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Cost-effectiveness analysis of levonorgestrel-releasing intrauterine system (LNG-IUS) 13.5mg in contraception

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Abstract

Background—LNG-IUS 13.5mg (total content) is a low-dose levonorgestrel intrauterine system for up to three years of use. This analysis evaluated the cost-effectiveness of LNG-IUS 13.5mg in comparison with short-acting reversible contraceptive (SARC) methods in a cohort of young women in the US from a third-party payer's perspective.

Study Design—A state-transition model consisting of three mutually exclusive health states – initial method, unintended pregnancy (UP) and subsequent method – was developed. Cost-effectiveness of LNG-IUS 13.5mg was assessed versus SARC methods in a cohort of 1,000 women aged 20–29 years. SARC methods comprise oral contraceptives (OC), ring, patch and injections which are the methods commonly used by this cohort. Failure and discontinuation probabilities were based on published literature, contraceptive uptake was determined by the most recent data from the National Survey of Family Growth and costs were taken from standard US databases. One-way sensitivity analysis was conducted around key inputs while scenario analysis assessed a comparison between LNG-IUS 13.5mg and the existing IUS, LNG-IUS 20mcg/24 hours. The key model output was cost per UP avoided.

Results—Compared to SARC methods, initiating contraception with LNG-IUS 13.5mg resulted in fewer UP (64 UP vs. 276 UP) and lower total costs ($1,283,479 USD vs. $1,862,633 USD, a 31% saving) over the three-year time horizon. Results were most sensitive to the probability of failure on OC, the probability of LNG-IUS 13.5mg discontinuation and the cost of live births. Scenario analysis suggests that further cost savings may be generated with the initiation of LNG-IUS 20mcg/24 hours in place of SARC methods.

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Conclusions—From a third-party payer perspective, LNG-IUS 13.5mg is a more cost-effective contraceptive option than SARC. Therefore, women switching from current SARC use to LNG-IUS 13.5mg are likely to generate cost savings to third-party healthcare payers, driven principally by decreased UP-related expenditures and long-term savings in contraceptive costs.

Keywords

Cost-effectiveness; economic evaluation; contraception; long-acting reversible contraception; unintended pregnancy; levonorgestrel-releasing intrauterine system

1. Introduction

Unintended pregnancies (UP) remain an important public health issue, contributing to significant health system costs. Approximately 49% of pregnancies in the United States (US) are unintended [1] with direct annual medical costs between US$4.5 and US$5 billion [2, 3]. Over half of the cost burden (53%) may be attributable to imperfect contraceptive adherence [3]. Uptake of contraception to prevent UP has been suggested as a cost-effective approach both to US health systems [4, 5] and to the broader public sector [6].

Less than half (40%) of women of reproductive age in the US use some form of reversible contraception and 23% have undergone permanent sterilization or have a partner who has been sterilized [7]. Of those women using reversible methods, 55% use hormonal short-acting reversible contraception (SARC), 27% use barrier methods, 10% use withdrawal, rhythm, or periodic abstinence while only 9% use long-acting reversible contraception (LARC) [7]. The available methods vary greatly in their effectiveness and overall cost. SARC methods, including oral contraception (OC), patch, ring and injections, require administration once or more every three months, and their effectiveness is dependent on regular user adherence [8]. The effectiveness of LARC methods (copper intrauterine device [IUD], hormonal intrauterine system [IUS] and implant) in contrast, is not reliant on regular user adherence [8] and these methods are considered cost-effective options relative to SARC methods [3, 5, 9].

LNG-IUS 13.5mg (total content) is a new long-acting reversible low-dose IUS approved by the U.S. Food and Drug Administration (FDA) for up to three years of use with a smaller size (in terms of the diameter of the insertion tube, transverse arms and the vertical stem) in comparison to existing intrauterine contraception [10,11]. The unadjusted three-year Pearl Index is 0.33 (95% CI: 0.16, 0.60) meaning that it is more than 99% effective at preventing pregnancy [12]. It is indicated for women regardless of whether they are parous or nulliparous and, as a LARC method, it is not reliant on user adherence. It is a contraceptive method which offers increased choice for women who do not wish to become pregnant for up to three years, who favor a reversible contraceptive and who would consider uptake of a method which they do not have to take daily.

US healthcare services face continued resource constraints within a changing healthcare and economic environment. Healthcare decision makers will likely see increased pressure to provide services which maximize value and effectiveness in relation to their cost due to the introduction of the Health and Human Services (HHS) mandate on preventive services [13].

Contraceptive products and services would fall into this category and it is within this context that the present analysis aims to evaluate the cost-effectiveness of LNG-IUS 13.5mg relative to the methods most likely to be displaced by its use.

