review. Study selection procedures are summarized in the PRISMA flow diagram [Figure 1].

General characteristics of the studies

The characteristics of the selected studies were summarized as follows; author and year of study,

country, sample size, intervention and alternatives for comparison, perspective and time horizon, and the incremental cost-effectiveness ratio (or cost per QALY or cost saving). Reviewed studies had been conducted from 2005 to 2021. Among the reviewed studies, three studies investigated cost-minimization analysis, three studies investigated cost-utility analysis, and 14 studies investigated cost-effectiveness analysis. The characteristics of the twenty studies included in this review were summarized in Table 1.

The largest and smallest sample sizes were 98 patients^[23] and 150,000 patients,^[27] respectively. About 70% of the studies (14 studies) received a score of above 85% and had “excellent” quality and had very low risk of bias^[1,7,9,14,15,17-23,27,29] [Appendix 2]. Five studies had been conducted in the United States.^[7,9,13,14,26] Other studies conducted in Spain,^[15] Malawi, Pakistan and Tanzania,^[16] Uganda,^[16,22] Netherlands,^[17,20] Nigeria,^[18,24] Ghana,^[18] Mexico,^[1] Canada,^[19] South Africa,^[21] Finland,^[23] England,^[25] Senegal,^[27] and China.^[28]

Included cost categories

Costs included in the studies were categorized into three type; direct medical costs (e.g., Antibiotics, medications, anesthesia, ultrasounds, surgery, diagnostic, laboratory, visits, consumables, equipment, staffing, supplies, side effects, bleeding, infection, pain control, and hospitalization costs), Direct nonmedical costs (e.g., transportation, training, and family costs), and indirect costs (e.g., patient time costs and productivity loss).

Cost-effectiveness analysis

We examined the economic evaluation conclusions by specific treatments and study perspectives [Table 1]. The comparison of medical with surgical abortion was most frequently studied, accounting for 10 (50%) of the 20 studies included in this review. Medical abortion was cost-effective and cost-saving option in compare to the surgical abortion in all of these studies and across all perspectives.) Medical abortion (Misoprostol) saved US\$ 6 to US\$ 2,373 per patient’s costs in South Africa^[21] and Spain,^[15] respectively. Also, ICER ranged from US\$ 419 to US\$ 4,044 in Nigeria^[24] and United States,^[9] respectively.

Discussion

To our knowledge, the present systematic review is a first attempt to comprehensively examines the results of economic evaluation studies on pregnancy termination management interventions. In this review, taking into account all economic evaluation methods, including cost-effectiveness analysis, cost-utility analysis, cost-benefit analysis as well as cost-minimization analysis, as well as we investigated all patient’s situations, including induced abortion, managing incomplete

