

A pregnant pause: rethinking economic evaluation in contraception and pregnancy

Lucy Abel¹, Matthew Quaife²

1. Nuffield Department of Primary Care Health Sciences, University of Oxford
2. Faculty of Public Health and Policy, London School of Hygiene and Tropical Medicine

Abstract

Pregnancy presents a unique challenge to economic evaluation, requiring methods that can account for both maternal and fetal outcomes. The ethical challenges to healthcare presented by pregnancy are well-understood, but these have not yet been incorporated into cost-effectiveness approaches. Economic evaluations of pregnancy currently take an ad-hoc approach to outcome valuation, opening the door to biased estimates and inconsistent resource allocation. We summarise the limitations of current economic evaluation methods and outline key areas for future work.

Introduction:

Cost-utility analysis requires universal and comparable health outcome measures, in which health benefits and harms accrue to an individual receiving treatment. While interpersonal outcomes may be relevant, such as in the case of infectious disease, or in the recent development of spillover effect measures, these are generally secondary to the health benefits of a given treatment. Pregnancy complicates this by introducing a second set of outcomes to consider: those of the fetus. In pregnancy, fetal outcomes may be relevant, irrelevant, secondary, or primary to maternal outcomes depending on the stage of pregnancy, the preferences of the mother, and the nature of healthcare sought. The matter is complicated further by the possibility that no interventional healthcare is provided during pregnancy, or even at the point of delivery.

At present there is inconsistency in whether and how fetal outcomes are included in economic evaluations. Review evidence suggests that outcomes are selected to give findings of cost-effectiveness and justified through flawed rationale (1). The aim of this commentary is to highlight the challenges facing health economists and decision makers evaluating the cost-effectiveness of interventions in the context of contraception and pregnancy. We outline the different decision problems faced, and how maternal and fetal outcomes could be considered in these. We then summarise the limitations of current economic evaluation methods and outline extant research needs.

Measuring benefits when more health may not be better: the pregnancy paradox

A fetus has no measurable preferences, and any healthcare it receives must be consumed and consented to by the person carrying it. The majority of countries do not consider the fetus an individual with rights to healthcare. Nonetheless, fetal outcomes are an important component of obstetric medicine and are important to pregnant patients. However, even accepting the relevance of fetal outcomes to many pregnancy decisions, positive outcomes in pregnancy can take many different forms. Within a person's lifetime, it is common for healthcare to be sought to both prevent and encourage pregnancy at different times; we discuss these in turn.

Care can be sought to prevent pregnancy through contraceptive use, or to terminate an unintended pregnancy. The same person could, later in life, seek care to increase the likelihood of conception. Maternal preferences may also change conditional on pregnancy (i.e. upon becoming pregnant). Therefore, the value of fetal life is conditional on maternal preferences, which may invert for periods of time. For clarity, in this article we refer to maternal preferences in the context of the decision to

carry a fetus to term conditional on maternal or fetal health, and do not refer to, for example, maternal preferences for the location or type of delivery, or for other healthcare characteristics. In this approach we must also assume that maternal preferences do not change upon seeking or receiving care to terminate or proceed with a pregnancy or birth. In other words, the decision problem does not change once it has been set in line with maternal preferences.

The challenge for decision makers is best illustrated using the edge cases. Pregnancy itself incurs a small health risk, which has been reflected in in some studies(2). If the decision maker's aim is too narrow in maximising maternal quality-adjusted life years (QALYs), disregarding maternal preferences and fetal QALYs, they would seek to minimise the number of pregnancies entirely. Conversely, a healthy baby born in the UK has a life expectancy of around 80 years, which with quality adjustment and discounting at 3.5% translates to 27 QALYs (3–5). Thus QALY maximisation on fetal QALYs would almost certainly see interventions to terminate an unintended pregnancy dominated in a cost-effectiveness analysis.

This paradox continues into later pregnancy. Assuming the mother intends to continue the pregnancy, she faces the choice of how to manage healthcare decisions in the context of prenatal screening. These screening tests monitor the progression of the pregnancy and can reveal developmental abnormalities before birth. The value of this information is multifaceted, but it primarily presents people with the opportunity to terminate a pregnancy that is affected (or potentially affected) by developmental conditions that either render the fetus nonviable, or that will substantially affect the future child's quality of life. "Substantially affect" is ultimately a subjective judgement. Two women carrying foetuses with identical conditions may choose very different healthcare pathways, depending on their preferences and values. Again, the decision maker's framework may vary widely, with substantial implications for the perceived cost-effectiveness of these interventions.

