



An exploration of health economic approaches in pregnancy: incorporating maternal and fetal outcomes.

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ABSTRACT

Background: Pregnancy presents unique challenges to economic evaluation and the valuation of health outcomes. These include: how to include both maternal and fetal health outcomes in the analysis; how to appropriately value future life; and how to account for maternal autonomy and reproductive freedom. The aim of this thesis was to develop a framework of relevant outcomes in pregnancy that could be used in economic evaluation.

Methods: First, a systematic review was conducted of cost-utility analyses in pregnancy, evaluating how maternal and fetal health outcomes have been measured and valued. Second, a qualitative secondary analysis of interviews with pregnant people was conducted. This sought to understand how people reflect on and make decisions during pregnancy. The themes from this analysis were then contextualised within health economic theory and practice. Finally, a preliminary framework of outcomes and considerations for pregnancy was developed.

Results: The systematic review identified 127 studies, and found that maternal and fetal health outcomes were included inconsistently. The assumptions made regarding the measurement and valuation of maternal and fetal health outcomes were often not stated. The qualitative analysis identified six overarching themes that shaped the decisions taken in pregnancy: autonomy, maternal health and wellbeing, fetal health and wellbeing, family building, social context and morality. These themes were contextualised in terms of health economic theory and methods to develop a set of concepts relevant to decision-making in pregnancy. These were refined into a framework which was applied to three published examples to identify outstanding areas of research.

Conclusions: This thesis presents a preliminary framework that reconceptualises pregnancy in health economic terms. It highlights a range of outstanding normative and

methodological questions that need to be answered to enhance the consistency, transparency and fairness of resource allocation for healthcare during pregnancy.

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COLLABORATIONS, CONTRIBUTIONS AND PUBLICATIONS

Chapter 1. My own work. Some concepts discussed were developed out of a published paper written by myself and Matthew Quaife, which is referenced in Chapter 1, but the writing here is original and by me.

Chapter 2. Written solely by myself.

Chapter 3. This systematic review has been published. The text was written solely by me, with revisions from my co-authors, who are also my supervisors. There is one additional author on the published paper: Ting Cai, a fellow doctoral student who acted as the independent screener alongside me, and also contributed revisions to the text. The chapter is a lightly edited version of the published paper. A draft of the paper was discussed at the 2022 Summer Health Economists' Study Group, and that discussion informed the development of the draft.

Chapter 4. Written solely by myself.

Chapter 5. The qualitative analysis was informed by discussion with my supervisor, Abigail McNiven during the coding and analysis. Lisa Hinton provided feedback on an early draft of the chapter. The written work is solely by me.

Chapter 6. Written solely by myself.

Chapter 7. Written solely by myself.

Chapter 8. Written solely by myself.

ABBREVIATIONS

APEC: Action on Pre-eclampsia

ARR: adjusted relative risk

ART: assisted reproductive technology

BPAS: British Pregnancy Advisory Service

C-section: caesarean section

CBA: cost-benefit analysis

CCA: cost-consequence analysis

CEA: cost-effectiveness analysis

CHEERS: Consolidated Health Economic Evaluation Reporting Standards

CMA: cost-minimisation analysis

CUA: cost-utility analysis

DALY: disability-adjusted life year

DCE: discrete choice experiment

EQ-5D: EuroQoL-5 Dimension

GBD: Global Burden of Disease

GP: general practitioner

HDN: haemolytic disease of the newborn

HEXI: Health Experience Insights archive, University of Oxford

HIV: human immunodeficiency virus

HRQoL: health-related quality of life

HUI: Health Utilities Index

ICB: integrated care board

ICECAP: ICEpop CAPability measure

ICER: incremental cost-effectiveness ratio

ICU: intensive care unit

IVF: in-vitro fertilisation

MBRRACE-UK: Mothers and Babies: Reducing Risk through Audits and Confidential Enquiries across the UK

MCDA: multicriteria decision analysis

mHealth: mobile health

MLU: midwife-led unit

NHS: National Health Service

NICE: National Institute of Health and Care Excellence

NIPT: non-invasive prenatal testing

OU: obstetric unit

PEDE: Paediatric Economic Database Evaluation

PPI: patient and public involvement

PTSD-FC: post-traumatic stress disorder following childbirth

QALY: quality-adjusted life year

SF-6D: Short Form 6 Dimension

UK: United Kingdom

WHO: World Health Organisation

WTP: willingness to pay

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1 INTRODUCTION

1.1 PREGNANCY

Pregnancy is the process through which every human comes into being. In England and Wales, there are approximately 600,000 live births each year (1), each resulting from a pregnancy that lasts approximately 40 weeks. Around 7.6% of live births are preterm. In addition to these births, in the United Kingdom (UK), around 1 in 4 pregnancies end in miscarriage, and 4 in 1000 end in a stillbirth (2). A further 200,000 pregnancies are terminated each year in England and Wales; 1.6% of these are terminated due to fetal abnormalities (3).

Being pregnant and giving birth carries a range of health risks to the pregnant person. Pregnancy can have both short- and long-term health effects on maternal health and, in severe cases, carries a risk of maternal mortality. Healthcare during pregnancy therefore has two overarching goals: to ensure the safety of the baby, and to safeguard the health of the pregnant person.

In addition to these clinical concerns, pregnancy also forms part of the normal life course. Every human is born, and many people experience pregnancy and give birth. Pregnancy carries social and cultural significance. Contrary to other health conditions, pregnancy is not in itself an illness or disability, and is often a healthy part of the human condition. It can result in, or be complicated by, illnesses or other health problems, and can be disabling – either temporarily or permanently – but it can also be an ordinary part of life. It is possible to go through an entire healthy pregnancy with no need for clinical intervention at all.

Because of this cultural significance, there are strong social ideas around the notion of having a good pregnancy and a positive birth experience. In many countries, including the UK, antenatal care is primarily provided by midwives rather than doctors. Doctors instead

intervene only when complications arise or are at risk of arising. According to the International Confederation of Midwives, a midwife's scope of practice includes to "optimise the normal biological, psychological, social and cultural processes of pregnancy, childbirth, the postnatal and newborn period", as well as to "work in partnership with women, respecting the individual circumstances and views of each woman" (4). This scope of practice encompasses a much broader range of goals than the two outlined above, and reflects the unique position pregnancy occupies within both healthcare systems, and wider society.

A number of initiatives have existed that seek to define the optimal type of birth. In 1985, a World Health Organisation (WHO) panel on caesarean (c-)section rates concluded there was no justification for a region having a rate of c-section births higher than 10-15%. This was based on measuring the effects of rising c-section rates on mortality, namely that a c-section rate above 10% was not associated with a reduction in maternal or perinatal mortality (5). This statistic became a central part of maternal health policy in many countries, but led to concerns around the risk of denying birthing people agency in order to comply with a pre-determined, acceptable level (6). In 2015, the WHO clarified that "every effort should be made to provide caesarean sections to women in need, rather than striving to achieve a specific rate" (7).

The emphasis on minimising intervention and promoting natural birth has existed in the context of pregnancy care for many years. The primary provider of antenatal classes in the UK – the National Childbirth Trust – was previously called the Natural Childbirth Trust, and existed with an explicit mandate to lobby against the use of "interventionist techniques" in childbirth (8).

However, this emphasis, when implemented at a policy level, can come with risks. There have been a number of scandals in maternity care in the UK in recent years, where pregnant people and babies have died or been seriously harmed in circumstances that were later found to be avoidable, and that resulted from systematic failures of care (9–11).

Investigations have identified a range of causes for the failures, including policies to encourage “natural” birth on labour wards and reduce c-section rates. By pursuing a policy of “natural at all costs”, labouring patients have been put into unsafe situations that in some cases resulted in the death of their baby (9). Other sources of failure were conflict between obstetricians and midwives (10), and failing to listen to patients’ concerns and respond to them appropriately and compassionately (11). These scandals highlight the risk of ethics violations in this sensitive clinical area, and the high consequences of such violations. They also emphasise the complexity of setting policy in a clinical area where the definition of optimal care can be subjective, between patients and clinicians, and between clinical specialties. The investigation into the East Kent maternity scandal highlighted (11):

“There is a crucial truth about maternity and neonatal services which distinguishes them from other services provided at hospitals. It is in the nature of childbirth that most mothers are healthy, and, thankfully, their babies will be too. But so much hangs on what happens in the minority of cases where things start to go wrong, because problems can very rapidly escalate to a devastatingly bad outcome.”

(11)

Pregnancy and birth differ from other areas of healthcare in the need for clinical care to accommodate and promote routine, healthy pregnancies and births, while also managing risk and preventing negative health outcomes.

This context presents challenges to economic evaluation of healthcare interventions; the purpose of this thesis is to further understanding of these challenges and investigate methods to address them.

1.1.1 A note on language

Throughout this thesis, I primarily use the phrase “pregnant person” to refer to the individual who is pregnant. This is the broadest descriptor available, and encompasses

every person who finds themselves pregnant, regardless of their age, gender identity or intentions regarding the pregnancy. It includes children, trans men and non-binary individuals.

This is not to detract from the fact that pregnancy and birth are feminist issues. On the contrary, the move towards more inclusive language has partly been brought about by the need to recognise the diversity of communities affected by patriarchal suppression and misogyny. While gender essentialism has sometimes historically been a valuable tool in advocating for pregnant people within the field of midwifery, modern guides to inclusive language in pregnancy and birth argue against the value of this approach:

“Many intersectional and postcolonial feminists discount the usefulness of generalizing terms (e.g., ‘sisterhood’ or ‘womanhood’) to capture experiences like childbirth and patriarchal suppression, since these terms not only deny the existence of gender-diverse experiences, but also ... perpetuate ongoing marginalization through assumptions rooted in essentialism.”

(12)

The majority of pregnant people are women, and I sometimes use female pronouns when referring to individuals throughout the thesis. For example, in Chapter 5 (qualitative analysis), none of the participants self-reported as being gender diverse, and so the use of the term “pregnant woman” or “she” feels more accurate, given that the experiences of gender diverse pregnant people may differ from those recorded here. I also use the descriptor “maternal” when referring to the health of the pregnant person, for example in the phrase “maternal health outcomes”. This is in keeping with the clinical language used in this context, but the reader should bear in mind that “maternal” here refers to a person who is pregnant, and that they may not identify as a woman or mother.

1.2 OUTLINE

The remainder of this chapter is structured as follows. Below, I provide an introduction to the relevant health economic concepts used in the thesis, including economic evaluation, cost-utility analysis (CUA) and health measurement. I then outline how pregnancy differs from other health conditions with respect to these concepts, and the challenges presented by pregnancy to conducting CUA in particular.

Subsequently, I present the aims, scope of the thesis, and outline of the remaining chapters. I summarise the contribution to the literature made by the thesis, and then conclude.

1.3 ECONOMIC EVALUATION

Improving the safety of pregnancy and childbirth has been one of the great success stories of modern healthcare. At the start of the 20th century, the maternal mortality ratio in the UK was 475 maternal deaths per 100,000 live births. By 2023, that rate had decreased to 8 deaths per 100,000 live births (13). Similarly, the neonatal death rate in the UK has decreased from 1600 per 100,000 live births in 1960 to 270 per 100,000 in 2023 (14). Globally, both maternal and neonatal mortality remain high in many countries, and both are the subject of WHO Sustainable Development Goals: target 3.1 is to reduce the global maternal mortality ratio to less than 70 per 100 000 live births, and target 3.2 is to end preventable deaths of newborns and children under 5 years of age, with a target to reduce neonatal mortality to at least as low as 1200 per 100,000 live births (15). In the UK, the MBRACE-UK programme investigates maternal and perinatal deaths, including late stillbirths, with the aim of using its findings to facilitate improvements to clinical care and prevent future deaths (16). Recently, the report has found a slight increase in maternal mortality in the UK, highlighting the need for ongoing research (17).

New interventions to improve these outcomes have resource implications for healthcare budgets. There is tension in funding new treatments within a fixed healthcare budget; if

an intervention increases resource use, then funding it will involve reallocating resources away from existing alternatives. When allocating resources within healthcare budgets, it is vital to analyse the costs and consequences associated with investing in new interventions. Specifically, the opportunity cost: whether investing in the new intervention will result in improved health outcomes, relative to investing that same money in the alternatives.

Economic evaluation is the process of understanding the opportunity costs of investing in new interventions. This is operationalised using the cost-effectiveness framework that determines the value for money of new interventions compared to the alternatives (18).

In an economic evaluation, relevant costs and outcomes associated with each possible course of action are identified, measured and valued. Which costs and outcomes are included depends on the perspective of the analysis, which reflects the interests of the decision maker. Common perspectives in health economic evaluation are the societal perspective, where all possible costs and consequences are considered, and the healthcare perspective, where only the costs and consequences relevant to the healthcare system are included. The relevant outcomes under this perspective are the health outcomes experienced by patients (and when relevant their carers). The National Institute for Health and Care Excellence (NICE) reference case on health technology evaluations requires an NHS and personal social services perspective on costs and outcomes (19).

1.3.1 Measuring and valuing health

In order to conduct an economic evaluation, it is necessary to have an outcome of interest that is both relevant to the decision maker and quantifiable. The outcome can take a variety of forms, but the outcome primarily of interest to decision makers and most health economists in healthcare resource allocation is health itself. Defining, measuring and valuing health is therefore of substantial interest to health economists (20).

Three methods of combining costs and outcomes have come to predominate in economic evaluation, offering three alternative ways of defining and measuring health. Below, I define each method and explain its strengths and weaknesses.

1.3.1.1 Cost-effectiveness analysis

Cost-effectiveness analysis (CEA) relies on health outcomes expressed using natural units (21). Rather than seeking to define health using a metric that can be used across conditions and therapeutic areas, a CEA will set its unit of effectiveness as a relevant clinical outcome. This could be a unit improvement on a patient-reported outcome measure, for example, or an observable clinical measure such as progression-free survival, where progression is a clinical observation recorded by the clinician. The advantage of CEA is that it reflects direct, observable clinical outcomes. The disadvantage is that comparison across clinical or disease areas is not possible. A CEA might help a decision maker allocate a budget across different cancer therapies if the CEA for each employed a common outcome such as progression-free survival, but is less helpful when deciding whether to invest in a new cancer treatment rather than a diabetes prevention programme, for example.

1.3.1.2 Cost-benefit analysis

In order to enable between-sector comparison, economists developed an alternate method, cost-benefit analysis (CBA), based on welfare economics (22). In CBA, the unit of benefit is welfare, or utility, expressed in monetary terms. If the utility gained by the intervention outweighs its cost, it is cost-beneficial, or, in other words, welfare-improving. The question of how to define whether an intervention is welfare-improving has been approached in two primary ways. The most simple definition is whether the intervention makes some individuals better off, but no-one worse off (a Pareto improvement) (21). This definition is simple but impractical for two reasons: first, it rules out any policy changes or budget reallocations that make anyone worse-off. In practice, this makes meaningful policy change impossible, since nothing can be disinvested from or replaced unless its current beneficiaries directly benefit, or at least are not made worse-off. Second, it assumes that the status quo is optimal. No account is made of the current distribution of general welfare. In a world in which one person has everything, and everyone else has nothing, any attempt to reallocate some of that individual's wealth to alleviate everyone

else's poverty would be forbidden under these conditions, since the rich individual would lose out. Consequently, an alternative definition was developed, that of the compensation principle (23,24). In this case, an intervention is considered to be welfare improving if the beneficiaries of the intervention would be able to compensate the losers and still be better off. There is no requirement for this compensation to actually take place. This approach – known as a potential Pareto improvement – avoids directly comparing individual's welfare functions, but still allows the improvement to be measured, and for a judgement of whether overall social welfare is improved (25). The compensation principle still forms the basis of modern CBA (26).

The advantage of CBA is that interventions do not need to be domain-specific.

Hypothetically, a wind farm can be compared against a cancer treatment; the challenge lies in quantifying the value to each individual who is affected. CBA should reflect the welfare changes accruing to each individual, not merely their financial gains and losses. Capturing changes in welfare in monetary terms remains difficult and controversial. This is particularly noticeable in health. In classic economic thinking, prices are set by the market. One's willingness to pay (WTP) reflects the utility one gains from the item. The healthcare industry is subject to uncertainties regarding the effects of healthcare on health that make a marketplace in healthcare inefficient, and therefore the possibility of valuing healthcare interventions in terms of welfare improvement extremely challenging (27). In practice it is all but impossible to ascertain a true WTP for health gains empirically.

Depending on the method used, estimates vary substantially, and the value of health can only be obtained indirectly, through an individual's WTP for healthcare, not for health itself.