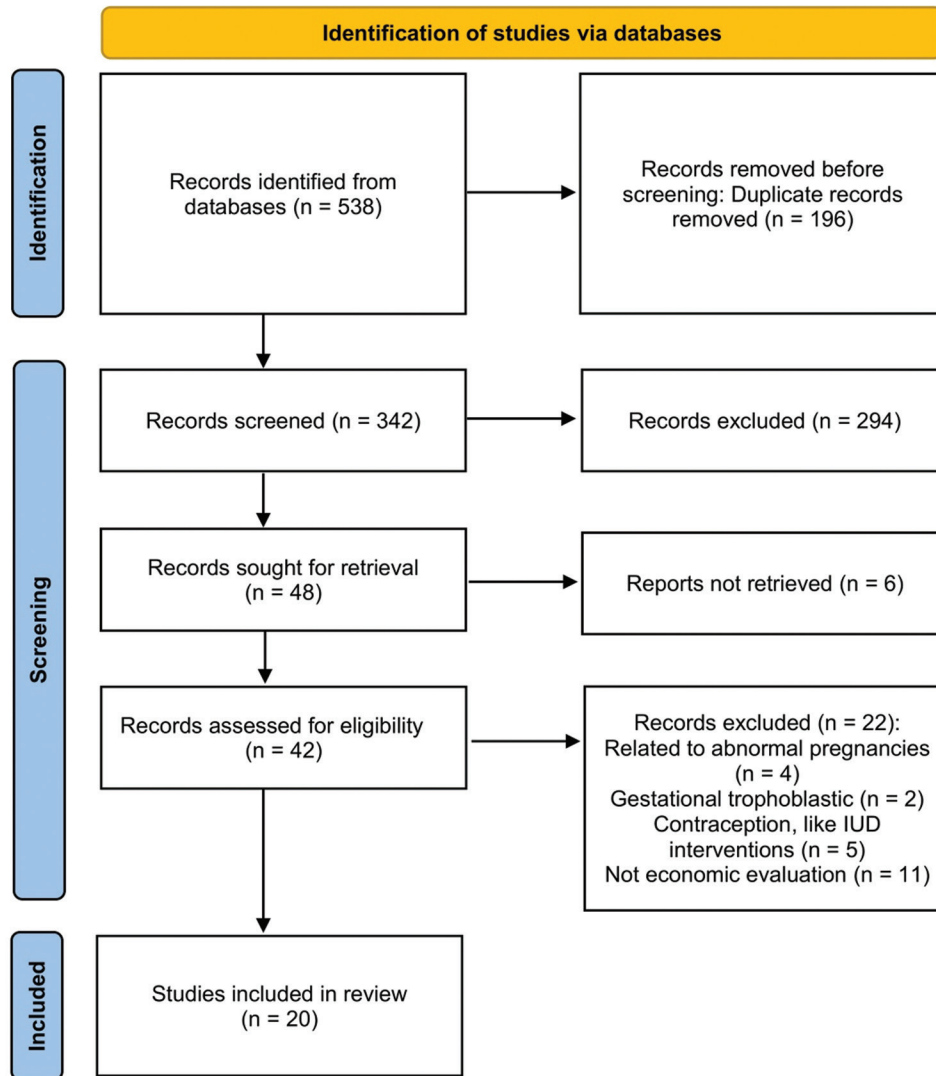


Figure 1: PRISMA flowchart

evacuation, control postpartum hemorrhage, treatment of spontaneous abortion, treatment of early pregnancy failure, management of miscarriage, nonviable early pregnancy management, and management of early pregnancy loss.

Medical versus surgical strategies

According to the results of Nava *et al.* study, medical treatment had success rates higher than 80%, mild side effects, controllable complications with additional medication, and the high degree of satisfaction. The final cost for medical treatment with misoprostol represents dramatically cost saving per patient in Spain.^[15] Lince *et al.* provided supporting evidence on scaling up of medical pregnancy termination alongside existing manual vacuum aspiration services in South Africa.^[21] In another randomized-based cost analysis study in low resource settings concluded that medical treatment of incomplete miscarriage is cost effective

method with higher client acceptance and satisfaction than surgical management. However, both medical and surgical methods were effective treatment options for first-trimester incomplete miscarriage in this study.^[24] Other studies have demonstrated the economic advantage of medical over the traditional surgical management methods.^[9] However, no cost difference has been found between two methods in a cost minimization analysis by Xia *et al.*^[28] Niinimaki *et al.* concluded that neither of medical and surgical method was economically superior or more cost effective in Finland.^[23]

Monotherapy versus combination therapy

Berkley *et al.* strongly verified that pretreatment with mifepristone followed by misoprostol offered a significant cost advantage over monotherapy and resulted in higher completion rate of pregnancy termination and shorter treatment time for medical management of miscarriage than treatment with misoprostol alone.^[13] This result is

consistent with what has been found by Hunter *et al.* They have demonstrated that statistical models showed a 61.3% chance that mifepristone plus misoprostol was more cost effective than surgical pregnancy termination, as well as a 90.8% chance that it was more cost effective than methotrexate plus misoprostol.^[19] These findings were broadly in line with pattern of results was obtained in Nagendra *et al.* study. They have shown that mifepristone pretreatment is a cost-effective option for women seeking medical management for early pregnancy loss cares. However, they reported not only cost concerns but also difficulties in accessing this highly effective regimen.^[7] Another trial-based economic evaluation analysis found that based on cost-effectiveness grounds, Mifepristone misoprostol combination intervention dominated the use of misoprostol alone and is more likely to be recommended by decision-makers for the medical management of women presenting with a missed miscarriage.^[29] Overall, these findings are in accordance with a previously published trial-based report on medical methods of abortion by Cochran Collaboration. This report states that available medical abortion methods are safe and effective and combined regimens are more effective than single agents.^[31]