Finally, there are circumstances in which maternal and fetal outcomes may be perceived to conflict. These may result from maternal behaviours such as smoking or alcohol consumption, or medical choices, such as declining intervention in labour. Where harmful behaviours are patterned by socioeconomic status, there are equity implications. In addition, in co-occurring health conditions such as pre-eclampsia, the duration of the pregnancy increases risk to the mother but conversely reduces harm to the fetus (6). These health outcomes are diametrically opposed and including both in a cost-effectiveness analysis would reduce the perceived cost-effectiveness of any intervention, no matter its direction of benefit. These *maternal-fetal conflicts* have been widely discussed in the medical ethics literature (7), but less so in health economics.

The final set of dilemmas occur prior to conception. The value of contraception is to maternal health only, and current approaches only averting maternal QALY losses due to mortality and morbidity in childbirth. Some work has valued the impact of an averting unintended pregnancies on maternal quality of life in addition to morbidity and mortality reductions (8), but measurement tools used to-date give extremely varied estimates of the quality of life impact of an unintended pregnancy. At present economic evaluations omit a number of highly relevant factors which may substantially affect maternal health and wellbeing, including adverse mental health (9), educational and other human capital investments, and productivity losses. As we highlight below, measuring and valuing a fuller picture of maternal health is an urgent and important matter.

Costs

An unintended pregnancy may either be averted for the mother's lifetime, or simply be an intended pregnancy but earlier than planned. This distinction matters because the health costs averted by

preventing an earlier-than-planned pregnancy are much less than an averted pregnancy, assuming that the planned later pregnancy does not occur. The impact of discounting also needs to be considered here, particularly if pregnancies are averted among younger women. These costs are relevant to interventions concerning contraception and fertility.

Beyond direct health costs, pregnancy may result in reductions to human capital. These include educational attainment, income, and employment (10,11). It is difficult, but possible, to value such indirect costs. Standard approaches exist to elicit indirect costs, for example losses to earning, from intervention participants, but there is a greater challenge in estimating the counterfactual ie. what would have happened if someone does not become pregnant or give birth.

Further, because access to and use of contraceptives is consistently lower among low socioeconomic status groups in high and low income countries, inequity may indirectly increase through disproportionate reductions in education and earnings among people of low socioeconomic status (12,13). Thus both the equity impact on health and economic outcomes are important, and need to be measured.

Finally, there are costs associated with providing long-term care to babies born with disabilities. This includes prenatally diagnosable conditions, such as Down's syndrome, but also conditions resulting from birth outcomes such as prematurity.

Recommendations and conclusions

How, then, can a decision maker reconcile these conflicting priorities? In the absence of a structured approach, the economic evaluation literature demonstrates inconsistency in which outcomes to include, resulting in outcomes being included (or omitted) in order to demonstrate cost-effectiveness of a particular intervention (1). In deciding whether to include fetal QALYS, we suggest that attention be paid to the *intention* of the intervention. Does the treating clinician, and pregnant person receiving that treatment, intend for the intervention to increase the likelihood of a live and healthy birth, or decrease it, as in the case of abortion? If the former then fetal outcomes should be included, if the latter then they should be omitted. The matter is complicated further if maternal preferences change during pregnancy or birth, which is beyond the scope of this both commentary and existing decision analytic frameworks.

Table 1 displays outcomes for consideration in economic evaluations of interventions with different aims at different stages of conception. What is included in an economic evaluation should be determined by the primary clinical outcome, which is in turn set by maternal preferences. In all cases, maternal outcomes should be included, unless it can be demonstrated that maternal outcomes are entirely unaffected by an intervention. Where contraception is the intended goal, maternal health impacts of pregnancy should be estimated and fetal outcomes omitted. Where the aim of the intervention is to reduce fetal morbidity and mortality, fetal outcomes should also be included.