Beyond these measurement concerns, the underlying assumptions of CBA are at odds with the goals of public healthcare systems. Firstly, the healthcare budget is finite, and set at the national or regional level. The budget is not responsive to one's WTP for health, other than an indirect effect through the democratic process. Secondly, under a public health

system the goal is to maximise health for the population, rather than for a single individual. All people's health is considered equal, whereas one's WTP is strongly linked to their income, resulting in higher WTP for richer individuals. If relying on this measurement of health valuation, this would lead to inequity in resource allocation decisions in favour of the rich. This concern would also affect CBA based on a human capital approach, where one's economic productivity is used to value improvements in their health outcomes (28). Collectively, these issues make the use of CBA difficult, and alternative approaches that relax some of these assumptions have been developed.

1.3.1.3 Cost-utility analysis

In response, health economists have moved to an extra-welfarist approach to economic evaluation of healthcare. In extra-welfarism, the improvement of welfare (or utility) is still the theoretical framing on which decisions are taken, but the type of utility under consideration is restricted to the domain of interest. In this case, health. In addition, while in traditional welfare economics utility is derived from the consumption of goods and services (i.e., healthcare), in extra-welfarism, utility can also be derived from what Culyer describes as the non-goods characteristics of individuals (29). In this way, utility can be derived from one's state of health in its own right, rather than merely via the goods and services one can procure as a result of good health. The concept of health as a source of welfare both in its own right and as a means to achieve other things, such as by enabling the exchange of labour for wages, was further developed into a health production function (30).

This approach of economic evaluation using health-related utility is known as cost-utility analysis (CUA). The outcome of interest in CUA is most commonly a utility-based measure of health known as the quality-adjusted life year (QALY). This measure combines length of life with health-related quality of life (HRQoL), which is calculated using a health-related utility derived from preference-based measures of health (PBMs). One QALY is equivalent to one year of life lived in good health, and incremental cost-

effectiveness is measured in terms of cost-per-QALY gained (21). PBMs are questionnaires that are completed by patients to summarise their health state, such as the EQ-5D and SF-6D (31,32). The health states indicated by PBMs are indexed at 0 to 1, where 0 reflects death and 1 reflects perfect health. Negative health states (states considered to be worse than death) are also possible. Health states are valued by a sample drawn in most cases from the general public using preference elicitation techniques (20).

An alternative measure of health in CUA is the disability-adjusted life year (DALY). DALYs are a measure of disease burden. Where 1 QALY represents one year of good quality life, 1 DALY represents a year of life lost due to disability or premature mortality (33). DALY disability weights are allocated to each condition, rather than each health state, and are drawn from a global sample of the public using a process of comparison (34).

There is also a non-welfarist interpretation of QALYs, which characterises health as a social good. Instead of the QALY representing individual utility, it instead approximates the decision maker's intentions in allocating resources to improve health. Health is valuable not because it is a source of utility so much as because it is in the social interest, as decided by governments, funding bodies and policy makers (35).

CUA has been recommended for conducting economic evaluation by a number of healthcare decision-making bodies around the world, including in the UK (36,37).

1.3.2 The role of CUA in health policy

In England, healthcare resource allocation decisions tend to be taken either at the national level, through the National Institute for Health and Care Excellence (NICE), or at a local level, such as through Integrated Care Boards (ICBs). CUA conducted at the national level helps to minimise inappropriate regional variation (the postcode lottery) by standardising the value assigned to health outcomes. At the national level, CUAs increase the transparency of decision-making and a sense of fairness across clinical areas by placing health outcomes on a comparable scale. Where CUAs are not available, resources are still

allocated by the same decision makers, on the same scale, from the same budget, but the outcomes of the analysis are not determined through nationally standardised methods. Instead, local decision making committees interpret the available evidence according to their own criteria and decision-making frameworks, which vary according to local needs (38,39). Evidence is subject to the implicit or explicit assumptions made by the committee taking the decision. While committees may seek to be explicit in the assumptions they make, different individuals will inevitably prioritise different outcomes based on their expertise and personal preferences (40). In practice, this can lead to variation in what care is available in what region, and inconsistency in decision-making across clinical areas (41).

In CUA, health outcome valuation has been standardised and is drawn from the general population according to agreed-upon methods. The NICE reference case guides how CUA is carried out in England (19).

1.3.2.1 Other approaches

This thesis is concerned with how pregnancy-related outcomes can be incorporated into economic evaluation, and therefore evaluative methods that analyse only costs and do not include health outcomes (such as budget impact analysis and costing analysis) are not in scope and will not be discussed further.

Additionally, two further approaches to economic evaluation are not considered here: cost-consequence analysis (CCA), and cost-minimisation analysis (CMA). CCA simply reports estimates of resource use and clinical outcomes associated with an intervention separately. Although outcomes are reported, they are not valued, and no incremental cost-effectiveness ratio (ICER) is generated (42). The concern of this thesis is how outcomes are valued in economic evaluation of pregnancy, and therefore CCA is not of interest. CMA relies on the assumption that the outcomes associated with the interventions being compared are identical. In effect, in CMA the outcomes can be ignored and only the costs are evaluated (43). As a result, this is also not in scope for this project.

1.4 ECONOMIC EVALUATION OF PREGNANCY

1.4.1 CUA in pregnancy

Pregnancy poses a unique challenge to methods of economic evaluation and, in particular, cost-utility analysis (CUA). Interventions given in pregnancy have the potential to affect health outcomes for both the pregnant person and fetus. In addition, those same health outcomes may be desirable or undesirable depending on the particular individual and context, for example in the case of unwanted pregnancy (44).

It is unclear how much weight (if any) should be given to fetal outcomes in CUA. In both medical and research ethics, the valuation of fetal outcomes remains a topic of debate (45–47). Estimating fetal quality-adjusted life year (QALY) gains in situations where miscarriage, stillbirth or termination of pregnancy are possible outcomes raises not only methodological challenges, but also difficult ethical questions about how to value potential future life years (48).

Because of this, a large proportion of economic evaluations use CCA or CEA. In chapter 3, I conducted a systematic review which found that out of 361 economic evaluations identified, only 127 were CUAs (35%) (49). In the absence of CUA, a decision-maker allocating resources must decide individually what their willingness to pay is per outcome, which can result in inconsistency between decision-makers and across health conditions (41). Thus decision-makers are left with inadequate tools to evaluate interventions for health conditions in pregnancy.

1.4.1.1 *Including all relevant outcomes*

In order for an economic evaluation to be valid, it must include all relevant costs and outcomes. In pregnancy, the range of affected outcomes is broader than in many areas of healthcare. As explained above, both maternal and fetal health outcomes can be affected by interventions, but the nature of those effects can also be complex. Maternal health effects could range from short-term morbidity to long-term morbidity, as well as effects

such as the inability to conceive more children, either because of physical barriers such as an emergency hysterectomy, or mental and emotional ones such as birth trauma.

On the infant side, the effects of pregnancy and birth on the health of the baby can range from short-term morbidity, such as jaundice, to lifelong disabilities and even death. One area of health economic research is the impact of birthweight on educational outcomes, and therefore on the ability of the baby to grow up into a full participant in society (50).

On the costs side, preterm birth can incur additional healthcare costs throughout the life course (51). Being able to account for all of these additional costs within an evaluation presents challenges (52).

There are also things like the effects of the infant's outcomes on the family. If a baby suffers a complication during birth and develops a disability, that will affect the parents' quality of life profoundly (53). There may also be economic consequences, in that it may no longer be possible for both parents to work as they may have done if the baby was not disabled, due to the child's more advanced care needs (54).

1.4.2 Challenges presented by pregnancy

Pregnancy presents a number of challenges to economic evaluation. Understanding these is crucial to outlining the aims of this thesis.

There is a large philosophical literature that has sought to understand the nature of pregnancy and the maternal-fetal dyad. At the heart of the discussion is whether pregnancy consists of one individual or two, and, specifically, when life begins. As medical technology has advanced, it has become possible to learn more about very early embryonic development, and this has led to arguments in favour of a two patient model from early in pregnancy, arguing that the embryo becomes a living individual as early as 16 days after conception (55). A counter argument to this is that the fetus remains part of the maternal organism up until the point of birth (56). Alternative models of pregnancy have also been developed, viewing pregnancy not as one or two individuals, but instead as a negotiation or process by which new life is formed (57,58).

The relevance of this discussion to healthcare pertains to how pregnancy should be treated within clinical settings, and in particular to issues of maternal-fetal conflict and how this should be addressed. The notion of what is owed to the fetus, potentially at the expense of the health of the pregnant person, is a key component of the discussion (59). Because of this ambiguity, birthing people are particularly vulnerable to violations of their consent, generally justified on the grounds of fetal wellbeing (60). There is a further argument in favour of maternal autonomy even outside of debates around the beginning of life, namely that bodily autonomy applies to any individual even where removing it would save the life of another. This was most famously put forward by Judith Jarvis Thompson in the “famous violinist” essay “A Defense of Abortion” thought experiment (61).

How to value all relevant outcomes fairly remains an open question. These issues were discussed in a previously published article written early in the doctorate (44). In it, we proposed that maternal intention, rather than clinical context, was a central factor in determining how fetal health outcomes should be valued in economic evaluations. The rationale for this was based on three features of pregnancy that make it unique as a health state, and are discussed below.

1.4.2.1 One person or two?

Most CUA assumes that there is a single patient who receives and benefits from treatment (although there are situations where this has been extended, such as in the case of health spillovers to carers (62)). In pregnancy, it is the pregnant person who consents to and receives healthcare interventions, but one of the goals of antenatal care is to also ensure the wellbeing of the fetus. Any intervention given to one, or health condition that affects one, will potentially impact the other (or others in the case of multiple pregnancy).

This relationship between the health of the pregnant person and the fetus is not straightforward. At various points in pregnancy, the pregnant person’s health may be put at risk by the pregnancy, despite the fetus thriving. Maternal HRQoL may be impaired by conditions such as pregnancy sickness or pelvic girdle pain. At other points, fetal

wellbeing may be in jeopardy, requiring the pregnant person to undergo significant intervention to no benefit of their own.

A condition that threatens the health of the fetus may not affect the pregnant person. Such conditions include chromosomal anomalies, congenital heart disease, and developmental abnormalities such as spina bifida (63–65). In these circumstances, the fetus may need additional care and monitoring during the pregnancy, which will necessarily be performed on the pregnant person. Intervention may be minimal and non-invasive, such as additional scans, or it may be extensive, up to and including surgery on the fetus (66).

There may be pre-existing health conditions that affect pregnancy, either directly or through harm caused by their treatment. Epilepsy is not inherently unsafe in pregnancy, but many anti-seizure medications are teratogenic (67). Likewise, the medications used to treat many mental health conditions are either unsafe in pregnancy or of unclear effect (68). Many pregnant people are taken off their medications for mental health, or cease taking them on their own initiative, but this increases the risk of a maternal mental health crisis, such as post-partum depression, anxiety or psychosis, which risks serious harm to both the pregnant person and baby (69).

Other health conditions may affect the pregnant person asymptotically but only manifest in physical harm to the fetus. These include rhesus disease, where a rhesus negative pregnant person carries a rhesus positive baby, having been previously sensitised, causing a haemolytic immune response where the pregnant person's immune system attacks the fetal blood cells (70). Another example is antiphospholipid syndrome, a clotting disorder that is usually asymptomatic, but that impairs the placenta and increases the risk of miscarriage, stillbirth, intra-uterine growth restriction, and pre-eclampsia (71). In both cases, medical treatment of the pregnant person is necessary to reduce the risk to the fetus and/or future fetuses.

There are also harms caused by pregnancy that risk the health, and sometimes the life, of the pregnant person. These include pre-eclampsia and gestational diabetes. Both put the

pregnant person at increased risk of both short and long-term adverse cardiovascular events (72–75). Hyperemesis gravidarum, severe nausea during pregnancy, can cause dehydration and malnutrition to the pregnant person (76).

In severe cases, maternal diseases of pregnancy can become so dangerous that it is necessary to end the pregnancy for the safety of the pregnant person (77,78). In less severe cases, these health conditions still place the health of woman and fetus in tension. An example of this is pre-eclampsia, where improving outcomes for the fetus, through prolonging gestation, increases the risk of morbidity and mortality for the woman (79,80). The question of how to time delivery appropriately will depend on how outcomes are measured and valued for both the pregnant person and fetus. This specific example will be discussed further in later chapters.

Put simply, healthcare in pregnancy is concerned with not only the health of the pregnant person, but also that of the fetus. This concern is complex, however. Fetal health outcomes may be affected or unaffected by an intervention and, more than this, the pregnant person may be motivated by a desire to ensure the wellbeing of the fetus, or conversely by a desire to cease to be pregnant at all. These motivations may change during pregnancy, and in response to changes in external circumstances.

Previous work has found that the choice of outcomes reported in published economic evaluations in pregnancy and fertility tends to favour the intervention being evaluated (81), and that the decision to include or exclude fetal outcomes has the potential to affect cost-effectiveness estimates substantially (82).

1.4.2.2 Maternal autonomy

Human rights law states that human rights begin at birth (83). Consequently, the pregnant person, in theory, retains full autonomy and control over their body throughout their pregnancy. Pregnant people have the right to refuse any treatment, regardless of the consequences for either themselves or their baby, as long as they have the capacity to make an informed decision.

However, the question of how to account for the wellbeing of the fetus has added complexity to this straightforward fact. Societies have long been concerned with the question of when life begins, and there remains no fixed consensus on this thorny question (for example: (55,56)). In clinical terms, exactly how much risk a pregnant person should be permitted (or may choose) to take in relation to their fetus is still discussed (84), even as both the United Nations and World Health Organisation advocate for respectful maternity care that protects women's human rights during labour and birth (85), and "enables informed choice" (86).

At the national level, there are a variety of laws that govern the exact nature of what a pregnant person can or cannot do with regard to their pregnancy. In the UK, abortion is permitted up to 24 weeks (with the consent of two doctors), and beyond if certain criteria apply, such as when the pregnant person's life is at risk or when the fetus would be unlikely to survive (87). Recently, women in the UK have been prosecuted for obtaining abortions outside of these strict legal parameters (88). In other countries, abortion continues to be heavily restricted. In the USA, the right to an abortion has been rolled back at the national level, and new laws banning or heavily restricting abortion access have been implemented in many states (89).

Another area where autonomy is both acutely visible and the subject of debate is during labour and birth. The choices of where to give birth and how much intervention to accept during labour is deeply personal. Loss of autonomy during labour is associated with a traumatic birth experience, something that affects up to 45% of birthing people, and of these, around 4-6% will develop post-traumatic stress disorder following childbirth (PTSD-FC) (90). Women who show some or all the symptoms of PTSD-FC are more likely to report a poor relationship with the staff caring for them, notably feeling less well-informed and less listened to (91). PTSD-FC carries potentially lifelong effects on mental health and patient's relationship with medicine, including any subsequent births (92). It may also affect new mother's ability to bond with the baby, potentially passing harm down

to the second generation (93). Alongside this, the right to give birth outside of guidance is also enshrined, even when it increases risks to the pregnant person or the baby (94).

1.4.2.3 Valuing future lives

The loss of a pregnancy that had been progressing, whether due to miscarriage, stillbirth, or termination, can be devastating to the parents and wider family. Miscarriages are associated with physical and mental health consequences for the pregnant person, including infection, anxiety and depression, post-traumatic stress disorder, and suicide. The short-term economic costs of miscarriage in the UK are estimated at £471 million (95).

However, from the perspective of the healthcare system, is the loss simply a personal health issue for the pregnant person? Or is there a greater value that should be recognised?

The ability to reproduce is a form of health that sits on the very edge of conventional notions of what it means to be healthy. As such, current health economic frameworks struggle to accommodate this fundamental aspect of human desire and functioning, and preference-based QoL measures largely exclude it. The HUI2 instrument includes a fertility dimension, designed to capture the effects on fertility of childhood cancer, but this is not present in the subsequent iteration, the HUI3 (96).

On top of this, new lives add economic value to society. Many high income countries, including the UK, are experiencing falling birth rates, and this effect is expected to continue, in part due to adults delaying reproduction and reducing the number of children they have (97,98). There are profound economic and social effects that result from this demographic transition (99), and, as a result, governments are increasingly implementing policies aimed at increasing the total fertility rate of their populations (100). While CUAs usually take a healthcare perspective, this policy landscape indicates that new lives have a wider societal value than just that of the person who births them and the family that raise them.

The question of how to value future lives is particularly pertinent to evaluations of assisted reproductive technology (ART). There is a growing literature grappling with the question of how to value a successful pregnancy in a population experiencing infertility (101–110). A detailed discussion of this literature is presented in Chapter 7 (7.5.1).