2. Methods

2.1. Overview

A state transition model was developed from the US third-party healthcare payer perspective to evaluate the cost-effectiveness of LNG-IUS 13.5mg versus a mixed market-weighted basket of SARC methods comprising branded and generic OC, ring, patch and injections in young women requiring contraception. Market weights were based on uptake distribution from the most recent assessment of data collected through the National Survey of Family Growth (NSFG) [7].

Women aged 20–29 years at risk of pregnancy were selected as the base case study population. This group contributes more than half (56%) of the UP burden in the US [14], a substantial proportion of which may be avoidable through use of non-adherence based methods [3]. These women also have the highest uptake of SARC methods and continue to have low utilization of LARC methods [7]. A recent study has highlighted perspectives and challenges of young women and providers in the provision and uptake of available LARC options and services [15]. The introduction of new LARC methods to the US market, such as the smaller LNG-IUS 13.5mg, expands the choice available to young women and providers to meet different contraceptive needs. The study population of young women is therefore a key population in whom increased LARC uptake might be explored, with the mixed basket of SARC methods an appropriate comparator of interest.

2.2. Model design

The model was used to simulate contraceptive use and outcomes over a three-year time horizon in a cohort of 1000 women. This time horizon was assumed because it represents the FDA approved duration of LNG-IUS 13.5mg usage per unit and a model cycle length of one year was applied such that costs and effects could be tracked more precisely over the full three year time horizon. The model structure was built on that of a previously published study [5] and consisted of three mutually exclusive states (Figure 1): (a) initial contraceptive method, (b) unintended pregnancy resulting from the initial method, and (c) subsequent contraceptive method.

All women began in the “initial contraceptive method” state and remained in this state until they experienced a failure or discontinued the method. Women moved to the “unintended pregnancy” state once they experienced a failure on their initial method. From here, all women moved to the “subsequent contraceptive method” state. Women also moved directly to the “subsequent contraceptive method” state if they discontinued their initial method. Once they entered the “subsequent contraceptive method” state, women remained in the state for the duration of the modeled time horizon.

The method which women take up once in the “subsequent contraceptive method” state is represented by a mixed market-weighted contraceptive ‘basket’ comprising all contraceptive

methods utilized in the US market including no method (chance). As per the composition of the SARC comparator, the market weights were determined by the uptake distribution data reported by the NSFG [7].

Within the "subsequent contraceptive method" state, all costs and effects (i.e., failures) of the mixed 'basket' are accrued and tracked; this allows for the impact of the subsequent method to be tracked independently from the impact of the initial method. Therefore, the costs associated with drug acquisition, medical resource use and UP and the number of UP resulting from the mixed market-weighted basket are all tracked within the "subsequent contraceptive method" state.

2.3. Probability of events

A systematic review was undertaken to identify estimates for probabilities of method failure and discontinuation. The results of the review concluded that a meta-analysis could not be conducted due to disparate evidence. A single source was identified by the review which reported the failure and discontinuation rates for the majority of contraceptive methods utilized in the US based on a robust survey of 7,643 women aged 15 to 44 years [8]; an additional reference was sourced for the failure rate of no method [16].

Women transition from the "initial contraceptive method" state to the "unintended pregnancy" state based on the published [8, 17] first-year contraceptive failure rates (Table 1). The failure rate was assumed constant over time and the first-year rates were used as a proxy for annual probabilities; the distinction between annual failure rate and annual probability of failure was ignored, in line with the approach taken on previous analyses which concluded that the two were almost identical [5, 18]. For the base case analysis, 'typical use' probabilities of failure are applied since these take into consideration both inconsistent use and correct and consistent use.

Women transition from the "initial contraceptive method" state to the " subsequent contraceptive method" state at a probability equivalent to the annual rate of discontinuation. Discontinuation probabilities were derived by subtracting published first-year continuation probabilities [8] from 1. In the absence of comprehensive data on discontinuation in subsequent years, a 5% probability of discontinuation was applied to all contraceptive methods for years two and three of the analysis (Table 1). Discontinuation is assumed to reflect the probability at which women wishing to avoid pregnancy choose to switch from their current method due to adverse events or personal choice; discontinuation in this analysis does not include women discontinuing because they seek a planned pregnancy as this group of women would no longer fit the eligible model population i.e., women requiring contraception.

This model does not distinguish nor track which specific method women commence within the "subsequent contraceptive method" state as women simply take up the weighted-average mixed basket and incur the associated average costs and effects.

2.4. Costs

Costs considered in the model can broadly be grouped as follows: i) cost of contraceptive method (i.e., drug acquisition costs), ii) cost of administration of methods which includes cost of initial physician consultation, insertion consultation, follow-up and device removal (i.e., medical resource costs) and iii) cost of method failure (i.e., UP costs). Side effect costs, non-medical direct costs and indirect costs were not considered. The unit cost inputs are summarized in Table 2 and the costs per health state are reported in Table 3.

