GYNECOLOGY

Cost-effectiveness of emergency contraception options over 1 year

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BACKGROUND: The copper intrauterine device is the most effective form of emergency contraception and can also provide long-term contraception. The levonorgestrel intrauterine device has also been studied in combination with oral levonorgestrel for women seeking emergency contraception. However, intrauterine devices have higher up-front costs than oral methods, such as ulipristal acetate and levonorgestrel. Health care payers and decision makers (eg, health care insurers, government programs) with financial constraints must determine if the increased effectiveness of intrauterine device emergency contraception methods are worth the additional costs.

OBJECTIVE: We sought to compare the cost-effectiveness of 4 emergency contraception strategies—ulipristal acetate, oral levonorgestrel, copper intrauterine device, and oral levonorgestrel plus same-day levonorgestrel intrauterine device—over 1 year from a US payer perspective.

STUDY DESIGN: Costs (2017 US dollars) and pregnancies were estimated over 1 year using a Markov model of 1000 women seeking emergency contraception. Every 28-day cycle, the model estimated the predicted number of pregnancy outcomes (ie, live birth, ectopic pregnancy, spontaneous abortion, or induced abortion) resulting from emergency contraception failure and subsequent contraception use. Model inputs were derived from published literature and national sources. An emergency contraception strategy was considered cost-effective if the incremental cost-effectiveness ratio (ie, the cost to prevent 1 additional pregnancy) was less than the weighted average cost of pregnancy outcomes in the United States ($5167). The incremental cost-effectiveness ratios and probability of being the most cost-effective emergency contraception strategy were calculated from 1000 probabilistic model iterations. One-way sensitivity analyses were used to examine uncertainty in the cost of emergency contraception, subsequent contraception, and pregnancy outcomes as well as the model probabilities.

RESULTS: In 1000 women seeking emergency contraception, the model estimated direct medical costs of $1,228,000 and 137 unintended pregnancies with ulipristal acetate, compared to $1,279,000 and 150 unintended pregnancies with oral levonorgestrel, $1,376,000 and 61 unintended pregnancies with copper intrauterine devices, and $1,558,000 and 63 unintended pregnancies with oral levonorgestrel plus same-day levonorgestrel intrauterine device. The copper intrauterine device was the most cost-effective emergency contraception strategy in the majority (63.9%) of model iterations and, compared to ulipristal acetate, cost $1957 per additional pregnancy prevented. Model estimates were most sensitive to changes in the cost of the copper intrauterine device (with higher copper intrauterine device costs, oral levonorgestrel plus same-day levonorgestrel intrauterine device became the most cost-effective option) and the cost of a live birth (with lower-cost births, ulipristal acetate became the most cost-effective option). When the proportion of obese women in the population increased, the copper intrauterine device became even more most cost-effective.

CONCLUSION: Over 1 year, the copper intrauterine device is currently the most cost-effective emergency contraception option. Policy makers and health care insurance companies should consider the potential for long-term savings when women seeking emergency contraception can promptly obtain whatever contraceptive best meets their personal preferences and needs; this will require removing barriers and promoting access to intrauterine devices at emergency contraception visits.

Key words: cost-effectiveness analysis, emergency contraception, incremental cost-effectiveness ratio, intrauterine device

Introduction

Nearly half of all pregnancies in the United States are unintended.[1] Annually, unintended pregnancy costs the US health care system approximately $11 billion.[2,3] Among women seeking emergency contraception (EC), oral levonorgestrel (LNG) remains the most commonly used method due to lower up-front costs and over-the-counter availability. However, more effective forms of EC are available, including ulipristal acetate (UPA) and the copper T380 (Cu) intrauterine device (IUD).[2,4-6] In addition to being useful for EC, the Cu IUD can provide highly effective long-term contraception for up to 12 years.[2,6-9] While the Cu IUD has been well studied as EC, US women have a strong preference for the LNG IUD, which reduces menstrual bleeding.[10] The LNG IUD has been studied in combination with oral LNG EC for women seeking EC.[8] However, no IUD is currently labeled for use as EC, and women seeking EC are rarely offered the option of an IUD.[2,11]

Health care payers and decision makers, such as health care insurers and government programs, have been hesitant to allow use of IUDs for EC due in part to higher up-front cost and uncertainty about continued use of IUDs placed as EC.[2,11] Given their financial constraints, health care payers and decision makers must determine if the increased effectiveness of IUD EC methods are worth the additional costs.[5,6,8] Building on prior evaluations of contraceptive cost-effectiveness, this

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study assessed the cost-effectiveness of 4 EC methods (ie, oral LNG, UPA, Cu IUD, and oral LNG + LNG IUD) from a US payer perspective over a 1-year time horizon.

Materials and Methods

Model description and analysis

We developed a decision analytic model using TreeAge Pro 2017 (TreeAge software, Williamstown, MA) to examine the cost-effectiveness of EC in a population of women of childbearing age presenting to a clinical setting for EC after an unprotected sexual encounter. We used a 28-day cycle length to represent menstrual cycles and included 13 cycles over the 1-year time horizon.