The focus of this thesis is pregnancy, rather than fertility, but the question of valuing future lives is pertinent here too. Pregnancy loss is a devastating experience, but one that remains common around the world. While the policy landscape is changing, stillbirth in particular remains subject to fairly limited policy initiatives compared with neonatal and newborn health outcomes (111), despite calls for change (112). Hesitation around the valuation of stillbirths has included concern around the valuing of unborn life, notably in the context of concern around reproductive rights and access to abortion (33, 62).

1.4.2.4 The maternal-fetal conflict

Taken together, these three features point to pregnancy as uniquely positioned within healthcare. Including fetal health outcomes is essential to capturing the value of many interventions used in pregnancy, but, at the same time, we are constrained by the need to respect maternal autonomy, and the question of whether it is appropriate to allocate resources away from those who are born, in favour of those who are not. This is compounded by the use of QALYs. If the loss of a pregnancy is valued in terms of the QALYs that would have been lived by that baby, the QALY value will be the highest value accruing to an individual: a full quality-adjusted life expectancy. This valuation would outweigh the QALYs gained by averting the death of the pregnant person. In essence, the life of the baby would be valued more highly than that of the mother. In medical ethics, the tension that exists between maternal autonomy and fetal outcomes is termed the maternal-fetal conflict, and confronting it remains a central question within medical ethics (47,114).

1.5 AIMS OF THE THESIS

1.5.1 Motivation

The purpose of this thesis is to explore how CUAs within pregnancy can be made more meaningful and useful to decision makers, through improved outcome measurement and valuation. As explained above, CUA is used to improve the efficiency, consistency and transparency of resource allocation decisions. In the absence of appropriate methods, interventions in pregnancy are at risk of being evaluated inefficiently, with potential negative consequences for the health of both mothers and babies, as well the indirect health consequences that result from inefficient resource allocation across the health system.

1.5.2 Context and scope

This thesis is primarily concerned with economic evaluation in the context of the UK and the NHS. Much of this thesis is not country-specific, and the results could be applied in other countries that use CUA. Where country-specific context is needed, my familiarity is with NICE and NHS England, and so that is the setting I have chosen. The qualitative data was drawn from participants living in the UK, and people living in other countries and cultural contexts may have differing values and priorities.

The scope is limited to interventions that take place during pregnancy, defined as from the point of conception to the cutting of the umbilical cord. Contraception, family planning, fertility interventions and postnatal interventions are excluded. My interest is in the time frame in which a pregnancy exists, and continues only as long as the maternal-fetal dyad remains a single entity.

1.5.3 Aims

This thesis addresses four aims:

1. To understand the current use of CUA in pregnancy.
2. To identify relevant outcomes in pregnancy using qualitative methods.

3. To consider how those outcomes might be integrated into health economic approaches.
4. To build a framework based on those outcomes to guide the development of new methods to better integrate economic evaluation of interventions during pregnancy into the wider decision-making process.

1.5.4 Outline

The thesis consists of seven further chapters:

Chapter 2 summarises the methods used in the thesis, including an outline of the overall approach and the ways in which these methods fit that approach.

Chapter 3 systematically reviews CUAs of interventions given during pregnancy. It focusses on how maternal and fetal health outcomes are evaluated and included. Methods for combining these outcomes are identified and described.

Chapter 4 reviews and critiques relevant pre-existing methods and approaches that have been used in economic evaluations of pregnancy, in light of the challenges presented in this Chapter. It also identifies methods that have relevance to pregnancy, in that the method addresses one of these challenges.

Chapter 5 is a qualitative secondary analysis of interviews conducted with women about their experiences in pregnancy. The interviews come from a range of studies into different conditions and experiences in pregnancy. The aim of the analysis is to understand how pregnant women make decisions about their care, and what this reveals about their preferences.

Chapter 6 contextualises the findings of the qualitative analysis within health economics. This chapter is a stepping stone that develops the themes of the secondary analysis into a set of outcomes that form the basis of a preliminary framework to aid economic evaluations of pregnancy.

Chapter 7 outlines the framework, building on the findings of Chapters 4, 5 and 6. Three decision problems, derived from existing economic evaluations and studies, are used to illustrate how the framework can be used to outline the relevant outcomes in each case. The framework is also used to highlight research questions that remain unanswered.

Chapter 8 discusses the findings of the thesis and places them in the context of the wider literature. Limitations are discussed and possible future avenues of research are presented.

1.6 CONTRIBUTION TO THE LITERATURE

This thesis contributes to the literature in four main ways. The initial contribution is in identifying the main issues confronting the use of CUA in pregnancy through a systematic review, particularly as they relate to the inclusion or exclusion of all relevant health outcomes.

The second contribution is in furthering the health economic understanding of what matters in pregnancy, in terms of both outcomes and experiences. Through the qualitative analysis, pregnant people's experiences and preferences are analysed, providing a foundation for further research into outcome measurement.

The third is in conceptualising pregnancy in health economic terms. The themes from the qualitative analysis are contextualised within health economic theory and methods. Decision-making in pregnancy and patients' preferences for their care are deconstructed and summarised so that they can be considered in the context of economic evaluation and CUA.

The final contribution is in the development of a framework that can guide future research, both by increasing the transparency of reporting of health outcomes that are included and in highlighting areas of research that remain underdeveloped.

Taken together, these contribute to the discussion of economic evaluation in pregnancy and aim to stoke conversation around the topic of health outcome measurement and valuation in pregnancy.

1.7 CONCLUSION

This chapter has summarised the relevant literature relating to CUA in pregnancy, described the issues under discussion, and outlined the remaining thesis. In the next chapter, I will describe and justify the methods used in the thesis.

2 METHODS

2.1 INTRODUCTION

The previous chapter introduced the issues associated with economic evaluation in pregnancy, and with CUA in particular. I described the aims of the doctoral research and outlined the contribution the thesis will make to the current literature.

The aim of this chapter is to briefly describe the methods used and explain the reasoning behind the approach chosen. Each chapter includes its own methods section, where appropriate, which outlines the methods in more detail. This chapter is intended to explain why those methods were chosen and how they address the overall aims.

As this is predominantly a qualitative and narrative thesis, a section on reflexivity forms part of this. I also outline the patient and public involvement (PPI) used in the development of the project.

2.2 DEVELOPMENT

When this project was originally conceived, I perceived that valuing pregnancy outcomes was a relatively simple – but thorny – issue of how to quantify the trade-off between maternal and fetal health in different contexts. I anticipated a systematic review, some qualitative research to inform a discrete choice experiment (DCE), and then a DCE to quantify that trade-off. This would in turn plug into a CUA and reconcile the use of QALYs in pregnancy.

Instead, I found that the aims of the project leant themselves to engaging with a qualitative approach more deeply. I found the experience transformative. The process forced me to confront my own assumptions about the nature of pregnancy and, in so doing, led me to completely rethink the foundational issues presented by the subject. The simple trade-off vanished in favour of something vastly more complex.

In light of this, I faced a choice: I could continue with the task of quantifying an imagined trade-off. However, this began to feel simplistic and disconnected from the reality of pregnancy. Instead, I refocussed my aims around developing the health economic understanding of pregnancy, based on qualitative research. I aimed to build the foundation for a new framework for evaluating outcomes in pregnancy.

I have taken a qualitative approach that makes use of secondary analysis to do this. The strength of this approach is that it enables me to re-analyse full existing transcripts from a wide range of relevant prior studies. This was chosen over meta-ethnography, which would rely on synthesised data from published studies, rather than full transcripts. I was able to obtain the appropriate permissions to access data from a range of studies through the Medical Sociology and Health Experiences Research Group archive at the University of Oxford (115). Conducting secondary analysis of these transcripts allowed me to apply my perspective as a health economist to interviews conducted by experienced qualitative researchers. The results bridge this disciplinary divide, being grounded in a health economic understanding of health but informed by the wider sociological discipline and qualitative interviewing.

This has resulted in a thesis that is much more qualitative and narrative than originally planned. The outcomes of this thesis are consequently at a relatively interim stage; they set the groundwork for future research, rather than solving, or claiming to solve, an oversimplified trade-off.

2.3 RATIONALE

The methodological approach taken in this thesis is derived from its aims. These are:

5. To understand the current use of CUA in pregnancy.
6. To identify relevant outcomes in pregnancy using qualitative methods.
7. To consider how those outcomes might be integrated into health economic approaches.

8. To build a framework based on those outcomes to guide the development of new methods to better integrate pregnancy resource allocation into the wider decision-making process.

Each aim lends itself to a particular methodological approach, which will be discussed in turn.

2.3.1 Aim 1: Current use of CUA in pregnancy.

This aim has two subcomponents. First, to systematically review CUAs of pregnancy, in order to understand how prevalent they are, and how analysts have approached the question of outcome measurement in pregnancy within a CUA context (Chapter 3). I am particularly interested in how prior studies have handled joint maternal and fetal health outcomes within CUA, given the ethical issues raised in Chapter 1.

Second, in Chapter 4, I explore potential methodologies that either have been used in the context of pregnancy, or that address one or more of the issues identified and therefore may be applicable in pregnancy. This is also literature-based, and exploratory rather than systematic. This chapter aims to identify any existing methods that address the challenges identified.

2.3.2 Aim 2: Identify relevant outcomes in pregnancy using qualitative methods.

This aim also has two components. The first phase (Chapter 5) involves the identification and analysis of relevant outcomes and considerations during pregnancy. I have adopted a qualitative approach to this, making use of existing data. The intention is to understand what is important to people experiencing pregnancy, in their own words and across a range of experiences. A qualitative approach is appropriate here as it allows for a more inductive approach than would be possible with a more quantitative approach (for example, surveys) (116). The qualitative research draws on my experience as a health economist but does not impose an explicit health economic framework on the analysis.

The goal is to understand relevant outcomes in pregnancy on the terms of pregnant people.

2.3.3 Aim 3: To consider how those outcomes might be integrated into health economic approaches.

The second phase (Chapter 6) takes the findings of the qualitative research and contextualises them within existing health economic theory and practice. This narrative exercise compares the themes identified in the qualitative chapter with the norms and assumptions of economic evaluation, and CUA in particular. This chapter will form the first step in the process of reconciling the outcomes that participants consider to be important with the requirements of decision makers allocating resources.

The analysis remains qualitative throughout. Structured surveys, including stated preference studies, were considered in the development of the project, but I considered that more foundational work was needed to understand the nuances of decision-making in pregnancy. Chapter 6 places the findings of the qualitative research into context within health economic theory, beginning the process of translating qualitative findings into a quantitative approach.

2.3.4 Aim 4: To build a framework to guide the development of new methods

The application of the findings of qualitative research can be done in a number of ways. Within health economics, qualitative research often takes place within a quantitative framework. An example of this is using focus groups to inform the development of attributes and levels for a discrete choice experiment (117). However, that relies on there being an existing framework for the themes to fit within. The challenges presented by pregnancy to outcome measurement and valuation, as identified in this thesis, are not easily addressed using current methods. As a result, rather than seeking to quantify outcomes, I have instead developed the results of previous chapters into a preliminary framework.

This framework provides a structured approach to evaluating the inclusion of outcomes within economic evaluations of interventions in pregnancy. I use applied examples to demonstrate how the framework highlights which outcomes have been included and excluded in economic evaluations. I also use the framework to identify areas of further research that would be required to support the development of quantitative approaches that could be used in future CUAs.

Together, the aims of this project are an attempt to understand the nature of pregnancy within the context of economic evaluation, and CUA in particular. The project draws on literature and qualitative research.

2.3.5 Qualitative research

Qualitative research is essential to understanding pregnancy outcomes. While quantitative methods are used to categorise and quantify phenomena, qualitative research seeks to understand how and why these things occur in terms of experiences, meanings, values, and beliefs. A wide range of methods can be used, all geared towards exploring a topic in depth and interpreting it through the meanings people bring to social phenomena (116).

Qualitative methods can add context and nuance to health economic studies. The standard positivist and normative approach of quantitative health economics provides clarity for decision makers, replicability and transparency, but does allow limited space to consider alternative models of health beyond clinical outcomes or QALYs, or ways of thinking about resource allocation outside the structure provided by economic evaluation and required by decision makers such as NICE.¹ Engaging in a more constructivist approach, wherein truth is something that is negotiated within its context rather than

¹ Various alternative quantitative evaluative frameworks – such as multicriteria decision analysis – are discussed in Chapter 4.

something objective and identifiable, can provide insight that increases both the validity and applicability of health economic methods (118,119).

There are a number of ways qualitative research has been used within economic evaluation of healthcare interventions (120). Most commonly, qualitative research is used during the development of contingent valuation studies, typically discrete choice experiments. Here qualitative research methods, often collected via focus groups, are used to inform the development of attributes and levels (117,121). There is also increasing interest in the use of qualitative research to inform model development, either to understand how models are developed, or to improve the process by eliciting information about key structural and parametric information from stakeholders (122). Relatedly, ethnographic methods have also been used to understand resource allocation decision-making (40).

Most relevant to this thesis, qualitative methods have been used to conceptualise health conditions in order to understand the validity of QoL instruments, or to begin the process of developing new ones. These typically are in the context of health conditions or situations in which conventional HRQoL measures may not capture relevant information, such as end-of-life care (123,124), and have also been used in the development of generic preference-based measures of health (125). In this thesis, qualitative research is used to understand the nature of people's preferences during pregnancy, and the factors that shape how they make decisions about their pregnancy. These findings are then placed in the context of existing health economic methods, thereby identifying gaps and opportunities for development.

2.4 METHODS

This project draws on a range of methods. In this section, I will briefly describe each method and explain why it was selected and how it contributes to the wider aims of the project and feeds into the final outcomes of the project. A full description of the methods will be provided in each chapter.

2.4.1 Systematic review

In Chapter 3, I conducted a systematic review of CUAs in pregnancy. Systematic reviews follow a rigorous, standardised approach in order to quantify the evidence in a given field (126). This systematic review was of methodology and aimed to capture how outcomes have been measured, collated, valued and reported in CUAs (127). In particular, I was interested in how maternal and fetal health outcomes have been measured and, where possible, combined. Are outcomes for both pregnant person and fetus included in the evaluation, or just for one of them? What reason is given where either one has been excluded? How are the effects of the intervention extrapolated out over the life course? How is harm to the fetus quantified? These quantitative questions are well suited to a methodological systematic review.

The rationale for this chapter was twofold. First, the systematic review provides motivation for the project by evaluating current methods used in CUAs, and identifying any inconsistencies in the approach taken for health outcome measurement and valuation. Second, I identified methods that have been used to combine maternal and fetal health outcomes. By reflecting on the strengths and weaknesses of these methods, I begin to identify what a more consistent approach could look like.

2.4.2 Identification of relevant methods

Chapter 4 presents a variety of methods that could be applied in the process of evaluating pregnancy health outcomes in economic evaluation. These were identified through a narrative review conducted over the course of the project. In contrast with the systematic review, this narrative review follows a more flexible methodology. I collated relevant papers and methods from a wide range of sources. The aim was to be expansive and to consider a broad set of methods from across health economics.

This chapter serves two purposes. It first summarises the body of work I have identified as being relevant to the evaluation of outcomes in pregnancy, including the challenge identified in the systematic review of combining maternal and fetal health outcomes.

Second, the methods identified provide an initial test for the framework developed in Chapter 7.

2.4.3 Qualitative secondary analysis

In Chapter 5, I conducted a qualitative secondary analysis of interview transcripts. Qualitative secondary analysis here involved reanalysing transcripts from previous projects (128). A full explanation of the strengths and weaknesses of this approach is presented in Chapter 5 (5.3). The interviews in this project were drawn from a wide range of projects that have been collected in the Medical Sociology and Health Experiences Research Group archive at the University of Oxford (115). Secondary analysis utilises existing data and avoids duplicating research burden. Due to the size and breadth of the archive used, it was possible to sample interviews from a diverse range of participants and experiences. Secondary analysis is also well-suited to the analysis I have conducted, as the research aim was broad and exploratory in nature (129).

The value of qualitative research is in allowing researchers to gain a deep understanding of a particular lived experience, and how individuals make sense of it. In this case, I sought to understand what is important to pregnant people when making decisions in pregnancy: their experiences, meanings, beliefs and values. This analysis attempts to broadly capture relevant outcomes, which can then be used as the building blocks for analysing how economic evaluation in pregnancy might be made more consistent, fair, and reflective of what is important to pregnant people.

2.4.4 Comparative analysis

Chapter 6 takes the themes identified in the qualitative research and analyses them through an explicitly health economic perspective. The chapter discusses the health economic concepts that apply to each theme, and considers how they might be incorporated into economic evaluation. Through this process, the themes identified in Chapter 5 were developed into a framework that can be used to evaluate outcomes in economic evaluations in pregnancy.