Postpartum hemorrhage control

World Health Organization estimates that there are 14 million obstetric hemorrhages every year, and postpartum hemorrhage is the most common cause of maternal death worldwide.^[32] Bradley *et al.* suggested that training traditional birth attendants to administer misoprostol for the treatment of postpartum hemorrhage has the potential to both save millions of dollars in countries with limited health resources, particularly in sub-Saharan Africa, and improve the mother's health across the developing world.^[14] Prenatal distribution of misoprostol has been reported to be potentially cost effective in Uganda, and authors suggested that it should be considered for national level scale up for prevention of postpartum hemorrhage.^[22] Vlassoff *et al.* demonstrated that despite equally efficacy of misoprostol and oxytocin in reducing postpartum hemorrhage, the misoprostol was more cost effective in rural health settings.^[27] A similar pattern of results was obtained by Sutherland *et al.* They showed that misoprostol was cost-effective for the prevention of postpartum hemorrhage among women who give cares at home in India.^[26]

Antibiotic prophylaxis

Upper genital tract infection, including the uterus and fallopian tubes, can cause complications after induced abortion and antibiotics given around the time of the pregnancy termination (prophylaxis) could prevent these related complications.^[33] Routinely using antibiotic prophylaxis before surgical miscarriage management in order to prevent the infection complications was reported

more effective and less expensive in less developed setting and would save millions of dollars for health-care systems.^[4,16]

Expectant management as an intervention

Expectant management that defined as accurate diagnosis, counseling, 24/7 telephone advice, follow-ups and waiting for the miscarriage to happen by itself naturally,^[34] has been compared with medical and surgical interventions in order to the treatment of incomplete evacuations in two studies. Finally, discordant results have been reported on the probability of being cost effective by two authors.^[20,25] Thus, more studies are needed for identifying miscarriages suitable for expectant management. In addition, according to the results of Graziosi *et al.* the misoprostol medical treatment is less costly than curettage for early pregnancy failure after failed expectant management.^[17]

Limitation and recommendation

The strength of our review is that the included studies performed in developed countries and low- and middle-income countries and almost of studies derived their required data from relatively large trials with a high number of populations. Hence, the results are relatively generalizable and possible to comparison in order to achieve a coherent conclusion. The availability of such detailed evidence certainly will assist informed decision making and facilitated the best possible use and create maximum benefits of available resources. A limitation of this systematic review was the inclusion of only English evidence because of our limited capacity to understand non-English languages. However, avoiding to quantitatively pooling the results of included studies through a meta-analysis study because of diversity of models used and different currencies used is another limitation of this review. The availability of such detailed evidences certainly will assist informed decision making and facilitated the best possible use and create maximum benefits of available resources. Developing a comprehensive guidance handbook for all situations of abortion and pregnancy termination procedures based on economic evaluation evidence, highlighting priority areas where information from economic evaluation studies would be most useful, and training researchers, policymakers, and pregnancy termination care providers in the use of economic data are strongly desired.

Conclusion

The present study, which systematically reviewed twenty authentic studies, showed that, based on various economic and clinical effectiveness, decision-making criteria used in various studies of health economic evaluation showed that the majority of research provided evidence on the advantage of pharmaceutical methods

compared to surgical methods, as well as the advantages of using combination therapy compared to single therapeutic interventions. The higher completion rate in combination therapy leads to reduce in time spent on treatment, office visits and need for surgical management for persistent pregnancies, which significantly reduces the overall costs of procedures.

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Ethical consideration

Ethical issues Including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc., have been completely observed by the authors.

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Conflicts of interest

There are no conflicts of interest.

