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Cost-effectiveness of a complex intervention in general practice to increase uptake of long-acting reversible contraceptives in Australia†

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Abstract.

Objective. The aim of this study was to evaluate the cost-effectiveness of the Australian Contraceptive ChOice pRoject (ACCORd) intervention.

Methods. An economic evaluation compared the costs and outcomes of the ACCORd intervention with usual care (UC). Data from the ACCORd trial were used to estimate costs and efficacy in terms of contraceptive uptake and quality of life. Rates of contraceptive failure and pregnancy were sourced from the literature. Using a Markov model, within-trial results were extrapolated over 10 years and subjected to univariate sensitivity analyses. Model outputs were expressed as the cost per quality-adjusted life years (QALY) gained and cost per unintended pregnancy resulting in birth (UPB) avoided.

Results. Over 10 years, compared with UC, initiating contraception through the ACCORd intervention resulted in 0.02 fewer UPB and higher total costs (A$2505 vs A$1179) per woman. The incremental cost-effectiveness of the ACCORd intervention versus UC was A$1172 per QALY gained and A$7385 per UPB averted. If the start-up cost of the ACCORd intervention was removed, the incremental cost-effectiveness ratio was A$81 per QALY gained and A$511 per

†This trial has been registered with the Australian and New Zealand Clinical Trial Registry (ANZCTR ID 12615001346561, 10 December 2015).

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UPB averted. The results were most sensitive to the probability of contraceptive failure, the probability of pregnancy-related healthcare service utilisation or the inclusion of the costs of implementing the ACCORd intervention.

Conclusions. From a health system perspective, if implemented appropriately in terms of uptake and reach, and assuming an implicit willingness to pay threshold of A$50 000 the ACCORd intervention is cost-effective.

What is known about the topic? The uptake of long-active reversible contraceptives (LARC) in Australia is low. The ACCORd trial assessed the efficacy of providing structured training to general practitioners (GPs) on LARC counselling, together with access to rapid referral to insertion clinics.

What does this paper add? This study is the first to assess the cost-effectiveness of a complex intervention in the general practice setting aimed at increasing the uptake of LARC in Australia.

What are the implications for practitioners? The results show that implementing a complex intervention in general practice involving GP education and the availability of rapid referral to LARC insertion clinics is a cost-effective approach to increase LARC use and its attending efficacy. If the majority of Australian GPs were able to deliver effectiveness-based contraceptive counselling and either insert LARC or use a rapid referral process to a LARC insertion clinic, the additional cost associated with the purchase of LARC products and their insertion would be offset by reductions to health system costs as a result of fewer UPB and abortions. Moreover, the benefits to women's physical and psychological health of avoiding such events is substantial.

Keywords: ACCORd, contraceptive counselling, economic evaluation, general practice, health economics, health services, long-acting reversible contraceptives, quality of life.

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Introduction

In Australia and other high-income countries, unintended pregnancies (UPs) are relatively common, and many result in abortion.[1,2] In a survey of Australian women conducted in 2010–11, 30% of women reported a UP; one in four pregnancies were terminated.[3]

International evidence suggests that long-acting reversible contraception (LARC) products such as subdermal hormone implants (etonorgestrel subdermal implant (Implanon NXT)) and hormone intrauterine devices (IUD; levonorgestrel (Mirena) and the copper IUD (Cu IUD)) can reduce the rate of UPs.[4–6] Compared with short-acting reversible contraception (SARC), including the oral contraception pill (OC), LARC methods are not dependent on user compliance and therefore have a very low failure rate.[6] Thus, increasing the uptake of LARC in Australia is likely to reduce the rate of UPs, the associated negative effect a UP has on a woman's quality of life and health service costs.[7]

LARC methods have been shown to be cost-effective[8–10] compared with other contraceptive methods, despite increased health care utilisation and up-front costs associated with their insertion. However, the uptake of LARC in Australia is low.[11] Important barriers to increasing LARC uptake include a lack of familiarity with their use at the primary care level and misconceptions among both general practitioners (GPs) and women about LARC.[12] Therefore, training to provide structured effectiveness-based contraceptive counselling and access to rapid referral to LARC insertion clinics provided by gynaecologists are potential strategies for increasing their utilisation.

Australian Contraceptive ChOice pRoject (ACCORd), an adaptation of the US Contraceptive Choice Project (CHOICE),[13] was designed as a cluster randomised controlled trial.[14] The aim of the ACCORd study was to test whether a complex intervention based in general practice consisting of online education for GPs on effectiveness-based contraceptive counselling, together with the availability of a fast-track referral process to a LARC insertion clinic, is a cost-effective means of increasing the uptake of LARC compared with usual care (UC) among Australian women (an overview of the baseline characteristics of the women included in the ACCORd trial is presented in Supplementary Table S1).

