BKM Public Health & Community Medicine
(Berita Kedokteran Masyarakat)

Volume 39 **Number** 9, 2023, **Pages** e9594
DOI: 10.22146/bkm.v39i09.9594

Comparing cost-effectiveness of implant and IUD contraception in women: a systematic review

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Abstract

Purpose: The use of long-acting reversible contraception (LARC) methods, implants, and IUDs, are assessed for cost-effectiveness, which compares cost-effectiveness in technology, environment, and health. The aim is to critically evaluate the economic evaluation of IUDs and implants based on previous scientific evidence, with a review to discuss cost-effectiveness. **Methods:** The literature review used was a systematic review, and PRISMA-SR 2020 was chosen as a reference for preparing the literature study. The authors used three databases, PubMed, Science Direct, and Wiley, to find scientific evidence of the cost-effectiveness of IUDs and implants. **Results:** The search in Pubmed (n=119), ScienceDirect (n=1,228), and Wiley (n=83) databases included (n=1,510) articles. Eighty-two articles were assessed for eligibility, and only seven were eligible according to the inclusion criteria for further review. **Conclusion:** IUDs and implants are two highly effective long-term contraceptive methods for preventing pregnancy, so using IUDs is more cost-effective than implant contraception based on scientific articles that meet the inclusion criteria.

Keywords: cost-effectiveness; implant; IUD contraception; review

Submitted:
August 25th, 2023
Accepted:
September 20th, 2023
Published:
September 27th, 2023

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INTRODUCTION

Worldwide, 41% of pregnancies are unplanned. The reported figures in the US and UK are 49% and 41%, respectively. There are no accurate statistics on women's pregnancy intentions in Australia. Australian women revealed that 51% had experienced an unintended pregnancy at some point [1].

The intrauterine device (IUD) stands out as an exceptionally efficient contraceptive, with a success rate surpassing 99%. It's the chosen method for roughly 4% of UK women in their reproductive years. Notably, the IUD can be inserted shortly after childbirth, specifically within 10 minutes post placenta delivery, offering instant and reliable contraception[2]. This user-independent method is favored for its low failure rate of less than 1%[3]. Moreover, the contraceptive implant, a diminutive cylindrical plastic rod, measuring 2 mm in diameter and 4 cm in length, is discreet and imperceptible once placed in the arm. It consistently dispenses micro-progestin into the bloodstream, maintaining a striking 99.9% efficacy for up to three years, with the minor failure risk mostly linked to occasional errors during its insertion[4].

Cost-effectiveness is a metric used to assess how well a policy, program, or intervention achieves a particular goal in the most time- and money-efficient way. In this sense, effectiveness refers to how well the goal is achieved, while cost relates to the resources needed to achieve the goal [2]. The idea of cost-effectiveness is used in various industries,

including technology, environment, health, and education. Finding the most beneficial and cost-effective way to achieve a particular goal is the goal of cost-effectiveness analysis [3].

To address this topic, assessing the cost-effectiveness of Long-Acting Reversible Contraceptives (LARCs) against other contraceptive methods is crucial. LARCs are not only cost-effective but also offer long-term financial savings. It's important to rigorously evaluate the quality of data used in such assessments, particularly since cost implications might not be as universally applicable as clinical outcomes, like the prevention of unintended pregnancies, observed in international studies[4]. This study aims to critically examine and analyze relevant published literature on the subject.

METHODS

In this study, two independent reviewers, NM and SA, utilized the CHEERS checklist to evaluate the quality of reporting in each research article, assigning scores ranging from 0 (not reported) to 1 (fully reported), with the inclusion of a 'not available' (NA) option. Their consensus-based approach aimed to critically assess the reviews' quality. The systematic review and PRISMA-SR 2020, known for its comprehensive checklist, served as a guideline for literature study preparation[8].

The research methodology involved using the PICO framework, encompassing a broad female population, with a focus on implantable contraception and comparison with IUDs. The study's emphasis was on cost-effectiveness and quality of life per year. KD and JU carried out the literature search across PubMed, Science Direct, and Wiley databases, using keyword combinations aligned with PICO. The final database search was completed on July 15, 2023.

Article selection criteria

Inclusion criteria in the selection of articles are (1) English language, (2) Cost and benefit effectiveness on contraceptive implants and Intrauterine Devices (IUD), (3) Original articles, and (4) full-text. Exclusion criteria in this literature are (1) Review articles, (2) Case reports, and (3) Books, theses, and dissertations.