The drug acquisition costs were taken from the Medi-Span Master Drug Database [19] and were the wholesale acquisition cost (WAC) price. The cost of each SARC method was listed per pack or per injection; within the one-year model cycle length, it was assumed that 13 packs would be required for OC, ring and patch and 4 injections would be required for injectable contraception. LNG-IUS 13.5mg is a three-year product but the drug acquisition cost is applied in the year of drug acquisition (i.e., it is not annualized).

The medical resource costs for administration of the contraceptive method were based on Current Procedural Terminology (CPT) 2008 Codebook and derived from the Healthcare Cost and Utilization Project (HCUP) data and the 2012 non-facility payments from the Medicare Reimbursement Fee Schedule [20–22]. The resource costs were estimated per one-year model cycle and therefore, reflected the cost of the method-related consultation fees required within the given modeling year. The cost of the insertion consultation, procedure and the required follow-up to ensure proper placement of LNG-IUS 13.5mg were fully assigned in the year of drug acquisition; the costs of the removal consultation and procedure were incurred in the model cycle where LNG-IUS 13.5mg was either discontinued or at the end of the method life-span.

In the model, method failure can result in one of four possible outcomes: live birth, induced abortion, spontaneous abortion or ectopic pregnancy. The costs related to the four UP outcomes were taken from the diagnosis-related group (DRG) 2008 Codebook and the CPT 2008 Codebook [20]. In line with previous methodology [2], the cost of live birth is additionally adjusted based on published data [23] to reflect the likelihood of the unintended pregnancy being simply mistimed rather than truly unwanted. The probability of each outcome occurring is age-specific [14, 18, 23–24] and each outcome was assumed to last for a defined duration. These data were used to estimate a weighted-average cost of UP and the expected duration of the UP itself (during which period no contraceptive method is required). Cost of UP was applied as a one-off cost once women enter the “unintended pregnancy” state. In addition, 5.76 months worth of subsequent contraceptive method costs were incurred within this state because it was assumed that on average, the expected duration of an UP is 6.24 months and therefore, contraception would be required for the remainder of the one-year cycle (Table 4).

Costs of all SARC methods were half-cycle corrected because these costs are incurred per pack over the course of the one-year model cycle length, during which time discontinuation or failure could occur at any point (i.e., after which time, the cost should not be incurred until the individual re-initiates a method). Cost of the subsequent method was also half-cycle corrected because SARC methods are included in the mixed market-weighted bag. LNG-

IUS 13.5mg costs and the weighted-average cost of UP were not half-cycle corrected as they are one-off upfront costs. Discounting of 3% was applied to all costs.

2.5. Effectiveness

The effectiveness measure calculated in the model was the cumulative number of UP resulting from contraceptive failure over the time horizon of the analysis.

2.6. Analysis

The incremental cost-effectiveness ratio (ICER) was calculated as the incremental cost per UP avoided; model outputs were also reported in terms of net monetary benefit (NMB). NMB calculations avoid the reporting of a negative ICER that can have dual interpretations; a positive NMB indicates cost-effectiveness because the monetary value of the incremental effectiveness gained exceeds the incremental cost of achieving it. In this analysis, the willingness-to-pay (WTP) threshold per UP avoided was set to $734, equivalent to the cost of an induced abortion [20, 21].

One-way sensitivity analyses (OWSA) and probabilistic sensitivity analyses (PSA) were performed on all key variables to explore the robustness of the results given the uncertainty of inputs. Scenario analyses were conducted to assess the impact of a one- and five-year time horizon in order to account for women with different contraceptive or family planning preferences. Additionally, a comparison between LNG-IUS 13.5mg and the existing LNG-IUS 20mcg/24hrs (total content 52mg), refered to as LNG-IUS 20mcg/24 hours, was also explored through scenario analysis.

3. Results

3.1. Base case analysis

Compared to the SARC comparator, LNG-IUS 13.5mg was more effective (64 UP vs. 276 UP) and less costly ($1,283,479 USD vs. $1,862,633 USD) in a starting cohort of 1000 women aged 20 to 29 years in each arm, over the three-year time horizon (Table 5). Therefore, LNG-IUS 13.5mg is said to be dominant.

Lower LNG-IUS 13.5mg costs associated with drug acquisition ($650,320 USD vs. $943,956 USD) and method failure ($14,026 USD vs. $299,784 USD) offset the higher cost of contraceptive-related medical resources incurred due to the requirement for insertion and removal consultations for LNG-IUS 13.5mg ($415,810 USD vs. $215,481 USD).

Additionally, costs associated with subsequent method use by those women who initiated LNG-IUS 13.5mg were also lower than costs incurred by women initiating SARC methods ($203,322 USD vs. $403,412 USD) due to the lower probability of failure and the lower probability of discontinuation associated with LNG-IUS 13.5mg as less women moved to the subsequent method.