Methods

The economic evaluation of the ACCORd trial was undertaken in two parts: (1) a within-trial cost-effectiveness analysis restricted to the period of the ACCORd study; and (2) a longer-term modelled evaluation.

The within-trial analysis focused on the short-term costs and outcomes of the ACCORd intervention (the proportion of women using LARC). A quasi-societal perspective was used to calculate costs, including the cost of the intervention and the cost associated with use of healthcare services. Contraception-specific health service utilisation was measured largely using Australian Medicare data (Medical Benefits Schedule (MBS) and Pharmaceutical Benefits Scheme (PBS)) for women participating in the ACCORd study; costs were calculated as the sum of observed out-patient service use. Hospital costs associated with pregnancy (as observed in ACCORd) and costs associated with the purchase and insertion of IUDs funded outside the public healthcare system were included based on reported Australian-Refined Diagnosis-Related Groups (for pregnancy) and private sector costs (for the copper IUD). Direct non-medical costs (e.g. transportation) and indirect costs (productivity losses) were not included in the analysis.

Total costs per group (intervention or UC group) are reported for the within-trial period (12 months) and disaggregated by service component: the cost of the contraceptive product; insertion and removal of the device; and management of contraceptive failure. Because the outcome of interest was the proportion of women using LARC at 12 months, the incremental

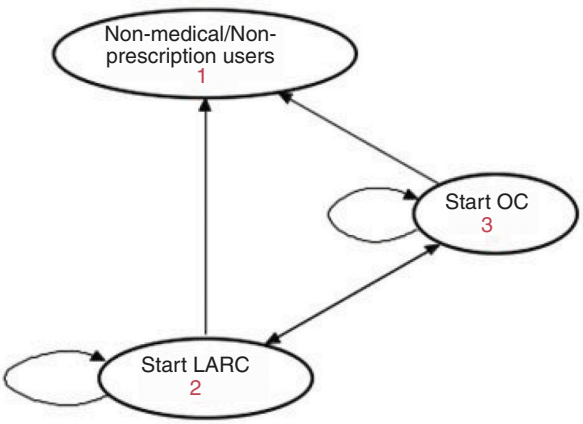


Fig. 1. Economic model structure.

analysis is expressed as the cost per additional woman using LARC at 12 months.

A Markov model was constructed to extrapolate the costs and outcomes observed in the ACCORd study over 10 years, allowing us to estimate the cost per quality-adjusted life years (QALY) gained. The model structure is shown in Fig. 1.

The model consisted of three health states: (1) discontinuation of the contraceptive method (non-medical contraceptive (NMC)); (2) commencement of a contraceptive method ('start LARC', 'start OC'); or (3) continuing use of a method. The NMC alternative included women who stopped using a contraceptive method due to adverse events or personal choice. The proportion and direction of method switch was estimated using information from the within-trial analysis and is provided in Table 1. The key assumptions underpinning the transitions applied in the model are as follows:

- women could switch between contraceptive methods once per cycle (each cycle = 6 months), but a switch independent of contraceptive failure could only occur once in the overall duration of the model
- all switches were from OC to LARC and NMC; there were no switches from LARC and NMC
- contraceptive failures were assumed to occur at the end of each cycle
- method failure resulted in termination of pregnancy (TOP) or unplanned pregnancy resulting in birth (UPB). Women who experienced a method failure were assumed to switch to a new method. Those whose method was effective continued to use the same method. We assumed that UPB and TOP could occur once per year for an individual woman.

Costs included are as described for the within-trial analysis. The costs of side-effects, such as infections and adverse events related to method use, were not included in the analysis because the occurrence of such events reported by ACCORd Trial Data Monitoring Committee was very low.[15]

Health state transitions and treatment use were based on data observed in the ACCORd trial (see Table 1). The probability of method failure and pregnancy outcomes was sourced from the literature.[8] The number of QALYs gained was calculated using the results of the 36-Item Short Form Health Survey (SF-36) surveys completed by women participants in ACCORd for which quality of life weights were estimated using the Short Form Health Survey Six-Dimension (SF-6D) algorithm with Australian weights.[16,17] The number of UPB avoided was expressed as the cumulative number of UPB resulting from contraceptive failure over the time horizon of the analysis.