2.4.5 Framework application

Chapter 7 introduces the framework and applies it to a variety of situations. First, I applied it to three different decision problems in pregnancy, based on published studies. Second, I reviewed the strengths and weaknesses of the methods identified in Chapter 4. Finally, the framework was also used to demonstrate where there are methodological gaps, and I use this to suggest areas of future research.

2.5 PATIENT AND PUBLIC INVOLVEMENT STRATEGY

Patient and public involvement (PPI) shaped this project in a number of ways. Initially, PPI provided clarity on the research question; that this was perceived to be valuable and interesting by participants. Additionally, talking with people with lived experience helped me to refine my own understanding of the project by learning to communicate it in lay terms. PPI participants raised ethical issues I needed to consider, such as the question of informed consent during birth emergencies. Finally, the PPI work provided reassurance that this potentially thorny topic was worth exploring. In the early days of project development, I encountered concerns from some colleagues about the vulnerability of pregnant women and whether the question of valuing fetal health outcomes might be distressing. In practice, I found that people were both supportive of the goals and often enthusiastic about sharing their own opinions and personal experiences.

I conducted five individual discussions and one in-person workshop in the course of developing the funding application and initial project plan. I also maintained a PPI group of around eight interested individuals who provided feedback on the scope of the project and any ethical concerns I had during the research, via email. These participants had a variety of experiences, including pregnancy with multiples, post-partum haemorrhage, and pre-eclampsia. There were also people who had had straightforward pregnancy and birth experiences. I consulted this group several times during the methodological development of the project, particularly at the point where I was planning the qualitative research.

One of the great benefits of working in the field of pregnancy is that many people have experienced it, and are often keen to talk about their experiences and share their thoughts. In addition to the more formal PPI conducted, I have also been able to gain insight from friends, acquaintances and colleagues throughout the project, who were frequently willing to share their thoughts on the project as well as their own personal experiences. Through these informal channels, I was also able to speak to partners, who shared their own thoughts and feelings about what their spouse or partner had experienced, and about their own experiences. While partner experiences are beyond the scope of this project, these conversations provided additional insight into the sometimes fuzzy bounds between the pregnant individual and the family unit.

One weakness of the PPI conducted is that participants were predominantly white and middle class. This is a common problem and can lead to bias in project design and analysis (130). In the qualitative research, I purposefully sought out interviews with participants from a range of racial and socioeconomic backgrounds to ensure a wider range of experiences were represented in the analysis.

2.5.1 Professional input

During my doctoral studies, I have also been able to speak with clinicians who work in the clinical care of pregnant patients. These included general practitioners (GPs), midwives, and a maternal-fetal medicine specialist who provided valuable insight into the interactions that happen between patients and clinicians, and the complex decision-making that takes place. Individuals in several cases also shared their personal experiences with pregnancy, and were able to share their insights having seen the process from both sides. I also discussed the project with a medical ethicist who provided feedback on how to approach the question of fetal health valuation in particular.

Finally, I was fortunate to be able to discuss the project with individuals from three relevant charities: Birthrights, the British Pregnancy Advisory Service (BPAS), and Action on Pre-eclampsia (APEC). All three were supportive of the project aims, and provided

valuable insight into the experiences of the individuals their organisations supported. These discussions took place during the planning phase of the project.

2.6 REFLEXIVITY

In developing the methods and approach used here, I have considered my own identity as a researcher.

In the qualitative research, I have approached the analysis as a relatively inductive process, aiming to allow flexibility in my findings, rather than imposing a deductive framework that adds structure but risks missing key information. However, this was all done from the perspective of health economics, and this shapes the results and findings. I aimed to use my expertise and perspective to anchor the findings in a way that would lend itself to the development of a framework that could inform economic evaluation, but without imposing the ideas of economic evaluation on the analysis. For example, the question of interest in the qualitative analysis was “what is important to women and pregnant people when making decisions in pregnancy?”. This emphasis on decision-making draws on the economic concept of utility, where preferences are measured by asking people to choose between options, and grounds the analysis in the idea that economic evaluation is fundamentally a tool in service of decision-making. By performing the analysis in this way, I sought to identify people’s priorities with a constraint (choosing between options) that would later facilitate compatibility with health economic concepts.

More personally, I have brought my own identity as a woman of child-bearing age to the analysis. Over the course of the thesis, I have personally experienced infertility and assisted reproductive technology (ART), pregnancy (including an ongoing pregnancy at the time of writing), and miscarriage. This inevitably causes me to identify with the subjects of this research: it is easy for me to imagine myself as the pregnant woman in any scenario, and consider what choices I might make in that situation. There are strengths to this closeness, in that I approach the analysis with empathy and a strong sense of the

stakes faced by pregnant people and their families, but also weaknesses. There is a risk that I might centre the issues that I would personally prioritise in the analysis, or that resonate closely with my own experiences. My identity as a middle class, educated, white woman in my thirties shapes how I view these choices. Throughout the research, I have maintained awareness of these biases through the use of a research journal, where I could record and interrogate my thoughts, particularly as they related to my own experiences. I also engaged in discussion on an ongoing basis with my supervisors, particularly Abigail McNiven, who supervised the qualitative research, in order to keep myself open and accountable about my own feelings on relevant topics, and to seek outside perspective on how my experiences were affecting my analysis.

I also identify as a feminist: I am in favour of reproductive rights and maternal autonomy during pregnancy and childbirth. I also identify as disabled and this shapes my views regarding the way disability is discussed in antenatal care, particularly in conversations around antenatal screening. These values shape how I have approached this analysis, both consciously and unconsciously.

Finally, this research took place during a time of intense interest globally in reproductive rights. In the United States of America, abortion rights were rolled back nationally, leading to restrictions on abortion and maternity care in many states (131). In the UK, debate continued around access to abortion, with court cases and laws passed relating to termination in the case of disability (132), abortion via telehealth (133) and the prosecution of women suspected of procuring an abortion outside of the legal process (88). Maternity care continues to be the subject of investigation in the UK, with concerns around safety at a number of hospitals around the country, most recently in Oxford (134). These cases informed my thinking throughout the project and shaped my awareness of a range of issues relating to the ethics of maternity care and human rights in pregnancy.

2.7 CONCLUSION

This chapter has summarised and justified the approach I have taken through the thesis, with reference to reflexivity, and described the PPI and professional discussions I engaged in. I have explained the choice of methods employed, and briefly described each method and how it contributes to the overall narrative.

The next chapter describes the findings of the systematic review of CUAs in pregnancy.

3 HOW ARE MATERNAL AND FETAL OUTCOMES INCORPORATED INTO COST-UTILITY ANALYSIS? A SYSTEMATIC REVIEW

3.1 INTRODUCTION

Chapter 1 described the challenges of including both maternal and fetal outcomes in economic evaluation. Briefly, these are how to include both maternal and fetal health outcomes in a way that accounts for both maternal autonomy, and also the individual and societal desire to safeguard the health and wellbeing of the fetus.

These issues are particularly relevant to CUA, as the question of whether and how to include fetal QALYs is outstanding. Previous literature has identified that including or excluding fetal QALYs can affect the cost-effectiveness of interventions. Other work has found inconsistency in the inclusion of fetal outcomes in CUA of pregnancy and fertility (81,82). Together, these studies indicate a need for consistent approaches to the inclusion of fetal health outcomes in CUA.

In addition to this, Chapter 1 also outlined the many complex interactions between maternal and fetal health that can occur during pregnancy (**1.4.2.1**). Health conditions of pregnancy and the interventions to address them can place maternal and fetal health in conflict. Conditions of pregnancy can also cause lifelong health effects for the pregnant person, including their ability to become pregnant again.

In order to address these issues, it is crucial to understand the current state of methods used in CUA of pregnancy through a systematic review. This approach both summarises and quantifies the overall state of methods in use for CUA in pregnancy, and also can be used to identify any existing methods and solutions.

3.1.1 Previous publication

This systematic review has now been published (49). A full outline of contributions made by co-authors to this chapter (and others) is presented at the start of the thesis.

3.1.2 Aim and objectives

The aim of this chapter was to investigate the theoretical frameworks used for estimating and combining QALYs and DALYs in pregnancy, by synthesising evidence from CUAs within pregnancy using systematic reviewing. I addressed the following three questions:

1. How frequently are both maternal and fetal outcomes included in CUAs of pregnancy?
2. How are fetal QALYs and DALYs constructed, particularly in cases such as fetal loss?
3. Where both maternal and fetal outcomes are evaluated, how are these combined, and what assumptions are made in the process?

3.2 METHODS

The systematic review protocol was registered on PROSPERO (135). The inclusion criteria are:

- CUAs – defined as studies reporting both costs and outcomes for an intervention and including at least one comparator, which measure outcomes in either QALYs or DALYs.
- Evaluations of interventions in pregnancy – defined as any intervention that was administered during pregnancy between conception and birth (up to cord cutting), including during labour.
- Published in English.

The exclusion criteria were:

- Conference abstracts and grey literature

- Reviews or any paper that did not include a novel CUA.
- Interventions administered pre-conception or postpartum.
- Interventions applied to a broad population are included only if the costs and outcomes for the pregnant subgroup are reported separately.

Two search strategies were adopted concurrently and the results combined. For studies published before January 2017, the Pediatric Economic Database Evaluation (PEDE) database of paediatric economic evaluations was searched for terms relating to pregnancy (136). At the point that searches were conducted, the PEDE database had not been updated since 2017. For studies published from January 2017 – December 2019, the PEDE search strategy (137) was adapted and replicated to identify pregnancy studies. Searches were conducted of Embase, Medline and EconLit in December 2019 and results were imported into Rayyan for screening. Rayyan is online software for systematic reviewing that allows duplicate screeners to work on the same review (138).

Titles and abstracts were screened in duplicate. The second screener was Ting Cai, a fellow doctoral student. Economic evaluations were identified as “included”, and then labelled according to the type of analysis (CUA, other CEA, CBA, CCA, or unclear). Disagreements were resolved through discussion. We were able to resolve all disagreements through discussion.

Included articles were extracted using a pre-specified data extraction template (Appendix 3.1). This captured citation information, country, intervention type, outcome measure reported, whether outcomes reported were maternal or fetal, and how QALYs and DALYs were constructed. Construction refers to the set of assumptions made during the process of estimating QALYs and DALYs for a given health outcome. These include the methods used to capture HRQoL effects, the duration that particular conditions are expected to affect HRQoL, the life expectancy associated with different outcomes, and the discount rate.

Extracted data was synthesised narratively. This looked at how maternal and fetal outcomes were combined, and any frameworks or assumptions that were applied to balance fetal outcomes relative to maternal ones.

Quality assessment of papers was not performed as the aim of this review was to provide a description of the different methods used, rather than appraising the results using quality assessment.

3.3 RESULTS

The search identified 127 CUAs reporting either QALYs (n = 89) or DALYs (n = 38) (Figure 3.1). Publication dates ranged from 1984 onwards (Figure 3.2). The full list of studies is presented in Appendix 3.2.

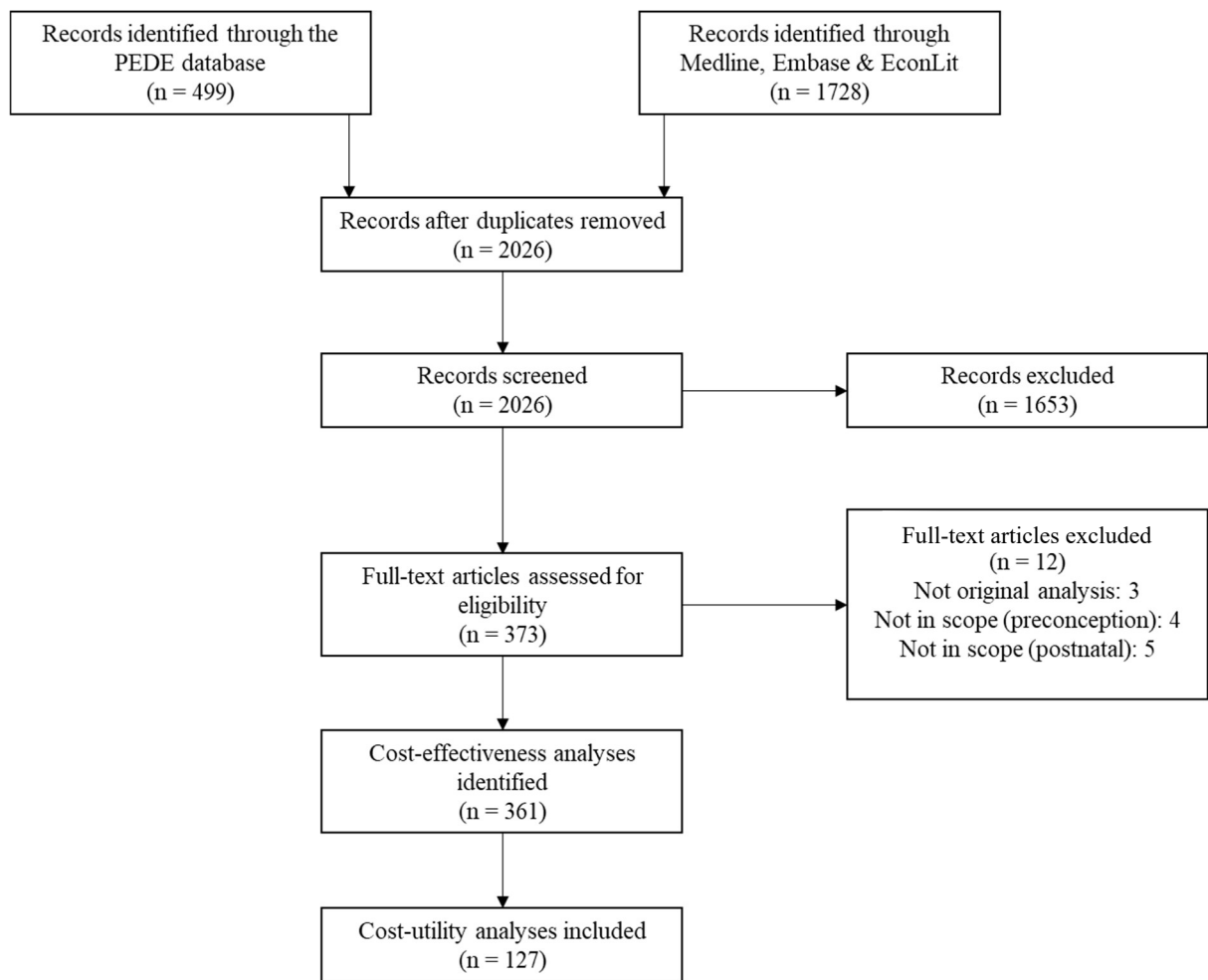


Figure 3.1. PRISMA diagram of systematic review

Included studies covered a wide range of high-, middle- and low-income countries, although most studies were either based in North America ($n = 54$, 43%) or Sub-Saharan Africa ($n = 32$, 25%). Studies covered a wide range of conditions, with human immunodeficiency virus (HIV) the most common condition ($n = 21$, 17%). In total, 50 conditions and 23 intervention types were analysed (Table 3.1).

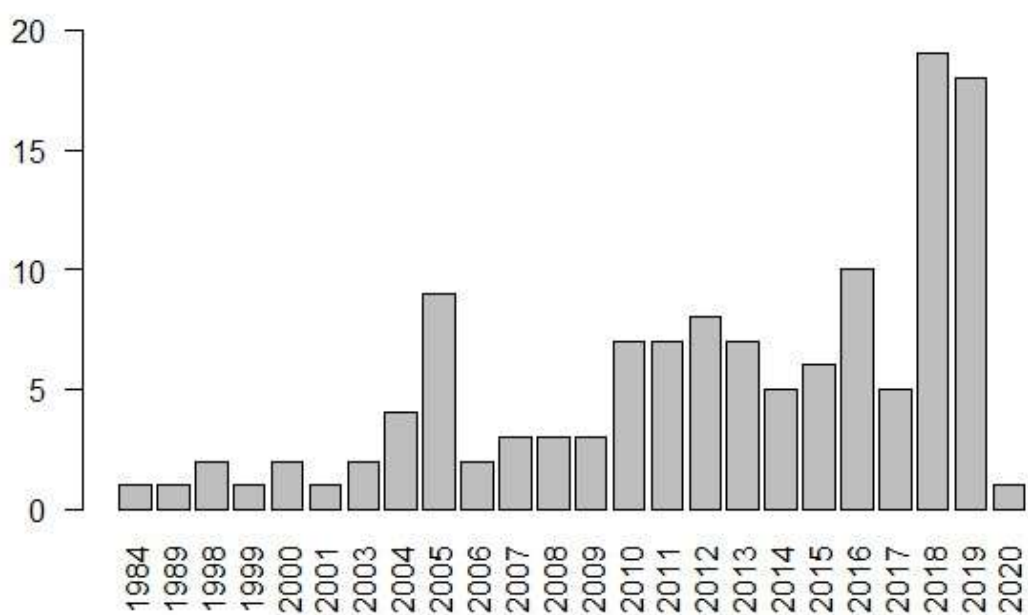


Figure 3.2. *Number of studies published per year*

Ninety-nine studies (87%) used a decision-analytical model in their analysis, 13 (10%) analysed individual participant data (such as within-trial analyses), and 11 (9%) used both methods. Four studies (3%) included neither models nor individual-patient data and instead synthesised pre-existing estimates of costs and effects across a set of comparators. For example, one study evaluated a range of interventions for reducing maternal and neonatal morbidity and mortality in low-income settings, using pre-existing estimates (139). All models were decision trees leading to outcomes that were extrapolated over the remaining life expectancy, or up to the time horizon of the study.