3.2. Sensitivity and scenario analyses

OWSA results based on the NMB (Figure 2) show that the results were most sensitive to the probability of failure on OC (the method holding the greatest weight in the mixed SARC comparator), the probability of discontinuation associated with LNG-IUS 13.5mg and the cost of live births (the UP outcome holding the greatest weight in the weighted cost of UP). The base case probability of failure on OC is 0.090 under 'typical use' and varying the input between a lower bound set to the 'perfect use' probability (0.003 [8]) and an upper bound set to 30% more than the base case input (0.117) retains a positive NMB ranging between $441 and $766 USD. This indicates that cost-effectiveness is preserved for LNG-IUS 13.5mg when the probability of failure is varied between plausible limits. Similarly, when the base case probability of discontinuation associated with LNG-IUS 13.5mg (20%) or the base case cost of live birth ($4,988 USD) is varied by 30% to determine the lower (14% and $3,492 USD, respectively) and upper (26% and $6,485 USD, respectively) bounds, positive NMB ranging between $604 and $782 USD is retained, preserving the cost-effectiveness of LNG-IUS 13.5mg when the inputs are varied between plausible limits. PSA outputs demonstrated that 100% of model simulations fell in the south-east quadrant of the cost-effectiveness plane (Figure 3), indicating that the intervention was both cheaper and more effective than the comparator in all iterations.

Scenario analysis assuming a one-year time horizon found LNG-IUS 13.5mg to be more effective (3 UP vs. 87 UP) but also more costly ($1,086,676 USD vs. $856,438 USD) compared to the SARC comparator. LNG-IUS 13.5mg was therefore associated with an incremental cost of $2,760 USD per UP avoided. Assuming a five-year time horizon resulted in higher effectiveness for LNG-IUS 13.5mg compared to the SARC comparator (136 UP vs. 464 UP) and lower total costs ($2,169,114 USD vs. $2,838,767 USD) meaning that LNG-IUS 13.5mg was considered dominant at five years. This was consistent with the findings of the base case (three-year time horizon) analysis but resulted in a greater magnitude of cost savings and a greater impact on UP numbers.

Furthermore, a scenario analysis in comparison to LNG-IUS 20mcg/24 hours was conducted. Over a three year time horizon, LNG-IUS 13.5mg was less costly (incremental cost savings of $46,126) but also less effective (incremental increase in UP events of approximately 3 UPs). Over a five year time horizon, LNG-IUS 13.5mg was more costly and less effective and therefore, dominated by LNG-IUS 20mcg/24 hours.

4. Discussion

This analysis demonstrates LNG-IUS 13.5mg is a cost-effective contraceptive option in comparison to SARC methods from a third-party payer perspective over a three-year time horizon. The results are driven by the lower failure and discontinuation probabilities for LNG-IUS 13.5mg relative to SARC methods, which elicited lower UP-related costs due to fewer failures and a lower cost of contraception over the analysis time horizon.

OWSA findings suggested that none of the variations in key model parameters reverse the finding of cost-effectiveness vs. the SARC comparator although not all scenarios resulted in LNG-IUS 13.5mg dominating the SARC comparator. PSA outputs indicated that model

findings were robust to random variation in the values of all parameters subject to second-order uncertainty and therefore suggest there is a high probability of LNG-IUS 13.5mg being considered cost-saving vs. the SARC comparator. Scenario analyses of various model time horizons suggest that a longer time horizon allows LNG-IUS 13.5mg to become increasingly cost-saving because the high upfront method costs are distributed over a greater length of time while limited additional costs are incurred during subsequent years of usage. Scenario analysis suggests that while there are notable and substantial cost savings resulting from the uptake of LNG-IUS 13.5 mg relative to SARC methods, greater savings may be generated from the uptake of LNG-IUS 20mcg/24 hours relative to SARC methods.

Increasing LARC uptake in place of currently utilized SARC methods may offer a viable path to reduce incidence and cost burden of UP [3]. This analysis therefore focused on the comparison to SARC methods as the category of contraceptives which LNG-IUS 13.5mg may be most likely to displace and so, the analysis of most relevance to payers and decision makers. The scenario analysis suggests that LNG-IUS 13.5mg is unlikely to be cost-effective in comparison to LNG-IUS 20mcg/24 hours, particularly over longer time horizons. However, given the low utilization of LARC methods in the US, the alternative LARC option resulting from the availability of LNG-IUS 13.5mg may allow for some concerns and preferences of non-LARC users to be addressed, in particular those of young women. In turn, this may increase LARC uptake, reduce the incidence of UP and improve the efficiency of healthcare resource utilization.

This analysis took into consideration the impact of discontinuation rates in order to reflect switch patterns which occur in real-life. For those women who do not discontinue, LNG-IUS 13.5mg continues to generate cost savings from UP avoided in subsequent years without incurring any additional method-related costs until the end of the method’s life span; on the contrary, SARC methods incur method-related costs year-on-year.