Data extraction

JU and KD used Mendeley applications to extract the data and cross-check it between the authors. Data extracted included the type of article published, population parameters, and economic evaluation outcomes in each reported population. The authors independently applied inclusion and exclusion criteria for eligible pieces, including screening titles, abstracts, and full text.

Recorded extracted article data for data collection, including the year and article design, population demographics, contraceptive implant and IUD use (insertion procedures and costs), average hospital and patient costs, and outcome data. Assessed article characteristics, including model, economic evaluation type, cost and effectiveness reporting source, discounts, perspective on outcomes, and sensitivity analysis. The types of economic evaluation applied in this study were cost-effectiveness analysis (CEA) and quality of life per year (QALY). The research designs used in this study include trial-based, observational studies, and various cost-effectiveness research models.

Database search results on Pubmed (n=119), Science Direct (n=1,228), and Wiley (n=83), with a total of (n=1,510) articles obtained. Articles that were removed duplicates were (n=313) articles and (n=1,197) articles included in the title, while (n=1,010) were excluded. (n=187) articles were excluded, and (n=105) were included based on the abstract. A total of (n=82) articles were assessed for eligibility. Then, articles were excluded based on irrelevant articles (n=72) and nonessential population (n=2), and only seven articles were eligible according to the inclusion criteria.

Table 1. PICO Framework

Population	Intervention	Comparison	Outcome
Women OR Woman OR female	Implanon OR Nexplanon OR Etonogestrel OR Contraceptives, implant OR Ketodesogestrel OR Etonogestrel Subdermal OR Contraceptive Implant	IUD OR Intrauterine device OR Contraceptive intrauterine device OR LNG-IUD OR Levonorgestrel OR Intrauterine Device	Cost-effectiveness analysis OR Cost-Effectiveness OR Cost OR Effectiveness OR Cost Effectiveness OR Cost-utility analysis