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Appendix 1: Sample search strategies developed using Boolean operators

Database Strategy

PubMed	"Cost-Benefit Analysis"[Mesh Terms] OR "economic evaluation"[Title/Abstract] OR "Cost Effectiveness Analysis" [Title/Abstract] OR "Cost Utility Analysis" [Title/Abstract] OR "economic study"[Title/Abstract] OR incremental cost effectiveness"[Title/Abstract] OR "cost saving"[Title/Abstract] AND "Abortion, Induced/economics"[Mesh Terms] OR "Abortion, Induced/methods"[Mesh Terms] OR "Vacuum Curettage/economics"[Mesh Terms] OR "Vacuum Curettage/methods"[Mesh Terms] OR "Vacuum Curettage/therapeutic use"[Mesh Terms] OR "Mifepristone/administration and dosage"[Mesh Terms] OR "Mifepristone/economics"[Mesh Terms] OR "Mifepristone/therapeutic use"[Mesh Terms] OR "Misoprostol/administration and dosage"[Mesh Terms] OR "Misoprostol/economics"[Mesh Terms] OR "Misoprostol/therapeutic use"[Mesh Terms] OR "Manual Vacuum Aspiration" [Title/Abstract] OR "Vacuum Curettage" [Title/Abstract] OR "Medical Abortion" [Title/Abstract]
Embase	('induced abortion'/exp OR 'vacuum aspiration'/exp OR 'mifepristone'/exp OR 'misoprostol'/exp OR 'medical abortion'/exp) AND ('cost benefit analysis'/exp OR 'economic evaluation'/exp OR 'cost effectiveness analysis'/exp OR 'cost utility analysis'/exp OR 'incremental cost effectiveness ratio'/exp) AND ('first trimester pregnancy'/exp)
Scopus	TITLE-ABS (induced abortion) OR TITLE-ABS (vacuum aspiration) OR TITLE-ABS (Mifepristone) OR TITLE-ABS (Misoprostol) OR TITLE (medical abortion) AND TITLE (cost benefit analysis) OR TITLE-ABS (economic evaluation) OR TITLE (cost effectiveness analysis) OR TITLE (cost utility analysis) OR TITLE (incremental cost effectiveness ratio) OR TITLE (cost minimization analysis)

Appendix 2: Risk of bias and quality assessment results

Item	Berkley	Bradley	Nava	Goranitis	Graziosi	Delphine	Delphine	Lince	Lubinga	Nagendra	Niinimaki	Nwafor	Petrou	Reusch	Sutherland	Vlasoff	Xai	Ogwulu
1. Title identify the study as an economic evaluation	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	×	✓	✓	✓	✓	✓	✓
2. Structured abstract	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
3. Introduction Provide study questions	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
4. Population characteristics	✓	✓	✓	✓	✓	✓	✓	×	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
5. Setting and location	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
6. Study perspective	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
7. Comparators described	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
8. Time horizon	✓	✓	✓	✓	✓	✓	✓	×	✓	✓	×	✓	✓	✓	✓	✓	✓	✓
9. Discount rate	×	-	-	×	✓	-	×	×	✓	×	-	×	×	-	✓	-	-	-
10. Choice of health outcomes	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
11. Measurement of effectiveness	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	×	✓
12. Measurement and valuation of preference based outcomes	×	×	×	×	✓	✓	×	✓	✓	✓	×	✓	×	×	×	×	×	✓
13. Estimating resources and costs	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
14. Currency, price date, and conversion	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	×	✓	✓	✓	✓	✓	✓
15. Choice of model reasons	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	×	✓	✓	✓	×	✓
16. Assumptions	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	×	×	×	✓	✓	✓	×	✓
17. Describe Analytical methods	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	×	✓
18. Study parameters. Inputs showed in table	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	×	✓
19. Incremental costs and outcomes	×	✓	-	×	✓	✓	×	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
20. Characterizing uncertainty	✓	✓	×	✓	✓	✓	✓	✓	✓	✓	✓	×	✓	✓	✓	✓	×	✓
21. Characterizing heterogeneity	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	×	✓
22. Study findings, limitations, generalizability and current knowledge	✓	×	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	×	✓
23. Source of funding	×	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	×	✓	✓	×	✓
24. Conflicts of interest	×	×	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	×	×	✓	✓	×	✓
Total score	19	20	20	21	18	22	21	22	21	23	20	19	19	20	18	22	12	23
Percentage (%)	79	86	90	91	78	91	100	87	91	95	86	82	79	86	75	95	54	100