Discontinuation in this analysis was captured based on data published in Trussell et al, 2011 [8]. An additional study known as the CHOICE study [25] was also identified as reporting discontinuation data; however, CHOICE was based on a very specific patient group i.e. women at high risk of UP in the St Louis region. It was therefore decided that the data from Trussell et al, 2011 would be more appropriate and representative as it is based on NSFG data which is collected from a national sample of women 15–44 years of age in the civilian, non-institutionalized population of the US [26–28].

This analysis has limitations. ‘Typical use’ failure probabilities were available for the first year of contraceptive use only and these were applied across all years. Subsequent year failure rates are likely to be lower than in the first year because those women prone to fail will do so early, leaving a group increasingly composed of more adherent users [27]. Therefore, the cost impact of UP, and the consequential incremental cost-savings generated from UP avoided whilst on LNG-IUS 13.5mg vs. SARC, may have been overestimated in the model. In contrast, Medicare prices were used to calculate costs associated with the outcomes of UP in the model, which are likely to be lower than those of private insurers; this assumption is likely to have resulted in an underestimation of the cost impact of UP in this analysis.

An assumption was made regarding subsequent year discontinuation rates due to a lack of robust literature on continuation of contraceptive methods beyond the first year of use. Subsequent year discontinuation was assumed to be lower than discontinuation in the first year of use and was set to 5% for both women on LNG-IUS 13.5mg and women on SARC methods. In reality, the rate is likely to change as women age and their contraceptive preferences and suitability change, and it is unlikely to be the same across different methods. Though the impact of discontinuation has been captured in the analysis, more robust data on continuation of methods would further strengthen this study.

The absence of robust data on switching preferences necessitated a mixed market-weighted contraceptive ‘basket’ to act as a proxy for the subsequent method women would switch to once they fail on or choose to discontinue their initial method. The mixed contraceptive ‘basket’ was a construct which approximated the average choices of women switching contraceptive method and was required as assumptions cannot be made on the exact method women may switch to.

Despite these limitations, the analysis is strengthened through consideration of discontinuation rates and inclusion of the concept of the mixed contraceptive ‘basket’ to proxy subsequent method choices. Inclusion of these parameters improves the external validity of the results and conclusions.

UP remains a costly issue for US health payers and the introduction of the HHS mandate will further necessitate the consideration of cost-effective contraceptive options. LNG-IUS 13.5mg is an effective contraceptive method and this analysis further concludes that it is also a cost-saving method in comparison to the widely used SARC methods, a conclusion which is in line with previous studies [5, 9, 29–30]. Furthermore, this study supports the established fact that the longer a LARC method is used, the more cost-effective it will become [5]. Based on these findings, this study concludes that switching from current SARC use to LNG-IUS 13.5mg is likely to generate cost savings to third-party health care payers, driven principally by decreased UP-related expenditures and long-term savings associated with the cost of the contraceptive product.

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Implications

Introduction of LNG-IUS 13.5mg expands the choice of long-acting reversible contraceptive methods in the US especially for young women, where SARC methods are most commonly used. LNG-IUS 13.5mg is cost-effective vs. SARC methods and therefore may contribute to the reduction of unintended pregnancies and the efficient use of healthcare resources.