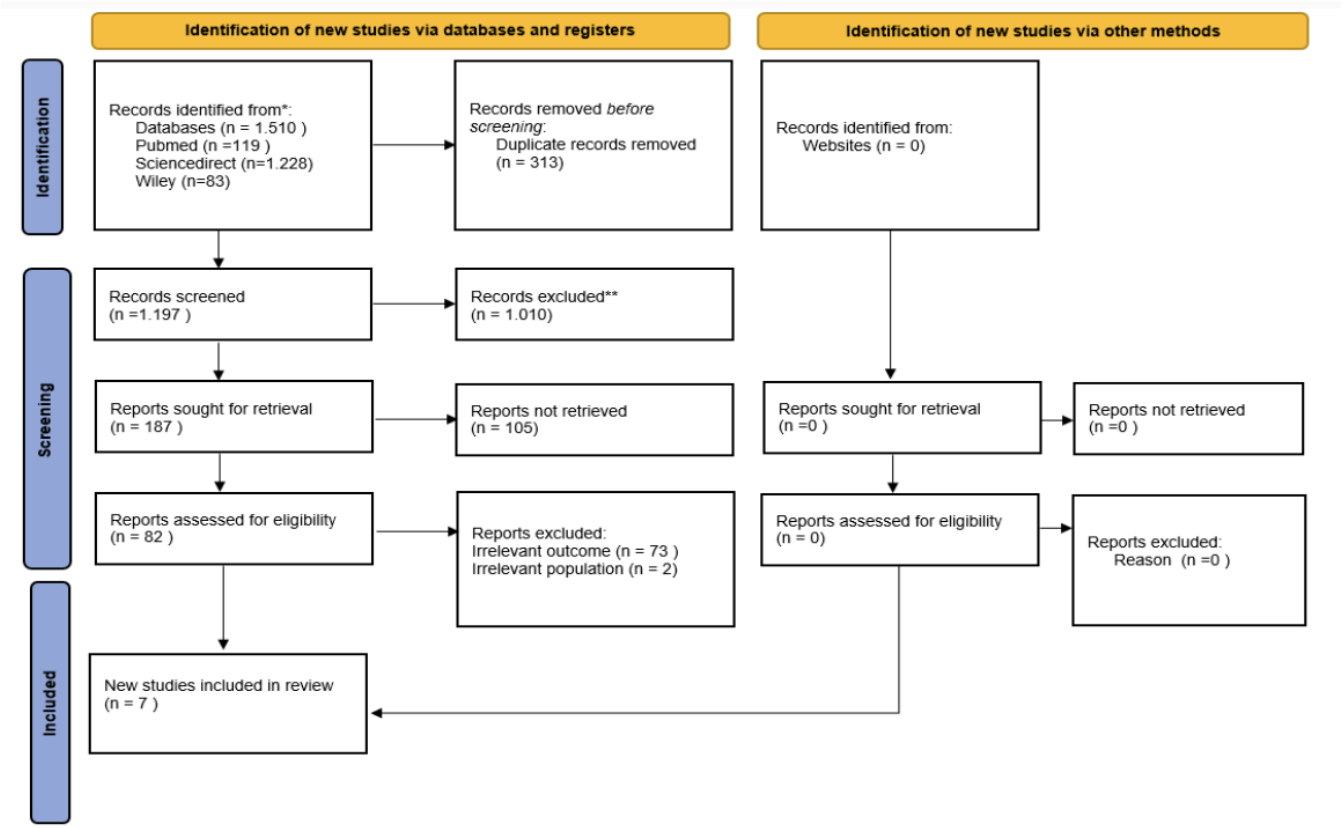

Figure 1. PRISMA Flow Chart

RESULTS

Table 2 shows a summary of the characteristics of the included studies. Of the seven articles by country, one piece was found to have a CHEERS value below 17, namely the article [11] with the decision-analytic model.

Table 3. Once the selection is made, the researcher will summarize detailed and relevant information based on the characteristics of the research material. The researcher performed data mapping by creating appropriate tables of the characteristics of the literature review of the results of the cost-effectiveness analysis. All articles found perspective and time horizon showed payer a with time horizon. Economic evaluation type with CEA and consequences as many as four pieces with QALYs, and two did not obtain outcome measures.

A scoring tool from the CHEERS checklist for evaluating economic evaluations was used to look at English-language studies from 2008 to 2021 that compared the cost-effectiveness of implants and IUDs (LARC method). The seven articles (n=7) were model-based and primary studies, respectively; six articles (n=6) were decision analytic, one-way sensitivity analyses, and a decision tree; and one (n=1) was a primary cohort study.

The studies were conducted from various locations in the developed countries of the UK (n=4), Sweden (n=1), and the US (n=3), with participants being adolescents, women at risk of unintended pregnancy, giving birth after one year postpartum, and women who wanted postpartum contraceptive insertion.

Critical appraisal of results

The initial seven articles identified were selected and included in the systematic review. All model-based studies met the decision to include studies that scored above 10. The primary articles obtained were included in the assessment criteria, and the CHEERS checklist was used in seven pieces. Article A1 scored 21 out of 28, Article A2 scored 23 out of 28, Article A3 scored 20.5 out of 28, Article A4 scored 17 out of 28, A5 scored 21.5 out of 28, Article A6 scored 16 out of 28, and Paper A7 scored 20 out of 28.

Table 2. Study Characteristics

Author/ Year	Country	Participant	Model	CHEERS
[2]	UK	The target group for this study includes UK women who are considering a postpartum intrauterine device (IUD), meet the criteria for having it placed at the time of childbirth, and are assessed as having a low risk of sexually transmitted infections (STIs).	A decision tree	21/28
[9]	USA	Every couple who used contraception within the analysis's time frame.	Markov model	23/28
[10]	Sweden	Women utilizing reversible contraception who are at risk of an unplanned pregnancy.	Markov cohort model	20,5/28
[11]	U.S	Women of childbirth to one year postpartum.	Decision-analytic model	17/28
[12]	UK	The evaluation involved tracking six hypothetical groups, each comprising 1,000 sexually active women of childbearing age. These cohorts were observed over a period ranging from one to fifteen years, with each group using one of the six recommended contraceptive methods.	A decision-analytic model	21,5/28
[13]	UK	The analysis involved reviewing the medical records of patients who received the Implanon implant in 2003 at Gwent clinics. This review spanned from the time of implant insertion to its removal, covering a period of up to 36 months, and included 400 cases. However, 28 cases were excluded from the study due to insufficient identification information.	Actual cost calculation	16/28
[3]	US	A 16-year-old patient who sought care and wanted LARC was our basic case.	Decision tree model	20/28

Main findings

The economic evaluations found in the seven articles used three forms of currency: dollars ($), euros (£), and Swedish krona (SEK). All coins were converted to US dollars, and the most common cost analysis examined the cost-effectiveness of (n=6) articles, while (n=1) reports only described IUD use in general. One article included overall LARC costs without specifically comparing implant and IUD costs. Three reported cost-effectiveness studies compared IUD and implant costs with a difference in the cost difference.