The Second Panel on Cost-Effectiveness in Health and Medicine recommends that the full range of societal costs and benefits of interventions are considered (14). In pregnancy, this would involve expanding the range of evidence to include the outcomes outlined above, namely maternal quality of life both within and following pregnancy, fetal outcomes throughout the life course, future costs incurred, including social care costs, and productivity costs for mothers.

It is therefore critical that measures of benefit reflect a fuller understanding of maternal welfare and quality of life, for example by including the presence and value of autonomy or considering fertility as an essential element of a potential mother's full functioning, and loss thereof an impact on welfare.

Such losses could be a justification for a claim on societal resources, and therefore be included in decision frameworks.

More health economic work is needed to account and value the nuances of contraception and pregnancy care. Although there are limitations to the proposed approach, notably that relying on the intention of interventions to guide analysis may mean inconsistencies remain, the field of health economics can still offer important contributions, so long as analyses are conducted in a transparent framework with judgements justified explicitly. Most pressingly, we need to understand how to evaluate interventions that increase the health of the baby but risk the health of the mother, or vice versa. Stated preference studies have a role to play here. Discrete choice experiments have been used to evaluate maternal preferences in a variety of decision problems, and could plausibly provide a route to developing or extending utility measures for economic evaluation (15,16). In particular research based on hypothetical preference elicitation tasks such as these should focus on obtaining choice and preference information on trade-offs that are difficult or not feasible to obtain through revealed preference studies. We note that preferences may be complex, context- and time-varying, whilst there may not be an active choice to receive some interventions (emergency care, for example).

While the ethics literature has debated the nature of consent and the rights of the fetus in pregnancy, health economic evaluations either consider fetal outcomes to matter (and are valued equivalent to maternal outcomes), or they do not matter. In addition, a number of studies choose only to value fetal outcomes, even when maternal outcomes will be clearly affected by the intervention, such as in pre-eclampsia (17). There is a clear need for greater collaboration between ethicists and economists in defining feasible interventions and outcomes in economic evaluations, and in particular for ethicists to bring disciplinary expertise in informing discussions around the appropriateness of including or excluding health benefits in different contexts.

Furthermore, pregnancy interacts closely with equity considerations. Harmful behaviours such as smoking are inequitably distributed, propagating lifelong health consequences for babies, and pregnancy also exacerbates income inequality among mothers. Where behaviours or choices are socioeconomically patterned, distributional cost-effectiveness analyses should be conducted to disaggregate these by equity strata to provide information on the distributional impact of interventions.

Where the health economic literature currently lacks credibility is not the absence of a single, unified fetal QALY value, but in its lack of prespecified pregnancy outcomes. Pregnancy is not a single decision problem but many, each needing their own set of outcomes to be incorporated into an economic evaluation. There are unique challenges facing the researcher who wishes to extend their analysis to the societal perspective, but even within the healthcare perspective, consistent QALY or DALY estimates that reflect both maternal preferences and the clinical aims of treatment are not currently available. This amounts to a significant gap in the health economics toolkit, and we hope these suggestions for future research priorities provide a useful basis.

Table 1: Illustrative examples of outcomes to consider in economic evaluations of pregnancy-related healthcare

References

1. Goldhaber-Fiebert JD, Brandeau ML. Evaluating Cost-effectiveness of Interventions That Affect Fertility and Childbearing. *Med Decis Mak* [Internet]. 2015.35(7):818–46.
2. National Institute for Health and Care Excellence (NICE). Hypertension in pregnancy: diagnosis and management (NG133), Evidence Review C [Internet]. NICE; 2019 [cited 2019 Aug 15]. Available from: <https://www.nice.org.uk/guidance/ng133/evidence/june-2019-evidence-reviews-6836186125?tab=evidence>

Time	Healthcare sought	Example indicator	Health outcomes
Before conception	Contraception	Unintended pregnancy	Maternal health
	Folic acid	Adherence, sequelae	Fetal health
	Fertility services	Pregnancy	Maternal and fetal health
After conception	Pregnancy test	Test sensitivity/specificity	Maternal and fetal health
	Mid-pregnancy checks	Test sensitivity/specificity	Maternal and fetal health
	Abortion services	Success, sequelae	Maternal health
	Sexually-transmitted and other infection screening	Test sensitivity/specificity, vertical infections averted	Maternal and fetal health
	Miscarriage services	Sequelae	Maternal health
Prenatal and delivery	Abortion services	Success, sequelae	Maternal health
	Miscarriage services	Sequelae	Maternal health
	Pre-natal care	Number/quality of visits	Maternal and fetal health
	Delivery	Place of delivery, quality of care	Maternal and fetal health
	Post-natal care		Maternal and fetal health
	Care for post-birth sequelae (mother and child)		Maternal and fetal health