Table 1. Probabilities and utility weights applied in the Markov model
LARC, long-acting reversible contraception; OC, oral contraception; NMC, non-medical contraception; TOP, termination of pregnancy; UPB, unintended pregnancies resulting in birth

Method type	ACCORd intervention	Usual care	Source
Initial health states probabilities			
LARC	0.51	0.33	ACCORd
OC	0.28	0.43	ACCORd
NMC	0.21	0.24	ACCORd
Within-health state outcomes probabilities			
TOP LARC	0.0014	0.0014	Trussell *et al.*[8]
TOP OC	0.0378	0.0378	Trussell *et al.*[8]
UPB LARC	0.0019	0.0019	Trussell *et al.*[8]
UPB OC	0.0492	0.0492	Trussell *et al.*[8]
Transition probabilities			
Probability of continuing OC	0.57	0.75	ACCORd
Probability of switch from OC to LARC	0.28	0.12	ACCORd
Probability of switch from OC to NMC	0.15	0.13	ACCORd
Probability of continuing LARC	1.00	1.00	ACCORd
Probability of switch from LARC to OC	0.00	0.00	ACCORd
Probability of switch from LARC to NMC	0.00	0.00	ACCORd
Utility weights			
TOP	0.59	0.59	ACCORd
LARC	0.60	0.60	ACCORd
OC	0.60	0.60	ACCORd
UPB	0.62	0.62	ACCORd

All costs were discounted at a rate of 5% per year. The within-trial data analysis was performed in STATA version 15.1 (StataCorp LLC, College Station, TX, USA) and the modelled analysis was performed in Tree Age Pro 2019 (TreeAge Software, Williamstown, MA, USA). Differences in mean costs between groups were estimated by bootstrapping.

One-way sensitivity analyses were conducted, rather than probabilistic sensitivity analyses, because this is consistent with Australian and international health technology assessment guidelines[18] and avoids potential uncertainties associated with determining parameter ranges and distributions for probabilistic analyses.[18] Sensitivity analyses were used to test the effects on the incremental cost-effectiveness ratio (ICER) of varying the failure rates of the methods, assuming switching from the LARC method to OC and NMC (in 5% of women) after the initial replacement period for LARC (i.e. 5 years for Mirena[19] and the copper IUD;[20] 3 years for Implanon NXT[21]), and the costs of contraceptive products, UPB and TOP.

We also conducted two scenario analyses: (1) we tested the effect on the ICER of removing the start-up costs of the ACCORd intervention; and (2) we applied standard MBS fees for healthcare

services rather than mean costs per service obtained from the within-trial-based costs. This second analysis served as a robustness check on the sensitivity of the results to the estimation of the costs from the observed administrative data. Australian funding authorities have no explicit willingness to pay (WTP) threshold. However, we have assumed an implicit WTP of A$50 000 as the benchmark for determining cost-effectiveness.[22]

Results

Within-trial analysis

The results from the ACCORd trial showed that 13.8% more women in the intervention group used LARC compared with the UC group (46.6% vs 32.8%; $P = 0.0015$).[14] Cost data related to medical services (MBS data) were available for 212 women (69%) in the ACCORd intervention group and for 306 women (71%; $P = 0.56$) in the UC group; data on the use of contraceptive products (PBS data) were available for 206 women (67%) in the intervention group and for 297 women (69%, $P = 0.11$) in the UC group. An analysis of these data showed a difference in LARC use that was consistent with the primary analysis from ACCORd: 6% more women in the intervention group used LARC compared with the UC group (45% vs 39%; $P = 0.17$).

Markov model analysis

The results of the within-trial analysis comparing the total costs and mean cost per woman are presented in Table 2. It is assumed

Table 2. Estimated annual costs: within-trial analysis

GP, general practitioner; IUD, intrauterine device; LARC, long-acting reversible contraceptive; MBS, Medicare Benefits Schedule; OC, oral contraception; PBS, Pharmaceutical Benefits Scheme; TOP, termination of pregnancy; UPB, unplanned pregnancy resulting in birth