Economic evaluation

The various modeled and primary studies in the article found the cost of IUD insertion had an additional charge of $138, and implants were not measured in this study; the time horizon was within one year (A1). An additional $1,531 expense, which results in an ICER of $3828 (A2), sets apart IUD and implant use. In Sweden, implants and IUDs had a difference and additional charge of $82.67 over a 3-year time horizon (A3).

Immediate and delayed implantation had an additional cost of $441 and an ICER of $2304 at a 3-year time horizon (A4). The 15-year time horizon for comparing implants and IUDs was $13,206, meaning intervention and control groups. We found no difference in demographic characteristics among the two groups. The intervention group participants had significantly more use of LARCs in the three months following birth compared to controls (52% versus 31%; p.05). Before hospital release following birth, brief structured LARC-focused counseling dramatically boosted LARC technique usage at three months postpartum [19].

DISCUSSION

High user satisfaction and persistence levels have been seen among IUD users in high-income nations. Women who use IUD contraception have a high proportion of satisfaction in Madagascar, Nigeria, and Zambia. [20]. IUD usage varies depending on the program setting, indicating that women of any age, educational level, marital position, or parity may find the technique appealing.

The IUD is the only extensively used long-acting form of birth control in Vietnam. 52.1% of married women use IUDs, which comprise more than half of total contraceptive use nationwide. Women who stay at home in Vietnam are less likely to stop using IUDs than women who work in government or business, farming, or other occupations [21].

The IUD, a widely utilized LARC)worldwide[22], is supported by scientific evidence for its safety and cost-effectiveness. It outperforms contraceptive pills, patches, and rings in preventing pregnancy[23]. However, despite its global popularity, there is a concerning trend of inadequate adoption by women, as indicated by the assessment of IUD uptake[24].

Table 3. Cost-effectiveness analyses results

Author-Year	Intervention	Cost measurement	Results
[2]	Intervention: Immediate Comparison: Routine Perspective and time horison: Payer, time of one year Evaluation type: CEA Consequences: QALY Outcome measures: ICER	Cost related to IUD insertion, Cost on typical contraceptive methods, Unforeseen pregnancy costs while using IUD, Cost associated with unintended pregnancy when using standard contraception or male condoms.	Immediate: $453,8 Routine: $315,53 Incremental cost: $138 The assessment resulted in an Incremental Cost-Effectiveness Ratio (ICER) of $23,933.49. This figure implies cost savings of $23,539.07 for each Quality-Adjusted Life Year (QALY) gained through the immediate placement strategy.
[9]	Intervention: IUD Comparison: Implanon Perspective and time horizon: payer with 5 years of time horizon. Evaluation type: CEA Consequences: NA Outcome measures: ICER	The expenses related to contraceptive medication and equipment were determined using data from Multum, Medi-Span, and the 2007 Thomson Red Book average wholesale price (AWP). To reflect the likely costs for health service payers, the model incorporated prices set at AWP-15% for drug acquisition. This approach was also applied to calculate the costs of medical services, which encompassed device expenses.	IUD: $647 Implant: $2.178 Incremental cost: $1.531 The results of the analysis yielded ICER of Implant is $3828, and IUD is $1415 additional percentage point of effectiveness, respectively.
[10]	Intervention: LNG-IUS 13.5 mg Comparison: Implant Perspective and time horison: Payer with a time horizon of 3 years Evaluation type: CEA Consequences: QALY Outcome measures: ICER	Survey data is used as a standardized gauge of health-related quality of life. The incremental cost per unwanted pregnancy avoided was used to measure cost-effectiveness. Additionally, it computed the incremental cost per quality-adjusted life year.	Implant: $99,23 IUD: $16,56 Incremental cost: $82,67 Among women aged 20–29, the LNG-IUS 13.5 mg continued to exhibit cost-effectiveness compared to oral contraceptives (OC). This translated into fewer unintended pregnancies (242), increased Quality-Adjusted Life Years (QALYs) by 1.39, and reduced costs amounting to $264,732.13.
[11]	Intervention: Immediate postpartum etonogestrel implant insertion Comparison: Delayed insertion of etonogestrel implant; Perspective and time horison: Payer with a time horizon of 3 years; Evaluation type: CEA; Consequences: NA Outcome measures: ICER	Direct medical expenses per patient	IUD:-; Implant:- Immediate insertion: $1,091/patient; delayed insertion: $650/patient; Incremental cost: $441 $2,304 in ICER for each pregnancy avoided. Immediate implant placement is anticipated to save each patient $1,263 when accounting for the medical expenses of unplanned pregnancies that could be prevented.