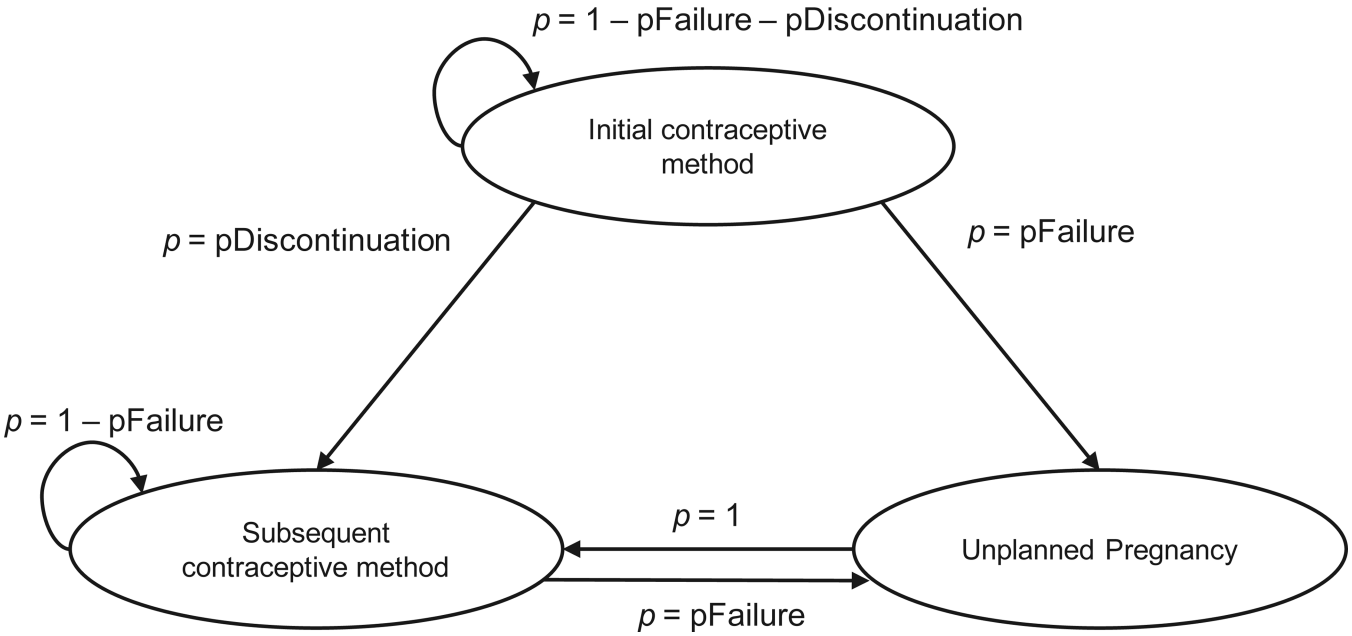

Figure 1.
Model schematic

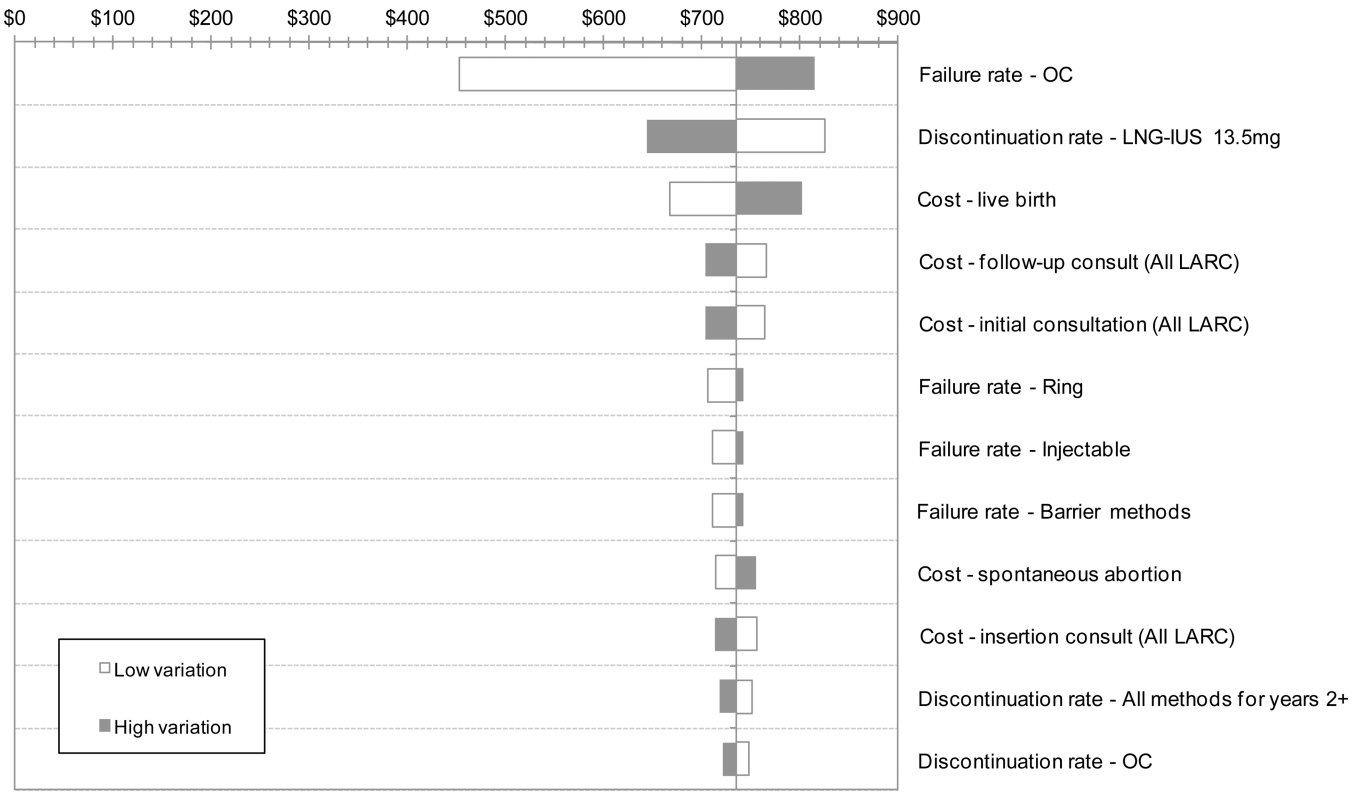

Figure 2.
Tornado diagram of net monetary benefit ($/UP avoided)