The vast majority of analyses took a lifetime horizon ($n = 105$, 83%; Table 3.1). Four followed fetal outcomes to adulthood (18 or 20 years), 10 did not clearly report the time horizon, and the remainder used a shorter horizon ranging from delivery to 10 years after the intervention. Three studies used separate time horizons for maternal and fetal outcomes.

All studies using a time horizon longer than a year applied discounting, with 3% being the most common value. No studies reported using different discount rates for maternal or fetal outcomes.

	Number of studies (%)
Region	
East Asia and Pacific	12 (9)
Europe and Central Asia	29 (23)
Latin America and Caribbean	2 (2)
Middle East and North Africa	3 (2)
North America	54 (43)
South Asia	6 (5)
Sub-Saharan Africa	32 (25)
Unspecified	3 (2)
Condition	
Fetal abnormality	10 (8)
Fetal condition	1 (1)
Fetal immunological condition	8 (6)
Infection	62 (49)
Labour complication	14 (11)
Maternal behaviour	3 (2)
Maternal condition	11 (9)
Maternal mental health	1 (1)
Maternal nutrition	3 (2)
Placental abnormality	2 (2)
Pre-existing maternal condition	2 (2)
Preterm birth	7 (6)
Various	5 (4)
Intervention type	
Antenatal care	1 (1)
Behavioural	3 (2)
Clinical decision rule	1 (1)
Delivery method	9 (7)
Delivery timing	1 (1)
Exercise program	1 (1)
Fetal monitoring	1 (1)
Mobile Health (mHealth)	1 (1)
Pharmaceutical	29 (23)
Policy	5 (4)

	Number of studies (%)
Screening	54 (43)
Supplementation	5 (4)
Surgery	2 (2)
Surrogacy	1 (1)
Training	2 (2)
Vaccination	11 (9)
Various	3 (2)
Analysis type	
Model	99 (78)
Trial	13 (10)
Both	11 (9)
Other	4 (3)
Time horizon	
Delivery	1 (0.8)
48 hours post-delivery	1 (0.8)
3 months	2 (1.6)
1 year	2 (1.6)
2 years	1 (0.8)
10 years	1 (0.8)
18 years	1 (0.8)
20 years	3 (2)
Maternal lifetime	8 (6)
Fetal lifetime	97 (76)
Not reported	10 (8)

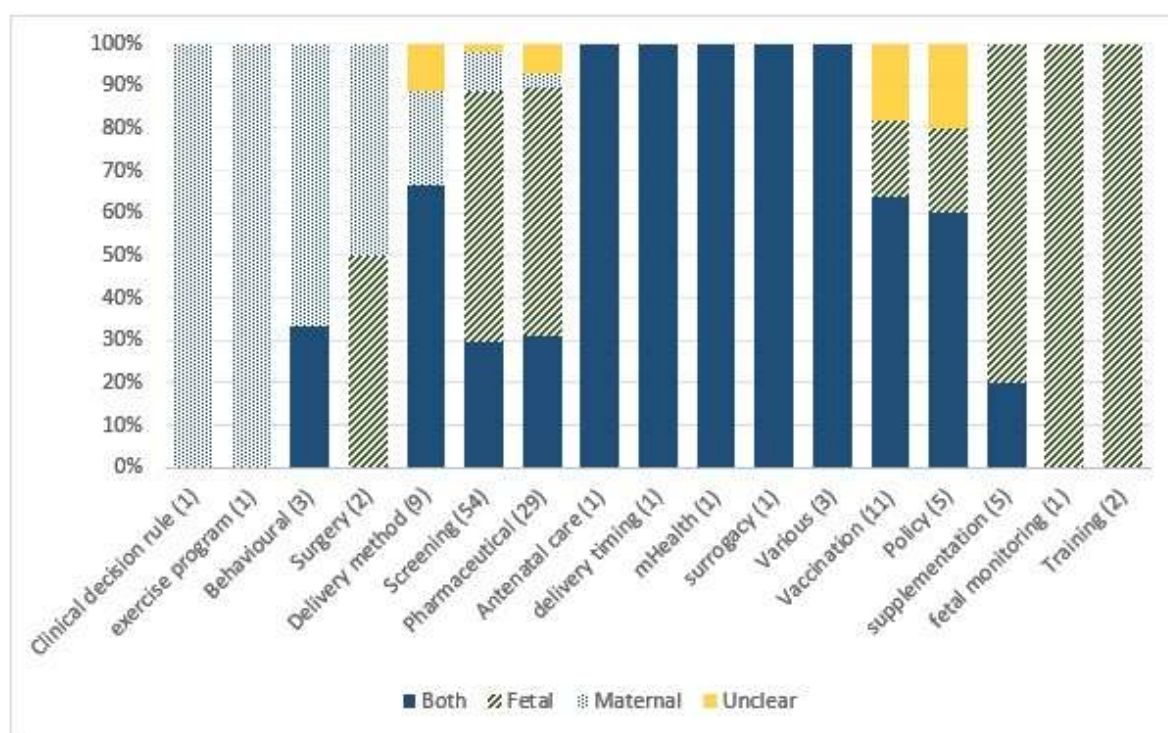
Table I. Summary of characteristics of included studies

3.3.1 Outcomes

Most studies reported fetal outcomes, either with maternal outcomes (49 studies, 39%) or without (59 studies, 46%). By contrast, only 13 studies (10%) reported solely maternal outcomes. Where outcomes are excluded, the analysis assumes either that those outcomes are unaffected by the intervention, or that no value is placed on any change in those outcomes. It was unclear which outcomes were included in one study (140). In five studies, fetal outcomes were included, but it was unclear whether maternal outcomes were included.

The inclusion or exclusion of maternal or fetal outcomes varied between and within intervention types and conditions (Figure 3.3). Occasionally, there was also a discrepancy between who the authors stated the intervention was intended to benefit, and which outcomes were included. In three studies, the authors described the intervention as intending to benefit the fetus, but reported solely maternal outcomes in their evaluation. Twenty-three studies reported the intervention as intending to benefit the fetus primarily, but reported outcomes for both. For 42 studies the intervention was described as benefiting both pregnant person and fetus; of these, 27 reported outcomes for both, five reported only fetal outcomes, seven only maternal, and, in the remaining three it was unclear.

A.



B.

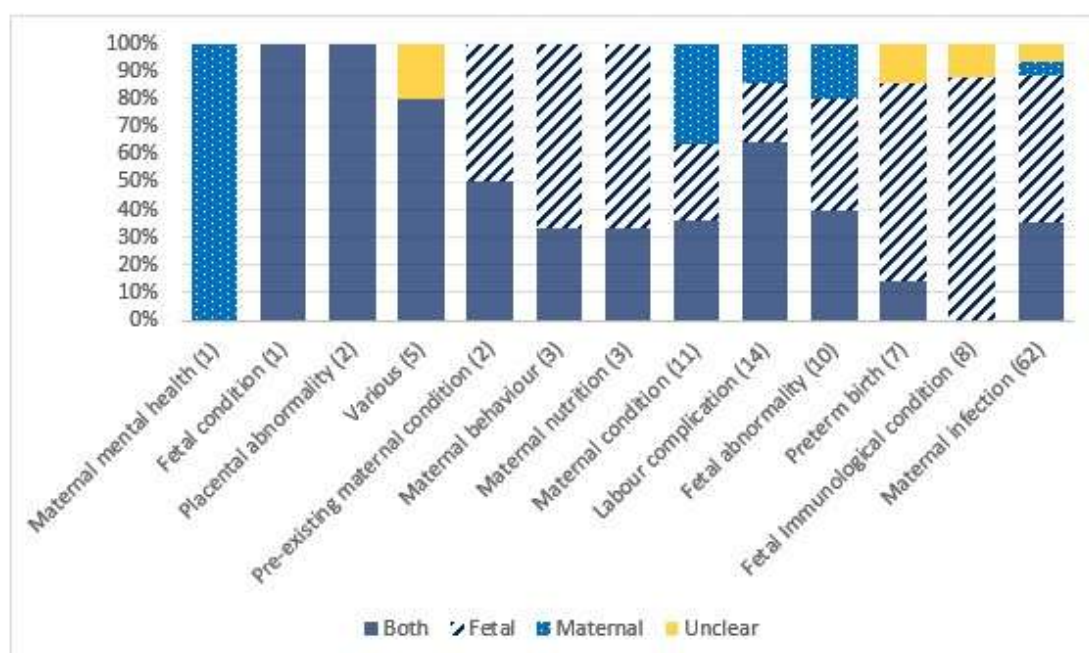


Figure 3.3. Percentage of studies reporting only maternal, only fetal or both outcomes, by (A) intervention type and (B) condition type. The number of studies is indicated in brackets for each outcome.

Studies that took a lifetime horizon estimated QALYs or DALYs from clinical outcomes using an estimated life expectancy and one or more utility values. Typically, decision trees modelled the care pathway up to delivery, and then a health state was assigned to the pregnant person and infant at birth. This health state was assigned a utility and life expectancy. In some cases, the utility was assumed to change at some future point, such as when the child reached adulthood.

A common health outcome was a normal recovery, in which both pregnant person and infant were assumed to return to full health. A variety of methods were used to assign utilities to these outcomes, including population norms (9 studies), age-adjustment (5 studies), and extrapolation (1 study). In 52 studies (41%), a utility of 1 was assigned for the entire lifetime where pregnant person and infant were unaffected by negative health outcomes.

Fetal life expectancies often varied by outcome, to cover infants affected and unaffected by conditions such as cerebral palsy. The unaffected life expectancy was typically taken from national estimates such as life tables, while the affected was drawn from relevant literature. Maternal life expectancies were generally calculated as the difference between the relevant national estimate and average maternal age. This approach does not follow best practice of estimating remaining life expectancy using life tables, as life expectancy at birth includes mortality that occurs before the age of the intervention, giving a biased estimate (141).

Incomplete or unclear reporting was a common occurrence across studies. Of the 62 studies reporting maternal outcomes, 39 (63%) did not report the source of utility values. Of the 23 that did report utilities, sources included Global Burden of Disease adjustments (GBD – 5 studies), expert opinion (5 studies), direct preference elicitation (4 studies), values obtained from published literature (3 studies), EQ-5D-3L (3 studies), SF-6D (2 studies) and the Quality of Wellbeing Scale (1 study). One study used the SF-6D, but conducted sensitivity analysis using the EQ-5D-5L (142). Of the 108 analyses reporting

fetal outcomes, 24 (22%) reported utilities. Sources included GBD (13 studies), direct preference elicitation (4 studies), published literature (3 studies), HUI-3 (2 studies), EQ-5D-3L (1 study) and expert opinion (1 study). Life expectancies used to construct lifetime QALYs/DALYs were similarly underreported; 27 maternal values for life expectancy (44%) and 38 fetal values (34%) were missing.

3.3.2 Methods for combining outcomes

In total, 53 studies included both maternal and fetal outcomes in their CUA. A variety of methods were used to combine these outcomes for the purpose of the analysis (Table 3.2).

3.3.2.1 Additive

This was the simplest and most common method identified; used by 31 studies (59%). QALYs or DALYs were summed across both pregnant person and fetus with equal weight, and any discounting was applied at the same rate. The value judgement implied here is that all QALYs are equal, regardless of whether they accrue to pregnant person or fetus, and that changes in fetal health outcomes should be valued as they would be postnatally.

3.3.2.2 Dual time horizon

Three studies followed the additive approach, but used different time horizons for maternal and fetal outcomes, typically a shorter maternal time horizon followed by an extended fetal one. Two studies took a maternal time horizon up to delivery, and then a separate lifetime or 20-year horizon for fetal outcomes (143,144). Another study combined a fetal lifetime horizon with a 10-year maternal horizon (145).

The judgement implied here is that the intervention being analysed has differing effects on the pregnant person and fetus, and that these effects are of different durations. This might be the case if, for example, the condition is potentially fatal in the case of the fetus, but has only short-term health effects for the pregnant person. In that case the shorter maternal time horizon would reflect that the outcomes beyond the time horizon will be

identical regardless of which intervention they receive, rather than a judgement on the relative value of those outcomes.

Alternatively, in cases where the effects are known to continue beyond the time horizon (for example, a childhood time horizon where one outcome is a lifelong disability), the effect is to reduce the value of health outcomes for the individual for whom a shorter time horizon is used, relative to health outcomes that accrue for the other individual. In this review all three studies used a shorter time horizon for maternal outcomes. If maternal health effects from the intervention could plausibly persist beyond the time horizon of analysis, this would have the effect of devaluing maternal health outcomes relative to fetal health outcomes.

3.3.2.3 Maternal disutility

Five studies valued fetal outcomes as a maternal utility decrement. For example, one study valued maternal utility following labour and live birth as 0.99, and maternal utility following labour with a fetal death as 0.91 (146).

Three studies included a maternal disutility associated with fetal loss as part of an additive approach that included both maternal and fetal QALYs (147–149). A fourth study expanded this to include both parents, who participated in a time trade-off to ascertain the parental disutility associated with having a child with cystic fibrosis (150).

The value judgement here is that fetal health outcomes are not valued as a separate individual, but that the mental health toll of fetal loss or disability is a component of maternal (or parental) health outcomes.

3.3.2.4 Dyad

One study treated the maternal-fetal dyad as an entity with a single outcome (151). In this approach, life expectancies of pregnant person and fetus were added together, and then a utility value derived from expert opinion was assigned based on their combined health outcomes. The dyad was assigned 131 life years (76 fetal life years plus 55 maternal),

which were then multiplied by a utility score. A completely healthy dyad was assigned a utility of 1, maternal death with a healthy child was assigned 0.03, and healthy mother but permanent brachial plexus injury to the child was assigned 0.6. These values were obtained from expert opinion.

The exact value judgements implied by this approach are difficult to disentangle. The combined utility values allow for maternal and fetal health outcomes to both be valued, and with varying weight relative to each other. However, the justifications behind the individual values chosen were not presented. Dyad approaches potentially allow for interdependence between maternal and fetal outcomes, relaxing a strong assumption made by the additive approach that these outcomes are independent from one another.

The remaining nine studies reported maternal and fetal outcomes, but did not report how these were combined.

Method	Example Maternal outcome (M)	Example fetal outcome (F)	Method formula	Result	Assumptions	Number of studies
Additive	20 QALYs	25 QALYs	M+F	45	- Pregnant person and fetus are separate individuals - All QALYs are equal	3 ¹
Maternal disutility: maternal outcomes only	20 life years	Lifetime maternal disutility of 0.1	AM, where A is the maternal disutility attributable to a poor fetal outcome.	18 QALYs	- Only maternal outcomes are included - Maternal HRQoL is impacted by fetal outcomes	5 4 further studies combined this with an additive approach
Dual time horizon	10 QALYs (up to 10-year time horizon)	25 QALYs (up to lifetime horizon)	M+F	35 QALYs	Additive, but impact of treatment effect lasts longer for fetus than pregnant person	3
Dyad	55 life years	76 life years	B(M+F), where B is the utility value assigned to the combination of outcomes.	In the case of brachial plexus injury: $0.6 (55+76) = 78.6$ QALYs	- Additive on life expectancy - Fetus and pregnant person remain a lifelong dyad, rather than two individuals, with a constant utility	1

Table II. Example calculations of the four methods for combining maternal and fetal outcomes. (M, maternal; F, fetal; QALY, quality-adjusted life year; HRQoL, health-related quality of life).

3.4 DISCUSSION

3.4.1 Summary of findings

There do not appear to be consistent approaches for valuing maternal and fetal outcomes within the QALY or DALY framework. The process of constructing a QALY in pregnancy presents a unique challenge: how are the outcomes for both the pregnant person and fetus to be balanced against both each other and against a broader cost-effectiveness threshold? The findings of this review outline how health economists up to this point have tackled this challenge in practice, and what assumptions they have made in the process.