The decision analytic model estimated the costs and number of unintended pregnancies that would occur in 1000 women over 1 year for each EC strategy. We used the cost and pregnancy outcomes to calculate incremental cost-effectiveness ratios (ICERs), which are interpreted as the incremental cost to prevent 1 additional pregnancy, for each EC strategy. We also calculated incremental net monetary benefit, which rearranges the traditional ICER and directly incorporates willingness-to-pay (WTP) values (ie, how much one is willing to pay to prevent a pregnancy), to determine if the benefits of each strategy outweighed the costs (see online Appendix for detailed description of incremental net monetary benefit).[12] We used a weighted average cost of pregnancy outcomes in the United States of $5167, which was derived from the Healthcare Cost and Utilization Project (HCUP), as our WTP threshold.[13]

In our model, EC could either be successful in preventing pregnancy or fail (Figure 1). EC failure could result in an ectopic pregnancy, spontaneous abortion, induced abortion, or live birth. The Markov model consisted of health states based on pregnancy outcomes and continuing contraception use: (1) not pregnant and using contraception, (2) not pregnant and not using contraception, (3) ectopic pregnancy, (4) spontaneous abortion, (5) induced abortion, and (6) live birth. After EC, 3 continuing contraception groups, tiered by effectiveness, were included as separate health states. Highly effective (tier 1) methods included IUDs and contraceptive implants. While permanent contraception methods (ie, sterilization) are also highly effective, our model assumed all women used reversible contraception. Moderately effective (tier 2) methods included injectable, patch/ring, and oral contraceptives. Methods with the lowest effectiveness (tier 3) included condoms, diaphragm, sponge, fertility awareness methods, and withdrawal.

Women using an IUD as their EC method could continue using it for contraception. Those using oral EC methods could start using a tier-1, -2, or -3 contraceptive, or not use any contraception. Each cycle thereafter, women could: (1) continue their current contraception, (2) switch tiers, or (3) discontinue contraception (see Tables A1 and A2 for probabilities).

Model parameters

We derived EC effectiveness, continuing contraception effectiveness, and costs from published literature (see Table 1 and online Appendix for details of the search strategy and parameter synthesis as well as the probability of continuing contraception).[12] Oral LNG and UPA EC effectiveness estimates, stratified by body mass index (BMI), were derived from a meta-analysis comparing these oral EC methods.[4] We used Centers for Disease Control and Prevention epidemiological data to assign proportions for normal (<25 kg/m^2), overweight (25-29.9 kg/m^2), and obese (≥ 30 kg/m^2) BMI for women aged 20-34 years.[14] Cu IUD EC effectiveness estimates were obtained from randomized controlled trials and observational studies.[9,15,16] Only 1 study was found that examined the effectiveness of the oral LNG + LNG IUD as EC.[8]

We employed a US payer perspective for this analysis and thus included only direct medical costs (2017 US dollars) in the model. Costs were obtained from the HCUP diagnosis-related groups, the Centers for Medicare and Medicaid Services reimbursement fee schedule, Red Book online database average wholesale price, and published literature (see online Appendix for details on costs).[13,17,18] The mean EC costs used in the primary analysis were $29 for oral LNG, $43 for UPA, $887 for Cu IUD, and $917 for LNG IUD (Table 1).

Model assumptions

The model made the following assumptions: (1) pregnancy intentions remained stable over the 1-year time horizon; (2) women giving birth would not get pregnant again within 1 year; (3) women who discontinued contraception would not start again, except possibly after a pregnancy that did not result in a live birth[19,20]; (4) in keeping with a previous cost-effectiveness analysis, women with an ectopic pregnancy were assumed not to be at risk for pregnancy for 2 menstrual cycles[21]; (5) similarly, after a spontaneous or induced abortion women were assumed not to be at risk for pregnancy for 3 cycles[21]; (6) effectiveness estimates and probability of discontinuation accounted for contraceptive adherence; (7) side effects of contraception resulted in negligible direct medical costs; and (8) the effectiveness of oral EC decreased as BMI increased.[4]

Analysis

To incorporate the impact of uncertainty in the estimates for probability and cost inputs on model outcomes, we used a probabilistic approach for the primary analysis.[22] The probabilistic approach randomly draws values for each model parameter from predefined distributions to estimate costs and pregnancy outcomes for each EC strategy. The model then repeats this process 1000 times to give 1000 estimates of costs and pregnancy outcomes for each strategy, which are then used to estimate cost-effectiveness. We used beta distributions for probabilities and gamma distributions for costs. This approach allowed us to describe the uncertainty intervals (UIs) around direct medical cost and pregnancy outcomes as well as determine the probability that an EC strategy was the most cost-effective across a range of WTP thresholds.[22]

We performed several sensitivity and scenario analyses. We performed 1-way, deterministic sensitivity analyses, which