[12]	Intervention: LARC method Comparison: Contraceptive pill (COC) Perspective and time horison: Payer with a time horizon of 15 years Evaluation type: CEA Consequences: NA Outcome measures: ICER	Costs were calculated from the NHS's point of view. They covered the price of providing contraceptives as well as expenses related to unplanned pregnancy outcomes. Ingredients, medical experts' time, and equipment for IUD, LNG-IUS, and implant insertion and removal were all included in the price of the contraceptive provision.	LARC methods were found to be more effective and less costly compared to COC. Female sterilization dominated LARC methods beyond 5 years of contraceptive protection. Among LARC methods, DMPA and LNG-IUS were the least cost-effective. The etonogestrel implant was the most effective LARC method compared to IUD, the cheapest LARC method.
[13]	Intervention: Implanon Comparison: NICE Clinical Guideline 30 on LARC Perspective and time horison: Payer with a time horizon of three years Evaluation type: Costing Consequences: Financial implication Outcome measures: NA	Implant cost Cost of implant insertion Cost of implant removal due to side effects Cost of medication due to side effects Pregnancy test cost Doctor consultation fee Nurse assistance fee Doctor training fee	Fees for insertion and removal + additional visits + prescription + pregnancy or Cost of removal under general anesthesia: $79683,40; Indirect costs: training costs: $4539,89; Pre-insertion visit: $982,34; Total cost per patient: $171,50; Annualized cost per patient; Incremental cost: $73.904,78 This analysis offers implant use at a lower cost than NICE guidelines, at an average annual price of 25%.
[3]	Intervention: Same-day access to LARC Comparison: LARC placement at a subsequent visit Perspective and time horison: Payer with a time horizon of one years; Evaluation type: CMA; Consequences: Pregnancy outcomes; Outcome measures: Cost of pregnancy outcomes	Patient cost per year First visit cost Cost of increased savings cost improvement savings Cost of LARC removal	Average patient cost per year: $4.133; First visit cost: $2.117; Cost of increased savings: $4.692; LARC removal cost: $24.487; Incremental cost: $13.545 The analysis shows that LARC insertion on the first day is more likely to save money than on the second. This finding is more straightforward and traditional in decision-analytic and sensitivity models.

Numerous studies have identified three fundamental problems that contribute to low IUD uptake: a lack of qualified medical professionals, infrastructure issues in the healthcare system, and user factors, particularly user factors related to user fear of side effects [25], given that the IUD is a reliable, secure, and effective method of birth control. IUD use is still low, though, and the government must raise provider performance and training, enhance service delivery, update and expand information, conduct clinical and programmatic research, broaden access, and streamline interventions if it hopes to see an increase in IUD use [22,26].

The IUD is a widely accepted contraceptive method in Indonesia and a key component of government efforts to manage population growth. The Family Planning Program, initiated in 1970, aims to control population growth, reduce maternal and infant mortality related to unintended pregnancies, and has evolved with advancements in science and technology, gaining increased attention from various sectors[27].

CONCLUSION

IUDs and implants are two highly effective long-term contraceptive methods for preventing pregnancy. However, in terms of cost, in some articles compared, IUDs can be more cost-effective than implants. The general cost-effectiveness results were 57% for IUDs and 28.5% for implants.

RECOMMENDATIONS

Further investigation is required to ascertain the cost-effectiveness of employing implant contraceptives. Moreover, it is worth noting that the studies conducted on cost-effectiveness have predominantly focused on developed countries. Therefore, it is imperative to do research in poor countries, given their inherent challenges of inadequate resources within the healthcare sector. Cost-effectiveness research is crucial in determining the optimal contraceptive techniques that offer the highest health benefits while minimizing costs. In this manner, allocating limited resources can be optimized to enhance the efficiency of broader reproductive health initiatives.

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