3.4.1.1 Are both maternal and fetal outcomes included?

The strongest assumption identified in this review is that interventions can be considered to affect only one member of the pregnancy dyad. More than half of studies (72 out of 127) chose to exclude either the fetus or pregnant person from the analysis. Fifty-nine papers excluded maternal outcomes. Whether this is justifiable depends on two considerations: first, whether the clinical evidence supports the assumption that maternal outcomes are unaffected by the intervention, and second, whether a change in fetal outcomes has an indirect effect on maternal HRQoL. This indirect effect is captured in nine studies that included a maternal disutility relating to fetal outcomes.

Only two studies gave a justification for excluding maternal outcomes, and two justified excluding fetal ones. Two main reasons were given for the exclusion: lack of evidence for an effect, and lack of clinical mechanism for an effect (for example, excluding maternal health outcomes when screening for fetal genetic disorders). For the vast majority of papers, a justification was not provided. However, in a number of cases, the exclusion of a set of outcomes does not seem plausible. This is particularly noticeable in the case of evaluations to screen and treat maternal infections. For example, 13 studies evaluated interventions for treating maternal infections such as HIV and syphilis, but reported that

the sole target for the intervention was the fetus and only included fetal outcomes in the analysis.

3.4.1.2 How are fetal QALYs constructed?

The majority of studies (n = 113) included fetal outcomes in their analysis. Most commonly, this involved extrapolating from the point of delivery using life expectancy data. Health effects from interventions therefore captured morbidity (through utility decrements lasting all or some portion of that life expectancy), deaths or losses during pregnancy and shortly after, and reduced life expectancy. Under this approach, the QALY loss attributable to a stillbirth is the discounted QALY value of an entire lifetime – quite literally the highest possible value. Many studies also assumed this life was lived in perfect health, with a utility of 1.

The assumptions implied by this approach are:

1. That the fetus is a wholly separate individual with equivalent personhood to any other individual receiving care,
2. That avoiding a fetal death is of more value than any other patient's death, simply by virtue of the remaining life expectancy,
3. That the QALYs gained by averting fetal loss during pregnancy are at least as great as averting a neonatal death.

These assumptions are worthy of interrogation. Maternal and fetal outcomes are occasionally affected by interventions in opposing directions, and in these cases prioritising fetal outcomes over maternal ones may not be an appropriate choice (82). An example of this is timing of delivery in hypertensive pregnancy, where an early delivery reduces the risk of poor maternal outcomes but increases risk to the fetus (41). More broadly, assigning the highest possible QALY value prioritises fetal loss over all other health outcomes. More evidence is needed to ascertain whether this is an appropriate valuation according to societal preferences. If so, this also needs to be reconciled with other societal priorities such as reproductive autonomy.

Six studies in this review sought to address these three assumptions by making use of the maternal disutility approach to valuing fetal outcomes. Under this model, the fetus is not treated as an individual, but rather as a component of maternal health outcomes; essentially a disutility of bereavement. This avoids the question of personhood, but conversely places an extremely small value on fetal outcomes. Indeed, treating fetal outcomes solely as a product of maternal ones assumes that there is no familial or societal value placed on new births, outside the personal desires of the pregnant person.

3.4.2 How are maternal and fetal outcomes combined

Four approaches for combining maternal and fetal outcomes were identified. The additive approach assigns equal value to the fetus as an independent patient, while the maternal disutility approach treats fetal outcomes as a component of maternal HRQoL. The dyad method is essentially a modified additive approach, with HRQoL assigned to the entire dyad. Finally, the dual time horizon approach assumes that the health effects of an intervention last for a shorter period for at least one member of the dyad, but otherwise follows the additive approach.

One approach not captured in the published papers is that of weighting fetal QALYs to be explicitly lower than maternal QALYs. Such an approach was used in at least one NICE guideline, where the QALY value attributable to fetal loss was set at 10 QALYs, based on the expert opinion of the committee (152). This case is discussed further in the next chapter.

Where an effect on maternal utility was quantified, it is notable that studies generally assumed that this was a parent-child relationship. In other words, that the loss of the fetus amounts to the loss of a child, and that a disabled child would be cared for maternally by the pregnant person. While this is the case in the majority of pregnancies, it would be interesting to consider whether the health effects recorded would be the same in different circumstances, such as surrogacy arrangements.

3.4.3 Implications for future research

The findings from this review outline three key issues present in current CUAs of pregnancy: poor standards of reporting; variability in the valuation of QALYs and DALYs for the same clinical outcome; and inconsistency in the inclusion of maternal and fetal outcomes and how these are combined.

The first issue requires that authors adhere to reporting standards outlined in good practice guidelines such as CHEERS (153), and report methods in sufficient detail to allow replication. The second could similarly be ameliorated by following best practice for the conduct of economic evaluations, namely including all relevant outcomes and applying relevant age-adjustment to long-term HRQoL outcomes (154).

The third issue requires considering whether current approaches to valuing fetal outcomes are consistent with maternal, familial, clinical and societal preferences. A substantial stated preference literature in pregnancy exists (155,156). However, only three studies made use of stated preference data in their analysis (150,157,158). All used them to assign utility values to fetal outcomes, rather than to validate or moderate how fetal outcomes should be valued relative to other outcomes. Given the variation observed in the QALY loss attributed to fetal loss in particular, a theoretical framework that addresses the value of fetal outcomes within the context of health system resource allocation is needed. Such a framework would enable the evaluation of existing methods, as well as any new methods that are developed.

In addition to the stated preference literature, there is also a growing literature on the concept of spillover effects that may be valuable. Health spillovers refer to the indirect health consequences that accrue to family and informal carers (62). Spillovers differ from pregnancy in several important ways, most notably in the independence of the individuals affected, but as a field it also faces ethical challenges where improving the health of one individual reduces the health outcomes of another (159).

In the absence of standardised methods, it is crucial that authors report the assumptions they are currently making in the comparative valuation of maternal and fetal health outcomes. I have identified a variety of approaches to this valuation, but the underlying assumptions of these approaches were not made explicit, which inhibits critical appraisal and further development.

3.4.4 Limitations

This review was subject to a number of limitations. In particular, a large number of studies were identified due to the broad inclusion criteria. This limited the depth of data extraction possible. Likewise, the scale of the search strategy meant that it was not possible to complete a full update of the searches before submission with the resources available to the project. However, this study focusses on the methodology and theoretical approaches used to combine maternal and fetal outcomes and I am not aware of any studies using different approaches that have been published since these literature searches were conducted in December 2019. To verify this, I conducted forward citation tracking on the studies that reported novel methods to see if any studies had further developed these approaches, which did not find any relevant studies. Nonetheless, it is possible that recent methodological developments have been missed.

Data relating to health valuation was not always clearly presented, and this may have reduced the accuracy of the findings. Assumptions were often implicit rather than explicit, which limits reproducibility.

3.5 CONCLUSION

This chapter has identified how maternal and fetal outcomes have been measured and valued in published CUAs. The number of CUAs published on pregnancy is increasing, and the lack of guidance for how to handle the issue of both maternal and fetal outcomes is becoming more apparent. Outcomes are frequently excluded, often without justification, and methods for extrapolating outcomes over a lifetime horizon are highly

varied, even within a given clinical context. There is also frequent poor reporting, with assumptions and calculations often missing.

Where both maternal and fetal outcomes are included in the analysis, methods for combining them vary widely. No clear guidance for handling this was identified. Methods and assumptions employed often fall foul of the ethical traps identified in Chapter 1, either by valuing fetal outcomes very highly, or by excluding relevant outcomes where conflict exists.

In the next chapter, I investigate alternative methods that might address some of the limitations of current methods for combining maternal and fetal outcomes. In later chapters, I conduct a qualitative analysis with the aim of establishing a framework that maps out relevant outcomes and considerations in pregnancy, and that could be used to develop new methods to fill the gaps identified here.

4 ARE THERE EXISTING METHODS THAT COULD BE USED TO EVALUATE OUTCOMES FOR ECONOMIC EVALUATIONS IN PREGNANCY?

4.1 INTRODUCTION

Over previous chapters, I have identified that economic evaluations routinely struggle to incorporate pertinent outcomes and context into analyses of interventions given in pregnancy. These include accounting for both maternal and fetal health outcomes in the analysis, valuing future (fetal) lives, and respecting maternal autonomy throughout pregnancy and birth.

Chapter 3 did not identify a standardised way of conducting CUA in pregnancy. A number of approaches have been used, but none are able to fully address these challenges. Additionally, the majority of economic evaluations identified were CEA rather than CUA (234 CEAs (65%)).

Health economists frequently encounter settings, interventions and clinical conditions that confound the basic assumptions of economic evaluation and CUA. Examples include healthcare in old age (124), health inequalities (160), and childhood health conditions (161). A number of creative approaches have been developed in response to these and other issues. It may be possible to address the challenges of pregnancy using tools developed for other fields.

4.1.1 Aim

The aim of this chapter was to identify methods that either have been applied to pregnancy or that were developed to address a challenge that is found in another clinical or research field, but which also applies to pregnancy.

The outline of this chapter is as follows: first, I present the criteria for including a method or approach. I then describe each approach and which aspects of the challenge of evaluating pregnancy it addresses. Finally, I summarise the general characteristics of the approaches in terms of their underlying theories.

In Chapter 7, these methods are compared against the framework of outcomes, in order to assess their potential applicability in the field of pregnancy evaluation.

4.2 METHODS

In this chapter, I have summarised methods and approaches identified from a narrative review of literature conducted informally over the course of my doctoral studies. Studies were collated from a variety of sources, including literature searches, conference abstracts (primarily from meetings of the Health Economists' Study Group), relevant workshops and meetings, social media (initially Twitter, later Bluesky), and suggestions from colleagues. Where relevant papers were identified, I conducted forward and backward citation searching to better understand the development of the method and its use in pregnancy. Studies were gathered informally, rather than following a structured methodology or any specific narrative review guidelines, to enable maximum flexibility in the review process.

I sought to summarise a broad literature that either had been used in pregnancy, or that addressed some aspect of the issues presented as outlined in Chapter 1. The aim was broad in scope, although this was not a formal scoping review (162).

4.2.1 Inclusion criteria

Two sets of inclusion criteria were used. One referred to the aims of the method or approach, and the other to the context in which it has been used. An approach or method was considered relevant if it was intended to solve one of the problems identified in previous chapters, such as:

- Outcome measurement of multiple individuals within an evaluation.

- Inclusion of multiple relevant outcomes within a single evaluation.
- Measurement or valuation of outcomes relating to future lives.

In addition to the above, methods were included if they were used in one of the following contexts:

- Has been used in economic evaluation of pregnancy.
- Has been used in economic evaluation in a clinical area that encounters similar challenges to pregnancy (for example, child health, family health, etc).
- Has not been used in pregnancy but is intended to address challenges relating to balancing multiple or conflicting outcomes.
- Describes an economic methodology relating to pregnancy (e.g., utilities in pregnancy).

4.3 METHODS IDENTIFIED

In total, six methods were identified. These are described below. First I recap the QALY approaches identified in the previous chapter, and then progress through the newly identified approaches.

4.3.1 QALY-based approaches

The systematic review (Chapter 3) identified six approaches to evaluating health outcomes in pregnancy, using the QALY approach. The first two are simply to exclude either maternal or fetal outcomes from the analysis. The other four attempt to capture these outcomes jointly in some way (additive, maternal disutility, dual time horizon, and dyad).

Because the review focussed on CUA, these approaches were all based on the QALY model where health outcomes are measured as decrements against an imagined perfect health state. The different approaches identified attempt to tackle the issue of combining maternal and fetal health outcomes, and each makes different assumptions.

The additive approach simply treats the pregnant person and fetus as two entirely independent individuals. This approach assigns independent value to health outcomes for the fetus, but in so doing may risk undermining maternal autonomy, by overvaluing fetal outcomes relative to maternal ones.

Maternal disutility is essentially a spillover effect that captures the psychological effects on the pregnant person of harm to the fetus. Fetal outcomes themselves can be included or omitted, depending on the assumptions of the analyst. This addresses some of the concern in Chapter 1 around the mental health harms of poor pregnancy outcomes, but does not assign a value to the fetus as a separate entity.

The dyad approach treats the maternal-fetal dyad as a single unit, not just in pregnancy but across the whole life course. The theoretical or practical justification for this assumption was not provided. One advantage is that this avoids completely separating the pregnant person and fetus.

Finally, dual time horizons are essentially a variant on excluding outcomes that are unaffected by the intervention. They may also provide a mechanism for weighting maternal and fetal outcomes separately – as I discuss next.

4.3.2 Separate weighting

One idea that has not received widespread attention, but that was raised over the course of my PPI work as an intuitive approach, is the idea of downweighting fetal health outcomes by some amount. For example, by valuing the sum total of a future fetal life such that it is worth less than that of the sum total of the remaining maternal life. This is a modification of the additive approach.

This would address one issue with the additive approach: that a longer remaining life expectancy results in fetal QALYs being greater than maternal QALYs. This results in a normative judgement placing the life of the fetus above that of the pregnant person. This is at odds with the ethical conventions surrounding pregnancy, including human rights

law, which contends that human rights begin at birth (83). It is also unclear whether such a judgement would be compatible with current clinical practice, in which the life and wellbeing of both the pregnant person and the baby are prioritised by different medical specialties (obstetrics, maternal-fetal medicine, midwifery), without passing judgement on which is worth more. The construction of QALYs used in the additive approach prioritises the survival of a healthy fetus above all else. Resource allocation decisions made in line with this judgement would essentially prioritise fetal survival as a result of a statistical inevitability, rather than on the basis of patient, societal or clinical preferences.

I have identified two cases in which a down-weighting of fetal QALYs was applied: in the NICE Technology Appraisal “Routine antenatal anti-D prophylaxis for women who are rhesus D negative” (TA156), and in its previous iteration, TA41 (163,164). The intervention under evaluation is anti-D prophylaxis to prevent the development of rhesus sensitisation in pregnancy, which can cause haemolytic disease in subsequent pregnancy (165).

The evidence listed alongside TA41 provides insight into how the weighting was calculated (166). A threshold analysis was conducted in which the cost of the policy was divided by a range of QALY thresholds for cost-effectiveness. This gave the number of QALYs the policy would need to provide to be cost-effective. The QALYs attributable to avoidable disability were subtracted from this total number of QALYs. The remainder – the unattributed QALYs – were then divided by the number of stillbirths that would be avoided in the policy. This gave the implied QALY differential per stillbirth avoided; essentially, the minimum QALY loss that would need to be attributed to a stillbirth in order to make the policy cost-effective.

The committee deliberated on a minimum QALY value for stillbirth avoided. The normative valuation was made by the decision maker, with the resulting decision pre-specified based on the threshold analysis. The committee came to the following conclusion:

“It was difficult to ascribe a precise utility value to this aspect of the use of the technology but it could be argued that the loss of a fetus late in pregnancy was equivalent to losing a full lifetime. Whether or not a full lifetime is considered to be lost in these circumstances, the Committee concluded that the loss of a fetus late in pregnancy or at birth was equivalent to a loss of at least 10 quality-adjusted life years (QALYs).”

TA41 technology appraisal report, section 4.3.3 (163)

It is noteworthy that the committee considered that a late-term loss could be considered equivalent to a full lifetime lost, but that, in their view, it at least met the value presented at their chosen threshold in the threshold analysis. The valuation of late-term loss at 10 QALYs was carried into the later appraisal (TA156).

Within the final appraisal and determination of TA156, the committee considered the value that should appropriately be applied to fetal loss. In the final appraisal determination the report states the following:

“The Committee considered the value that the economic model attached to the loss of a fetus or neonate owing to HDN [Haemolytic Disease of the Newborn]. The Committee recognised that it was difficult to ascribe a precise utility value to this aspect of the use of the technology, and noted that during the original appraisal (NICE technology appraisal guidance 41) the loss of a fetus late in pregnancy or at birth was assumed to be equivalent to a loss of at least 10 QALYs. The Committee concluded that, in the absence of other data, a disutility for fetal loss of 10 QALYs should also be applied in this appraisal.”

TA156, section 4.3.4 (164)

The fact that this approach has been raised only in the context of committee discussions could indicate that, while it has not been developed either theoretically or empirically, the approach passes a kind of common-sense test. This very simple approach might indicate a

societal preference for a valuation that recognises the unique status of a fetus as existing on the cusp of present and future lives, and that therefore requires separate consideration. Such an approach would capture the baby's importance and significance to both the pregnant person and wider society, while maintaining the boundary between the born and the unborn.

4.3.2.1 Stated preferences

However, how to calculate such a weighting is an outstanding question. One possibility is the use of stated preference studies. Stated preference studies, including DCEs, willingness to pay (WTP) studies, and contingent valuations, are used to ascertain people's preferences for different attributes (including outcomes) by asking them to trade between these attributes in a standardised setting. The results can be used to quantify the trade-offs people are willing to make.