3. ONS. National life tables, UK - Office for National Statistics [Internet]. 2019 [cited 2020 Sep 1]. Available from: <https://www.ons.gov.uk/peoplepopulationandcommunity/birthsdeathsandmarriages/lifeexpectancies/bulletins/nationallifetablesunitedkingdom/2016to2018>
4. NICE. Guide to the methods of technology appraisal 2013 [Internet]. 2013.
5. Kind P, Hardman G, Macran S. UK Population Norms for EQ-5D. 1999. (CHE Discussion Papers). Report No.: 172.
6. Frampton GK, Jones J, Rose M, Payne L. Placental growth factor (Alone or in combination with soluble fms-like tyrosine kinase 1) as an aid to the assessment of women with suspected pre-eclampsia: Systematic review and economic analysis. *Health Technol Assess (Rockv)* [Internet]. 2016.20(87).
7. Baylis F, Rodgers S, Young D. Ethical dilemmas in the care of pregnant women: rethinking “maternal–fetal conflicts.” In: Singer PA, Viens AM, editors. *The Cambridge Textbook of Bioethics* [Internet]. Cambridge: Cambridge University Press; 2008. p. 97–103.
8. Schwarz EB, Smith R, Steinauer J, Reeves MF, Caughey AB. Measuring the effects of unintended pregnancy on women’s quality of life. *Contraception* [Internet]. 2008.78(3):204–

- 10.
9. Bahk J, Yun S-C, Kim Y, Khang Y-H. Impact of unintended pregnancy on maternal mental health: a causal analysis using follow up data of the Panel Study on Korean Children (PSKC). *BMC Pregnancy Childbirth* [Internet]. 2015.15(1):85.
10. Fletcher J, Wolfe B. Education and Labor Market Consequences of Teenage Childbearing: Evidence Using the Timing of Pregnancy Outcomes and Community Fixed Effects [Internet]. Cambridge, MA; 2008 Mar.
11. Ashcraft A, Fernández-Val I, Lang K. The Consequences of Teenage Childbearing: Consistent Estimates When Abortion Makes Miscarriage Non-random. *Econ J* [Internet]. 2013.123(571):875–905.
12. Metcalfe A, Talavlikar R, du Prey B, Tough SC. Exploring the relationship between socioeconomic factors, method of contraception and unintended pregnancy. *Reprod Health* [Internet]. 2016.13:28.
13. Adebowale SA, Adedini SA, Ibisomi LD, Palamuleni ME. Differential effect of wealth quintile on modern contraceptive use and fertility: evidence from Malawian women. *BMC Womens Health* [Internet]. 2014.14(1):40.
14. Carias C, Chesson HW, Grosse SD, Li R, Meltzer MI, Miller GF, et al. Recommendations of the Second Panel on Cost Effectiveness in Health and Medicine: A Reference, Not a Rule Book. *Am J Prev Med* [Internet]. 2018.54(4):600.
15. Gärtner FR, De Bekker-Grob EW, Stiggelbout AM, Rijnders ME, Freeman LM, Middeldorp JM, et al. Calculating Preference Weights for the Labor and Delivery Index: A Discrete Choice Experiment on Women’s Birth Experiences. *Value Heal* [Internet]. 2015.18(6):856–64.
16. Ryan M, Ratcliffe J, Tucker J. Using willingness to pay to value alternative models of antenatal care. *Soc Sci Med* [Internet]. 1997.44(3):371–80.
17. Werner EF, Hauspurg AK and R, DJ. A Cost-Benefit Analysis of Low-Dose Aspirin Prophylaxis for the Prevention of Preeclampsia in the United States. Vol. 126, *Obstetrics & Gynecology*. 2015. p. 1242–50.