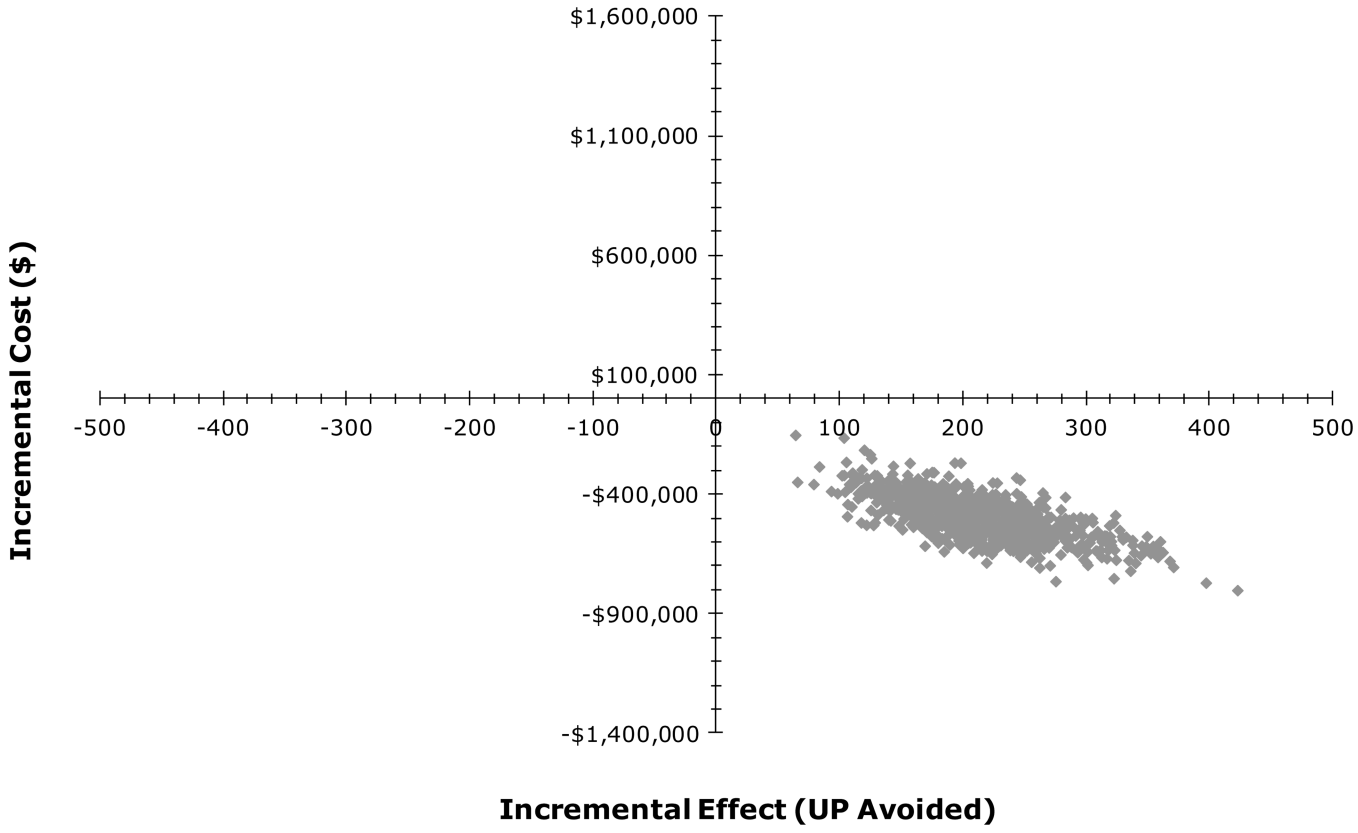

Figure 3.
Cost-effectiveness plane scatter plot

Table 1

Health state transitions, per annual cycle

	Method failure (*p*)	Discontinuation 1st year (*p*)	Discontinuation subsequent year (*p*)	Market weight
LNG-IUS 13.5mg	0.0033[1]	0.2000[2]	0.05	1.000
SARC[4]	0.0870	0.3409	0.05	1.000
COC	0.0900[3]	0.3300[3]	0.05	0.789
Vaginal ring	0.0900[3]	0.3300[3]	0.05	0.082
Patch	0.0900[3]	0.3300[3]	0.05	0.021
Injectable	0.0600[3]	0.4400[3]	0.05	0.108
Subsequent method[4]	0.1443	0.3048	0.05	1.000
LNG-IUS 13.5mg	0.0033[1]	0.2000[3]	0.05	0.020
OCs	0.0900[3]	0.3300[3]	0.05	0.370
Ring	0.0900[3]	0.3300[3]	0.05	0.039
Patch	0.0900[3]	0.3300[3]	0.05	0.010
Injection	0.0600[3]	0.4400[3]	0.05	0.051
Implant	0.0005[3]	0.1600[3]	0.05	0.010
IUD	0.0080[3]	0.2200[3]	0.05	0.030
LNG-IUS 20mcg	0.0020[3]	0.2000[3]	0.05	0.030
Barrier Methods	0.1800[3]	0.5550[3]	0.05	0.218
Tubal ligation	0.0050[3]	0.0000[3]	0.05	0.046
Tubal occlusion	0.0050[3]	0.0000[3]	0.05	0.046
No method	0.4600[5]	0.0500[6]	0.05	0.129

[1] Published source [12].