A number of stated preference studies have been conducted in pregnancy, primarily in the field of antenatal care provision and birth experiences (156,167–178). A number of these have included risks to health as attributes. Such studies could form the basis for an estimate of a weighting of how tolerant patients and the public are of fetal health risks relative to maternal ones.

One point of possible contention is the potential for differences in how highly fetal outcomes are valued by patients, the public, and clinicians. There is existing evidence that clinicians may differ in their preferences for fetal outcomes compared to pregnant patients (179,180). The question of whose preferences should be counted when assigning utilities to an outcome, in situations where different groups have different valuations, is an outstanding issue in health economics (181), and could be relevant here.

4.3.3 Spillover effects

Spillover effects are the health consequences arising from a health intervention that accrue to people other than the person receiving the intervention. Generally, these are the

family and informal carers of a patient who is treated. Measuring spillovers arose out of the desire to capture all relevant health outcomes attributable to a health intervention, including knock-on effects to people besides the patient receiving the intervention (182).

The costs and benefits of including spillovers in economic evaluations have been widely debated. In particular, the question of how far to extend the net of potential health consequences. There are also concerns around the equity implications of tying resource allocation to one's social connections (183).

Various frameworks to capture spillovers have been developed, and increasing attention is being paid to their implementation. One study assessed three methods for including spillovers (161). The methods all used health outcomes data collected from family members and carers to calculate a spillover coefficient. The spillover coefficient approximates the health gain or loss accrued to the family member or carer, per unit of health change in the patient receiving treatment. Subsequent method development has built upon this idea of a spillover coefficient in various contexts (159,184–187).

4.3.3.1 Relevance to pregnancy

Spillovers enable the consideration of the health effects of interventions beyond the individual receiving treatment. This approach relaxes the assumption of effects accruing only to the treated individual. It also models the knock-on effects of health conditions on family members and carers.

In pregnancy, a core challenge for evaluation is how to account for the maternal-fetal dyad. Treatments given to the pregnant person can and do (and are sometimes given solely intending to) affect the health of the fetus. Spillovers may provide a framework for considering the impact of treatments given to the pregnant person on the fetus, and vice versa.

A recent systematic review explored the inclusion of spillovers in CUAs of the maternal-perinatal dyad (188). This review investigated studies that included both maternal and

fetal outcomes in the analysis, and identified the ways in which the impact of fetal outcomes on maternal HRQOL have been measured and analysed (what I refer to in Chapter 3 as maternal disutility). The review's findings were similar to the relevant section of Chapter 3 (see **3.3.2.3**) in that a variety of approaches were identified to measure the maternal health impacts of fetal outcomes.

4.3.4 Multicriteria decision analysis

Multicriteria decision analysis (MCDA) provides a framework for evaluation where multiple outcomes are relevant, and where a decision maker has multiple objectives. MCDA refers to the formal, quantitative process of performing a comparative analysis of several options based on their performance across multiple criteria (189). The precise approach used can vary and methods differ in the approach used to aggregate across criteria (190).

MCDA has been used in economic evaluation in two broad categories: resource allocation decisions, and preference elicitation. In resource allocation, MCDA is relevant in scenarios where decision makers are entrusted with multiple sets of objectives. For example, it has been suggested that non-health outcomes may be relevant in the evaluation of orphan drugs (191). Such outcomes include the rarity of the disease, unmet need, and the level of research required to develop the drug. MCDA frameworks have been developed to support such an analysis (192,193).

In preference elicitation, MCDA has been used to assess patients' relative preferences for treatment options, accounting for multiple criteria, such as clinical endpoints and mode of administration. It has been argued that the value of this approach is in using patient preferences to guide the relative weights of the relevant criteria, rather than relying solely on clinical expertise or the value judgements of decision makers (194).

MCDA has been widely used in healthcare settings, although a lack of standardisation and transparency may limit the value of current methods (189). Care also needs to be taken to ensure that resource allocation decisions taken based on MCDA analyses operate within an explicit resource constraint, rather than new criteria serving as a way of effectively increasing the cost-effectiveness threshold (195). Any criteria added also need to be compatible with the objectives of the decision maker. Nonetheless, MCDA provides a vehicle for evaluating interventions in terms of multiple, sometimes conflicting criteria.

4.3.4.1 Relevance to pregnancy

As demonstrated in Chapter 3, researchers conducting economic evaluation in pregnancy often struggle to value both maternal and fetal health outcomes. One outcome or the other is frequently excluded from the analysis, often without proper justification. Such a justification would be that the health outcome excluded can be reasonably assumed to be unaffected by the intervention – a strong assumption given the nature of pregnancy.

MCDA allows researchers to account for multiple objectives in the analysis. One framing of pregnancy is that the health outcomes of both the pregnant person and the fetus are separate objectives for the decision maker. MCDA therefore could be a way of structuring the analysis to account for this. It could also provide a way to account for non-health outcomes in the analysis, where relevant. In pregnancy, there are outcomes and experiences that are not captured by standard HRQoL instruments, such as autonomy and the value of diagnostic information, that are essential to the formulation of an outcome as positive or negative, in situations where individuals with otherwise identical characteristics might choose different treatment options (for example, in response to antenatal screening results or during labour). MCDA might provide a vehicle for the inclusion of such features. The issue of additional outcomes and experiences are discussed in detail in Chapters 5, 6 and 7.

To evaluate the use of MCDA in pregnancy, I conducted a brief literature review in PubMed (see appendix 4.1). The review identified only one study that used MCDA in

economic evaluation in pregnancy: an evaluation of gestational anaemia (196). In that study, the aims of the analysis were to include a range of non-health outcomes in the evaluation, rather than to account for maternal and fetal health outcomes. These outcomes included unmet need, size of affected population, and disease severity.

4.3.5 Capabilities-based approaches

In contrast to utility-based approaches to outcome measurement, health economists have also used methods based on capabilities.

Capabilities were espoused by Sen as an alternative to utility, in response to concerns about its applicability to a wide range of situations (197). Sen rethought the concept of utility, and outlined a total of four concepts that describe how humans relate to the world around them: utility; goods; functioning; and capabilities. Functioning refers to the things people do. Capabilities refer to people's capacity to do those things, regardless of whether they actually do them. Sen proposed that capabilities therefore capture the most relevant outcomes in fields such as health and development. The capability for basic functionings (such as to be well-nourished) is therefore not dependent on the pleasure one gets from this state, but instead captures one's ability to meet a fundamental human need. As an example, one might have the capability to eat (one has access to food, or the means to obtain it), but choose to engage in fasting for religious reasons. While a fasting person is functionally not well-nourished (at least for the duration of the fast), the effects of fasting on their wellbeing are evidently very different to someone who is malnourished due to the inability to access food.

Capabilities have been proposed as an alternative to health-related utilities, and publications relating to their use in economic evaluation are increasing (198). By situating the analysis in terms of improved capability to function, advocates of the capability-based approach argue that it captures a more essential range of outcomes to the goals of healthcare, rather than restricting to a narrow conceptualisation of health outcomes (124).

In other words, capabilities capture the essential purpose of health and healthcare, rather than simply the health outcomes themselves. This is particularly relevant in areas of healthcare where HRQoL may not be the only relevant outcome. For example, the ICECAP-O measure was derived as a way of valuing relevant outcomes in older people, for whom social outcomes may be as, or more, important than health outcomes (199). It contains five attributes: attachment, security, role (doing things that make you feel valued), enjoyment and control.

4.3.5.1 Relevance to pregnancy

Pregnancy is an area of healthcare where the goals of decision makers are more complex than other clinical areas. The capacity to become, and remain, pregnant with a healthy baby at one's preferred time is a key component of fertility and antenatal care. The wellbeing of a person who can carry a healthy pregnancy but chooses not to is different from a person who would like to but cannot for medical reasons. There are also questions of autonomy and dignity that form essential components of maternity care. Capabilities may therefore offer a tool for capturing the elements of pregnancy that relate to diagnostic information, autonomy and choice, as well as the physical and mental health outcomes captured by conventional measures of HRQoL.

A capabilities approach has been considered in relation to non-invasive prenatal testing (NIPT) (26). NIPT tests the cell-free fetal DNA present in maternal blood to test for chromosomal anomalies in the fetus. NIPT is an area where the conventional economic evaluation approach risks diverging from the ethical discussions around the technology. A fuller discussion of this topic is provided in Chapter 7 (**7.3.2**), but the stated goals of NIPT are to provide information on fetal health conditions and enable parental choice.

However, economic evaluations often frame intervention effectiveness in terms of cost-per-case detected, rather than QALYs (202). This approach does not capture the value of the diagnosis to the pregnant person, or incorporate the range of outcomes following a diagnosis. This approach does not grapple with the appropriate valuation of lives affected

by chromosomal anomalies, whether directly (the individual themselves) or indirectly (parents and family members).

In the study in question (26), capabilities were posited as a way of valuing NIPT outcomes in terms more consistent with parental preferences. The study was a secondary qualitative analysis of interviews with pregnant women discussing their feelings and decisions around NIPT in Canada. The analysis was based on a pre-existing set of capabilities: Nussbaum's Ten Central Human Capabilities (203). The study found that eight of the capabilities could be applied to NIPT, and they added a ninth (care-taking) that was not adequately represented (Table 4.1).

Capability	Definition
Life	The capability for life both for the pregnant person and the baby.
Bodily health	In relation to reproductive health, and especially to avoid miscarriage.
Bodily integrity	Feeling empowered to make decisions about their reproductive care.
Senses, imagination and thought	Being able to attain a good enough understanding to consider what the test and results might mean.
Emotions	Peace of mind, reassurance and reduced stress.
Practical reason	The ability to engage in critical reflection and planning in order to make the best possible decisions about one's life.
Affiliation	The ability for families with disabled children to feel valued and supported in their community.
Control over one's environment	The ability to participate in choices that govern what is available in the larger medical or prenatal care system.
Care-taking	The ability to adequately take care of dependents, including children, both existing and potential.

Table III. *The nine capabilities identified in the context of NIPT*

These capabilities reflect a range of considerations beyond health outcomes that affect pregnant people's decision to accept NIPT and feelings around the results and subsequent diagnosis and treatment.

Outcome measures specifically for pregnancy based on the capabilities approach have not been developed, and existing capability-based measures, such as the ICECAP-A, have not been validated in pregnancy.

4.3.6 Economic models of fertility

Within the welfarist approach, there have been a number of alternative models of utility proposed specifically to address the question of fertility. These may have relevance to pregnancy evaluation.

Economists have sought to understand the drivers of fertility through the development of economic models of fertility. This work was primarily developed in the 1960s to the 1980s, in response to concerns about population growth and the “fertility transition” where demographics shifted in favour of lower fertility as countries developed economically (204). A range of models were developed (205). The predominant work was done by Becker (206). In this model, parents are assumed to be altruistic towards their children, and therefore parental utility is a function of children's utility, obtaining a dynastic utility function. Fertility is driven by the wage rate, children's consumption, and the degree of altruism.

An alternative model was developed specifically for the UK population by Tzannatos and Symons (207). In this model, children are considered both as an investment good (although this is considered trivial due to uncertainty around children's future earnings, the strong effect of discounting on said earnings, and modern anti-child labour laws), and as a consumption good, providing satisfaction for their parents. Unlike Becker's model, the utilities of children themselves are not considered. The costs of children are captured as the price of their consumption, the opportunity cost of female employment, and the costs of “confinement” (the disutility and costs associated with undergoing pregnancy).

There has been limited interest in the economics of fertility since the 1990s, possibly due to a decline in global interest in the fertility transition itself. These theories have limited applicability to economic evaluation, but they do make a utilitarian case for fertility, something that is otherwise absent from the field of health-related utility.

4.3.6.1 Relevance to pregnancy

One outstanding question in economic evaluations of pregnancy interventions is the value of pregnancy and fertility itself. Health outcomes used in CUA draw heavily from utilitarian theories of health. The economic concept of welfare provided a starting point that was then developed with reference to other approaches, such as capabilities, into the extra-welfarist approach used today (29). These economic models of fertility may therefore have some value in enabling us to develop new approaches to pregnancy valuation.

In practice, NHS decision-making has moved away from welfarist approaches drawing directly on utilities, such as CBA. The arguments against CBA were discussed in Chapter 1 (1.3.1.2), and they also apply here.

4.3.7 Summary

The methods described here each tackle some element of the challenges encountered in pregnancy. As a reminder, these are: how to handle the maternal-fetal dyad; how to preserve maternal autonomy; and how to handle future lives in economic evaluation.

Each method has the capacity to tackle some component of this. Spillovers and MCDA both offer tools to account for the maternal-fetal dyad in evaluations. MCDA and the capabilities approach provide flexibility that could enable greater inclusion of additional outcomes and experiences, thereby safeguarding maternal autonomy as a crucial outcome. The question of future lives is complex and ultimately normative, but a separate weighting might provide an option that has at least tentatively been considered in NICE decision-

making. Prior research into the utilitarian case for fertility might also provide useful insight.

4.4 CONCLUSION

Across Chapters 3 and 4, I have identified a lack of consistent approaches to outcome measurement and valuation in pregnancy. A number of methods are promising, but none are yet in common use, and no single method meets all the challenges identified. Existing CUAs are subject to substantial variation, both in their reporting and in their assumptions surrounding these issues.

In order to develop the methodology in this area, and address the outstanding normative questions blocking such development, a greater understanding of pregnancy in health economic terms is needed. In the next chapter (Chapter 5), I conducted a qualitative analysis to address this, with the view to developing a framework against which these methods can be compared (Chapter 7).

5 WHAT INFLUENCES PEOPLE'S DECISION-MAKING IN PREGNANCY? A QUALITATIVE ANALYSIS

5.1 INTRODUCTION

In the thesis thus far, I have outlined the challenges encountered by researchers conducting economic evaluation in pregnancy (Chapter 1). In Chapter 3, I identified that the measurement and reporting of outcomes in CUA is often inconsistent between studies, and that there is a lack of consensus around which outcomes to include and how to value maternal and fetal health outcomes together. In the last chapter, I reviewed relevant methods that could meet some of the challenges identified, and explained that no existing method solves all the problems identified.

In this chapter, I start the process of identifying what outcomes are important in pregnancy. This provides the foundation for considering new methods for measuring and valuing outcomes. This chapter takes a qualitative approach, aiming to explore how pregnant people make decisions, and the factors and preferences that influence those decisions.

5.1.1 Understanding value

In order to begin considering approaches for valuing outcomes in pregnancy, it is necessary to consider how pregnancy contributes to health and wellbeing, and how different possible outcomes in pregnancy increase or decrease maternal HRQoL. In other words, what is important to pregnant people?

One method for understanding the relationship between pregnancy and health and wellbeing is to look at the preferences people express during (or when reflecting on) pregnancy, labour and birth. Preferences are used in economics as a way of measuring utility. Preferences are most clearly expressed about the point of decision-making, either

through stated preferences (what would you do if you faced this decision?) or expressed preferences (what did you do when you faced this decision?) (20).

There are many points of decision-making in pregnancy. Antenatal care, labour and birth all involve the pregnant person making medical decisions of some kind, in addition to the myriad social and personal decisions people make during pregnancy.

By learning about the factors that influence pregnant people's decision-making, we can understand more about their preferences for different outcomes and, by extension, their health and wellbeing.

5.1.2 Why a qualitative approach?

Qualitative methods are well suited to this kind of exploration because of their focus on eliciting views, beliefs, personal values and feelings. Health economists are increasingly making use of qualitative methods (118,122,208).

Qualitative research has often been used as a precursor to stated preference studies, in order to ensure the attributes included reflect the condition being studied. Here, I took a broader approach, given that a framework or theory of pregnancy utility has not yet been developed, but could be a valuable addition to the literature.

The evidence generated by this analysis will provide a basis for developing a framework that can be used to evaluate new and existing methods for valuing pregnancy outcomes.

5.2 AIM

The aim of this chapter was to explore people's experiences of decision-making during their pregnancy, and to identify the factors that influence their preferences.

5.3 METHODS

This study was a secondary analysis of previously collected interviews. Secondary analysis allows researchers to make use of existing sources of data, maximising the value of

previous data collection efforts and the efficiency of ongoing research (128,129).

Interviews that have been transcribed and archived are re-analysed to answer a new research question.

Secondary analysis is particularly well-suited to research studies where the context or issue being studied is present in a range of interviews, even though it was not the original focus. It has been previously used in the context of pregnancy and childbirth (209,210).