Cost type	Cost (A$)		Difference in mean costs (*P*-value)[C]	Source
	ACCORd intervention	Usual care		
Copper IUD				
Total	440	807	NA	Chemist Warehouse[23]
Mean	73	73	NA	Chemist Warehouse/ACCORd
Levonorgestrel IUD (Mirena)				
Total	7708	7503		PBS data
Mean	79	49	15.56 (0.03)	PBS data
Etonorgestrel subdermal implant (Implanon NXT)				
Total	3372	6249		PBS data
Mean	25	48	–6.90 (0.17)	PBS data
OC				
Total	3426	5406		PBS data
Mean	38	39	–2.65 (0.42)	PBS data
Medical TOP (mifepristone)				
Total	623	311		PBS Data
Mean	156	156	2.62 (0.25)	PBS data
PBS total[A]				
Total	61 999	200 767		PBS data
Mean	301	676	–750.03 (0.11)	PBS data
GP consultations				
Total	2791	2528		MBS data
Mean	52	32	6.51 (0.13)	MBS data
Specialist consultations				
Total	22 884	32 222		MBS data
Mean	197	195	0.25 (0.99)	MBS data
LARC insertion				
Total	2205	3603		MBS data
Mean	30	33	–2.28 (0.38)	MBS data
LARC removal				
Total	738	1352		MBS data
Mean	35	33	–1.44 (0.32)	MBS data
UPB				
Total	6732	5139		
Mean	449	302	20.12 (0.37)	MBS data
TOP				
Total	508	1301		
Mean	73	145	–2.70 (0.32)	MBS data
MBS total[B]				
Total	368 374	489 550		MBS data
Mean	1738	1600	138.63 (0.56)	MBS data

[A]Total PBS mean calculated for all costs incurred per woman in the intervention or usual care group during the 12-month period.
[B]Total MBS mean calculated for all costs incurred per woman in intervention or usual care group during the 12-month period.
[C]The estimates around the differences in mean costs between the groups were estimated by bootstrapping.

that the patterns of care among women consenting to the use of their Medicare data are not different to those who did not consent and that the mean costs per women are therefore representative of all women in the trial.

Overall, compared with UC, women in the intervention group had both a lower annual mean Medicare cost per woman and lower total Medicare costs over the trial period. The mean cost of OC was lower than LARC in both groups (Table 2). Although the total cost of health care utilisation was lower in the intervention than UC group, the total cost associated with UPB was higher for the intervention group due to the higher proportion of unintended pregnancies in this group (0.05 vs 0.04). However, this difference was not statistically significant ($P = 0.37$).

When the start-up costs of the intervention were included, the cost per additional woman using LARC at 12 months was A$11 149. However, the intervention was more effective and less costly when start-up costs were removed; that is, compared with UC, the intervention resulted in both an increase of 14 percentage points in the proportion of women using LARC and a reduction in the mean cost per woman of A$226.The results of the modelled analysis are presented in Table 3. The key difference between this and the within-trial analysis is the addition of the quality of life effects. The results of the SF-6D survey showed no differences between the groups in terms of quality of life (0.63 vs 0.65 on a scale 0–1; $P = 0.14$). Although the number of specific pregnancy-related events (e.g. obstetric care) varied between the groups, the frequency of these events was very low, resulting in no statistically significant difference between the groups in terms of quality of life. Accordingly, the same quality of life weights were applied to events within the analysis, regardless of the treatment group, namely an overall quality of life weight of 0.60 for women without a pregnancy event, a weight of 0.59 for TOP events and a weight of 0.62 for UPB events.

The base case analysis resulted in a cost per QALY gained of A$1172 for the intervention compared with UC. After excluding start-up costs (A$1234 per woman), the ICER was A$81 per QALY gained for the intervention compared with UC group. This shows that the ICER is most sensitive to variations in the probability of method failure resulting in UPB or TOP. However, the results are relatively robust to variations in costs related to method failure and variation in probability of switching from LARCs to OC or NMC (see results of the sensitivity analyses provided as a tornado plot in Figure S1).

The results of the scenario analysis in which mean MBS and PBS item fees related to gynaecological services were used instead of mean costs based on the results of the within-trial analysis are presented in Table 3. These results were consistent with those of the base case.

Discussion

LARC methods have been shown to be a highly cost-effective means of reducing the rate of unplanned pregnancies.[24,25] Our analysis shows that the ACCORd intervention has the potential to be highly cost-effective, assuming an implicit WTP of A$50 000,[22] in terms of both increasing the number of women using LARC and the longer-term quality of life outcomes. Importantly, we show that the cost-effectiveness of the ACCORd intervention is influenced by both the efficacy of outcomes and the ability to defray start-up costs.

Our evaluation of the cost-effectiveness of the ACCORd intervention over a 10- year period indicates that, from a healthcare perspective, the ACCORd intervention is more effective than UC in preventing UPB and abortions but is more expensive. However, our assessment has also shown that the value to both the healthcare system and society of the ACCORd intervention is enhanced if more women access it (reducing the impact of start-up costs).