[2] Assumption – set equal to LNG-IUS 20 mcg/24 hours (total content 52mg) discontinuation rate [8]

[3] Published source [8].

[4] Estimated for base case age group of 20–29 years as a weighted average – weights based on NSFG [7] (see ‘Market Weight’ column).

[5] Published source [16].

[6] Assumption.

Table 2

Unit costs and resources

Unit	Cost	Comment
Method cost (annual)		
LNG-IUS 13.5mg	$650.32	Incurred only in year of insertion.
SARC	$544.25	Incurred each year.
Subsequent method	$401.83	Incurred each year.
Resource cost (per resource)		
Initial physician consultation (LNG-IUS 13.5mg)	$104.16	Higher fee as longer consult; CPT code 99214 [20 –22].
Initial physician consultation (all SARC)	$42.55	Lower fee as shorter consult; CPT code 99212 [20 –22].
Insertion consultation	$70.80	Incurred only in year of insertion; CPT code 58300 [20 –22].
Follow-up consultation (LNG-IUS 13.5mg)	$104.16	To check placement in year of insertion; CPT code 99214 [20 –22].
Follow-up consultation (all SARC)	$0	Assuming prescription renewals are provided during annual check-up therefore, no additional follow-up costs.
Injection administration	$129.50	Assuming 4 injections per year at $32.38 per administration; CPT code 96372 [20 –22].
Removal consultation	$97.01	Incurred only in year of discontinuation or at end of method life span; CPT code 58301 [20 –22].
Pregnancy outcome cost (per outcome)		
Live birth	$4,988.24	Weighted average of DRG codes 767, 768, 774, 775, 765 and 766 [20 –22].
Spontaneous abortion	$889.25	DRG code 778 [20 –22].
Induced abortion	$734.03	Weighted average of DRG codes 770 and 779 [20 –22].
Ectopic pregnancy	$4,919.21	DRG code 777 [20 –22].

Table 3

Health state costs, per annual cycle

Health state	Year 1	Year 2	Year 3	Comment
1 - Initial method				
LNG-IUS 13.5mg	$929	$0	$0	3 year cycle repeated.
SARC	$601	$558	$558	Initial consultation assumed in Year 1.
2 - Unintended pregnancy[1]	$1713	$1713	$1713	Not time dependent.
3 - Subsequent method[2]	$402	$402	$402	Not time dependent.

[1] Estimated as a weighted-average cost of live birth, spontaneous abortion, induced abortion and ectopic pregnancy (costs per outcome reported in Table 2) plus the cost of 5.76 months of subsequent contraceptive method costs as an UP is assumed to last 6.24 months of average (see Table 4); weights to determine age-specific probability of each outcome taken from published literature [14, 24].

[2] Estimated for base case age group of 20–29 years as a weighted average of all costs associated with all available methods available on the market; weights based on data reported by the NSFG [7].

Table 4

Average duration of UP

Health state	Weight*	Duration in months	Comment
Live birth	0.485	10.23	Assumption: 9.23 months of pregnancy based on an average gestation period of 40 weeks LESS 1 month before realizing UP PLUS 2 months off contraception [29].
Induced abortion	0.373	2.08	Assumption: Induced abortions are conducted within first 12 weeks of pregnancy [31] LESS 1 month before realizing UP.
Spontaneous abortion	0.137	3.62	Assumption: Spontaneous abortions occur within 20 weeks of pregnancy [32] LESS 1 month before realizing UP.
Ectopic pregnancy	0.005	1.50	Assumption: Ectopic pregnancies are detected within 7 to 8 weeks of pregnancy LESS 1 month before realizing UP.
Weighted average duration of UP		6.24	

* weights to determine age-specific probability of each outcome taken from published literature [14, 24].

Table 5

LNG-IUS 13.5mg vs. SARC, base case results

	LNG-IUS 13.5mg	SARC	Increment
Total cost ($)	$1,283,479	$1,862,633	($579,154)
Drug acquisition	$650,320	$943,956	($293,636)
Medical resource use	$415,810	$215,481	$200,330
Failure (UP)	$14,026	$299,784	($285,758)
Subsequent method[1]	$203,322	$403,412	($200,089)
UP	64	276	(212)
ICER ($/UP avoided)			**Dominant**

[1] Summation of drug acquisition costs, medical resource use costs and failure costs resulting from use of the subsequent method.