Table 3. Results of economic evaluation

ICER, incremental cost-effectiveness ratio; LARC, long-acting reversible contraceptive; NMC, non-medical contraceptive; OC, oral contraceptive; MBS, Medicare Benefits Schedule; PBS, Pharmaceutical Benefits Scheme; QALY, quality adjusted life year; UPB, unplanned pregnancy resulting in birth

	Intervention			Usual care			Cost (A$)/QALY	Cost (A$)/UPB	Outcome
	Cost (A$)	QALYs	UPBs	Cost (A$)	QALY	UPBs			
Base case[A]	2505	16.77	0.09	1179	15.64	0.25	1172	7385	Intervention more effective and more expensive
LARC	1609	13.07	0.05	433	9.59	0.06	337.93	117 600	Intervention more effective and more expensive
OC	534	0.76	0.04	602	1.92	0.19	59.48	453	Usual care more effective and more expensive
NMC	362	2.94	0.00	145	4.13	0.00	182.35	NA	Usual care more effective and less expensive
Scenario analyses									
Excluding start-up cost	1271	16.77	0.09	1179	15.64	0.25	81	511	Intervention more effective and more expensive
Applying MBS and PBS fees									
Including start-up cost	3482	16.77	0.09	1638	15.64	0.25	1631	10 276	Intervention more effective and more expensive
Excluding start-up cost	2248	16.77	0.09	1638	15.64	0.25	540	3402	Intervention more effective and more expensive

[A]Including start-up cost.

To the best of our knowledge, this study is the first to assess the cost-effectiveness of a complex intervention in the general practice setting aimed at increasing the uptake of LARC in Australia. The results are similar to studies of the cost-effectiveness of GP educational initiatives in other areas, such as diabetes[26] and the management of lower back pain,[27,28] which have shown that adding advice, education and behavioural counselling to usual GP care is efficient at the primary care level and has a positive financial effect on the health system.

This study has several strengths. The within-trial analysis is based on the results of a rigorous pragmatic randomized control trial. Most women participants consented to the use of their Medicare data for the analysis of medical service and pharmaceutical utilisation and costs, increasing the accuracy of the results and hence the relevance in the Australian context of the cost inputs to the model. The information about quality of life was collected from women participants and Australian weights were used to estimate the utilities for the QALY outcome measure.

The study also has some limitations. Because GPs who agreed to participate in ACCORd may have been more interested in contraception and LARC uptake than the average GP, the overall uptake of LARC, and therefore the benefits accruing to the wider population, are uncertain. The time span of the trial may not have adequately captured resource utilisation for women in the intervention and control groups. Therefore, we did not restrict the analysis based on study start date. Although the Markov model includes a pathway for non-prescribed contraceptive methods, we did not include the effect on the costs and effectiveness of these types of contraception, because we assumed the use of these methods would be similar in both groups. The use of private prescriptions was not included in the analysis because it was likely to be very low and not different across the groups. Our sensitivity analyses showed that the model results were robust to variations in the cost of care.

In this analysis we applied the same quality of life scores to women in both the intervention and UC groups. This is reasonable because it is unlikely that consulting a GP who participated in the ACCORd study would alter a woman's quality of life. Finally, the start-up cost of the ACCORd intervention may be overestimated. Because ACCORd involved an educational intervention, it is likely to have had a spin-off effect on women who were not directly included in the trial; we did not seek to capture the benefits to women who attended intervention GPs but did not participate in ACCORd, but note that this is likely to have enhanced the cost-effectiveness of the intervention.

Our results show that implementing a complex intervention in general practice involving GP education and the availability of rapid referral to LARC insertion clinics is a cost-effective approach to increase LARC use and its attending efficacy. Such uptake is likely to have benefits beyond those included in our analysis. Although the quality of life weights applied assumed no difference between the groups in terms of the impact of pregnancy events on women, LARC use may benefit women in ways not captured by standard quality of life measures (e.g. increased convenience, lower rates of heavy menstrual bleeding, improved fertility control, improved spacing of pregnancies and enhanced productivity). Further research should explore how such benefits may be valued.

If the majority of Australian GPs were able to deliver effectiveness-based contraceptive counselling and either insert LARC or use a rapid referral process to a LARC insertion clinic, the additional cost associated with the purchase of LARC products and their insertion would be offset by reductions to health system costs as a result of fewer UP and abortions. Moreover, the benefits to women's physical and psychological health of avoiding such events is substantial.[7]

Competing interests

The authors declare that they have no competing interests.

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