5.3.1 Data available for secondary analysis

This study analysed data collected as part of previous studies with outputs published on HEXI (www.hexi.ox.ac.uk) (115). HEXI is a public-facing website run by the University of Oxford, which aims to represent the real-world experiences of patients who live with a wide variety of diagnoses, talking about their experiences with their diagnosis and treatment. It comprises a collection of interviews that were conducted and recorded in a semi-structured format, and then transcribed verbatim and archived. Some are also videoed, and clips and excerpts are embedded in topic summaries published on HEXI, with participant permission. In some cases, interviews on a given topic are collated from across multiple primary qualitative studies. In others, interviews come from a single study with a specific focus. As a result, interviews are sometimes included in multiple datasets, for example if they were relevant to more than one topic. In these cases, I categorised the interview according to the topic it was originally collected for.

The archive of interviews is collected and maintained by the Medical Sociology and Health Experiences Research Group in the Nuffield Department of Primary Care Health Sciences at the University of Oxford. I was able to access the transcripts and some associated demographic information. Transcripts were provided as Word documents with explicitly identifiable information (names of people and places) removed. All interviews were conducted in the UK, but more granular regional information is removed from the documents available for secondary analysis and so was not available to report.

5.3.1.1 Ethics

The archive was accessed by prior approval from the Medical Sociology and Health Experiences Research Group at the Nuffield Department of Primary Health Care Sciences, University of Oxford. The original datasets in this secondary analysis were collected using qualitative interview methods approved by the NRES Committee South Central – Berkshire (REC reference number 12/SC/0495) and HRA for all health conditions involving adult participants, with the study title ‘Narratives of Health and Illness for HEXI’ (IRAS ID 112111).² Participants gave permission for the interview transcripts and associated information to be archived and made available for future research.

5.3.2 Approach to sample selection and analysis

5.3.2.1 Sampling the interviews

Because of the broad range of interviews I had access to on pregnancy and birth, it was necessary to screen the original projects and interviews to ensure their compatibility with this project. To this end, I developed a brief screening framework, discussed and reviewed with my qualitative supervisor, Abigail McNiven (Appendix 5.1), to ensure a relevant and information-rich sample of interviews for secondary analysis. This outlined the information I was looking for in the interviews.

Broadly, I was interested in projects and interviews that explored three overarching concepts. The first concept was pregnant people’s experiences of choice (both medically and socially) and how participants framed and approached their choices and the decisions they ultimately took. This included decisions around maternal health and risks to their health. The second concept was the emotional connection participants had with their pregnancy, fetus, or future baby. This included how and when personhood was ascribed to the fetus, and how the emotional connection the pregnant person felt to the pregnancy affected their decision-making. The third concept was any other influences on decision-

² NRES, National Research Ethics Service; REC, Research Ethics Committee; HRA, Health Research Authority; IRAS ID, Integrated Research Application System Identifier.

making in pregnancy, including social factors, interactions with healthcare professionals, and personal experiences.

A sample of interviews from each project was reviewed against the screening framework in order to decide whether the structure and content of the interviews were compatible with the aims of this project. If the project was deemed to be compatible, the rest of the interviews were obtained for sampling. Initially seven projects were obtained and one was deemed incompatible on further consideration. I then sampled purposively from within each project, aiming to include a diversity of clinical experiences, diagnoses, ages, ethnicities, education levels, professions and parities. As interviews were sampled, I noted demographic characteristics and clinical experiences. I initially selected and coded two interviews from each project. As I identified gaps, I selected further interviews to include those characteristics. I continued sampling until I was no longer obtaining new codes and additional interviews were not providing further insights. The approach for deciding on a stopping point drew on the concept of information power, where the sample size needed to answer a given question depends on a range of factors, including the study aim, the sample specificity and the analysis strategy (211).

5.3.3 Overview of datasets

The transcripts were drawn from six topic-focused projects. While some projects have resulted in publications, which are referenced, others were collected as part of the wider HEXI project and were not published separately.

Experiences of pregnancy (study name shorthand ‘Pregnancy’)

The interviews for this project were conducted in 2004-2005 and a total of 36 interview transcripts were available (212). This project aimed to capture an overview of experiences in pregnancy – from straightforward, low-risk pregnancies through to more complex experiences. The majority of interviews were conducted retrospectively, post-birth, reflecting on prior pregnancies. A few participants were interviewed during a pregnancy, although if applicable they were also able to reflect on prior pregnancies.

Conditions that threaten women's lives in pregnancy and childbirth (study name shorthand 'Near Miss')

These interviews were conducted around 2010-2015 as part of the National Maternal Near Miss Surveillance Programme (213,214). Forty-nine interview transcripts were available. Participants had experienced emergency conditions in pregnancy and childbirth that put the mother's life at risk, such as pre-eclampsia or post-partum haemorrhage. All interviews were conducted retrospectively, after pregnancy. Some interviews were with the partner of the pregnant person, either together or separately. These interviews primarily focussed on experiences of labour, birth and post-partum medical care, and had a strong focus on interactions with clinicians and healthcare.

Losing a baby at 20-24 weeks pregnancy (study name shorthand 'Late Miscarriage')

These interviews were conducted in 2018 and 39 interview transcripts were available (215). All participants had experienced miscarriage between 20-24 weeks gestation, and some interviews were conducted with partners in addition to the person who had been pregnant. These interviews included descriptions of contact with the healthcare system in relation to late miscarriage, as well as experiences of grief and reflections on loss.

Ending a pregnancy due to fetal abnormality (study name shorthand 'Ending a Pregnancy')

These interviews were conducted in 2005 and 38 interview transcripts were available. Participants had all terminated a pregnancy due to a fetal abnormality identified following antenatal screening. Participants described the process of screening, diagnosis, of deciding to terminate, and of their experience with termination and its emotional aftermath. The original analysis, and two secondary analyses by the same team, have been published (210,216,217).

Antenatal Screening (study name shorthand ‘Antenatal Screening’)

These interviews were conducted in 2004-2006 and 40 interview transcripts were available (218). Interviews focussed on participants’ attitude to antenatal screening and experiences of going through, or of refusing, screening. Interviews were largely conducted post-pregnancy, although some participants were still pregnant at the time of interview.

Making decisions about birth after caesarean (study name shorthand ‘Birth After Caesarean’)

These interviews were conducted in 2005 and 30 participants were included. The interviews were collected as part of the Decision Aids for Mode of Next Delivery (DiAMOND) trial, which evaluated the impact of a decision aid on pregnant people choosing the preferred mode of birth after a prior caesarean (219). For the qualitative component, participants were interviewed 2-3 weeks before giving birth, and then 22 of them were re-interviewed 6-12 weeks post-partum. Eight participants declined to be re-interviewed, citing lack of time or emigration. The first interviews focussed on participants’ experience of using a decision aid that presented information on the risks of different outcomes in labour and birth, as well as their feelings and emotions around their upcoming birth. In the post-partum interviews, participants described their birth experience and reflected on the decision they made. Further information about this study is published (220).

5.3.3.1 *Two interviews were specially obtained from two further projects (“Infertility” and “Pre-eclampsia and high blood pressure in pregnancy”) that were not initially considered compatible because they covered specific topics that were not present in the first six projects. These interviews were suggested by colleagues with familiarity with the datasets, and they came from datasets that otherwise were not compatible with the project because of the scope or framing of the original projects. The infertility study interviews were conducted from 2007 – 2009 and included 38 participants (221). One participant was pregnant at the time of interview and this was the interview included in this analysis. The pre-eclampsia interviews were collated from three separate projects ranging from 2014 – 2020 and contained interviews from 34 participants (222).*

Coding

Initially, two interviews from each project were coded. These were purposively sampled to maximise variation on the basis of demographic information or clinical diagnosis or experience. After the initial 12 interviews, 10 additional interviews were sampled to ensure that a diversity of characteristics and experiences were represented. In total, 22 interviews were analysed.

Interviews were read and re-read to gain familiarity with the material. All interviews were coded using NVivo Version 12 (223). Open coding was used and ongoing discussion with Abigail McNiven helped to refine codes iteratively. Initial interviews were dual-coded by Dr McNiven to ensure my understanding of the coding process, and to support discussion around sampling, interpretation and analysis of the data. I used both low-level granular codes and higher-level codes to provide structure by grouping lower-level codes.

A challenge of secondary analysis is in filtering the relevant data from the original project. Each project had its own aims and interview structure, which differed from the aims of this project. An open coding approach, supported by the screening framework, allowed for the new set of codes each project inevitably generated.

Codes were iteratively developed, revised and defined in a codebook, then grouped into a number of sub-themes. These sub-themes provided the basis for mind mapping exercises carried out initially by me, and reflected on with Abigail McNiven. A mind mapping workshop was then carried out with the doctoral supervisory team. This team consists of one academic General Practitioner and two health economists, in addition to Abigail McNiven, a qualitative researcher with prior experience conducting secondary analyses on HEXI datasets. Each workshop participant was provided with the sub-themes, along with a summary of the codes they contained. Participants organised the sub-themes into a mind map, the process of which they then described to the group. Mind maps and processes were then compared and contrasted in group discussion. This workshop was audio recorded, transcribed and then summarised. Themes were then further developed in discussion and using One Sheet of Paper methods (224).

5.3.3.2 Analytical approach

The analytical approach drew on a variety of methodologies, largely following a thematic analytical approach. I drew on methods developed by Braun and Clarke (225) and Ziebland and McPherson (226) for the analysis. The approach to secondary analysis followed methods described by Beck (128), and Ziebland and Hunt (129). Overall, the analysis shares similarities with the codebook thematic analysis described by Braun and Clarke (227). The approach emphasised flexibility in the coding approach. It centred a constructionist epistemology, where themes are developed according to the meaningfulness expressed by participants, rather than tracking codes and themes in a more structured way. Thematic analysis acknowledges the subjective nature of qualitative analysis, with researchers expected to be attuned to different findings based on their personal experience and expertise, while remaining aware of their own biases and experiences (227).

A flexible approach to the analysis was taken. Deductive analysis was used to ensure the coding was relevant to the research question (via the screening framework), but open

coding was used and the analytic process was largely guided by the data, rather than an externally imposed framework.

This more reflexive approach was chosen in order to make full use of a diverse range of data sources. Each project had its own interview structure, and so constraining the codebook in advance would have limited the value of the exercise. This also allowed for a fuller exploration of the notion of value. Rather than imposing either an economic or sociological lens pre-emptively or exclusively, I sought to construct a picture of people's values and experiences, shaped by my own expertise as a health economist but with the meaning described by participants as the driving force in the analysis.

5.4 RESULTS

5.4.1 Sample

All interviews were conducted in the UK. The age of participants at time of interview ranged from 20 – 44 years. Ethnicity was not available for all projects, but where it was available, 14 participants were White, two were Black and one was Asian. Ethnicity was not recorded for five participants. One participant was single at the time of interview, one was in a same-sex relationship, and the remainder were in heterosexual relationships. The gender identity of participants was not recorded. A range of professions and education levels were represented in the participant group (Table 5.1).

The number of pregnancies experienced ranged between 1 and 5 per participant, giving a total of 45 pregnancies discussed in the interviews. The number of live births was between 0 and 4 per participant, giving a total of 27. Some participants had not yet given birth at the time of interview, or were discussing a pregnancy that had not resulted in a live birth. Nine participants had experienced pregnancy loss (miscarriage, stillbirth or termination): four were miscarriages or stillbirths, and five were terminations. All terminations were for medical reasons. The earliest pregnancy loss was at 7 weeks, the latest at 25 weeks. There were two twin pregnancies.

Of the 23 births for which data on mode of delivery was available (not all interviewees had given birth at the time of interview, and some discussed multiple prior births), 16 were spontaneous vaginal deliveries. Three of these were forceps deliveries. There were also two inductions and five emergency caesarean sections.

5.4.2 Overview of subjects covered

The 22 included interviews covered a wide range of experiences. While some detailed relatively low risk, straightforward pregnancies and births, the majority included experiences that were more difficult or unusual. This was deliberate in that I sought to include a wide range of experiences, rather than a representative sample. I was also interested in narratives around decision-making and trade-offs. While all pregnancies involve some amount of decision-making, higher risk pregnancies typically involve bigger decisions both in terms of the emotional weight of the decision and how consequential it is in the participants' lives. Participants who had these experiences tended to talk in more depth about their preferences and values in relation to these decisions, and therefore formed a larger proportion of the codes and quotes described than those who had simpler experiences with fewer reflections on them.

ID	Project	Age	Profession
A7	Antenatal Screening (n= 5)	36	HR consultant
A9		29	GP
A22		44	Vicar
A32		35	Florist
A34		26	Housewife
B9	Birth After Caesarean (2)	33	Dentist
B20		31	Lecturer
E8	Ending a Pregnancy (2)	29	Classroom assistant
E23		38	Nursery teacher
I21	Infertility (1)	29	Insurance manager
L8	Late Miscarriage (2)	38	Primary school teacher
L17		26	Midwife
N10	Near Miss (3)	31	Physiotherapist
N18		36	Antenatal teacher
N19		44	Not reported
PE13	Pre-eclampsia (1)	27	Administrator
P10	Pregnancy (6)	27	Hairdresser
P11		37	Teacher
P13		20	Shop assistant
P14		36	Marine policy officer
P32		39	Teacher/counsellor
P35		40	Teacher

Table IV. Participant information

5.4.3 Themes and lenses

Pregnant people take a wide variety of factors and viewpoints into account when making decisions in pregnancy. Different factors may feature in different decisions. Most importantly, an outcome that is considered unimportant to one participant may be absolutely critical to another, because of differing elements in their personal circumstances or their views.

One way I considered this complex process of weighing and balancing was through the concept of lenses. A lens is an optical device that can, depending on its properties, change

the appearance of whatever is viewed through it. The object may appear larger or smaller, darker or lighter, or different colours may become more prominent, depending on the lens properties. Multiple lenses can be used and layered at the same time, amplifying or modifying the features of each.

In health economics, the concept of the analytical perspective is frequently used in economic evaluation. Here, costs and outcomes related to a decision may change depending on the scope and priorities of the decision maker (18). Lenses can be thought of similarly, albeit with more flexibility in that considerations can be prioritised or deprioritised by the pregnant person, rather than excluded entirely.

In this analysis, decisions could be viewed through multiple lenses. The factors that shaped a person's ultimate decision were broad and varied. They included not only a person's *a priori* preferences, but also the circumstances in which the decision was being made, and the perceptions and advice of those around them, whether clinical, familial or social.

Where two lenses lead to different optimal outcomes, decisions may become more difficult, and are ultimately made through a process of negotiation, both internally and socially. Decisions may appear "irrational" in the economic sense of the word, depending on how the decider resolves the complex interplay of the lenses.

A set of six lenses were identified (Table 5.2). A particular decision could be informed by one or more of these lenses. These are outlined in more detail below.

Lens	Definition
Autonomy	Having a sense of control, safety, and bodily integrity during pregnancy, labour and birth.
Maternal health and wellbeing	Mental and physical health, quality of life, and capacity to live the life you want.
Fetal health and wellbeing	The mental and physical health of this baby throughout its life. The health of the unique individual who will result from this pregnancy.
Family building	The role of the pregnancy within the family. The wellbeing of the spouse, siblings, and wider family.
Social context	How the pregnancy affects the social interactions of the pregnant person. The positive and negative social interactions resulting from the pregnancy, including mutual support, community, judgement, stigma and isolation.
Morality	The personal moral and religious beliefs of the pregnant person. Being able to make choices and act in accordance with those beliefs.

Table V. *Lenses and definitions*

5.4.3.1 *Autonomy*

Autonomy and sense of self were strong themes across all interviews. Participants described pregnancy as challenging their sense of self, including their relationship to their own body. Multiple participants described the toll of pregnancy on their body, and a sense of loss of bodily integrity. This was articulated even in the case of those who experienced a clinically straightforward pregnancy.

“Although it was in the middle of summer I was wearing trackie bottoms and big baggy T-shirts, to try and hide the bump, because I felt massive, I felt huge. They were saying, everyone was saying, “Oh, you’ve got a dead neat tiny bump” and things like

this. I didn't, I - to me it felt huge. I felt enormous and it was just knocking me sick. I just wanted it over with so I could have my body back to myself, that was it."

Pregnancy 13

This was even more pronounced in cases where complications necessitated more invasive medical care, such as in the case of a participant who had experienced severe haemorrhage and spent time in the intensive care unit (ICU) as a result.

"I just had this feeling that I just didn't want anybody near this area. I'd had too much invasion, too much intrusion and I didn't want anybody going near that area."

Near Miss 19

When describing significant moments in their care, participants frequently raised the concept of (not) having a feeling of control over the situation as a significant determinant of their positive or negative experiences.

"I had to stay in hospital for a couple of nights which I wasn't planning on. Because I was planning on my lovely home birth. But I was happy after that. Because I felt in control. I felt that people had listened to me. I felt I'd had care givers that I'd trusted. And I felt that nothing had been done that shouldn't have been done."

Near Miss 18

In this case, the participant had opted for a home birth for her second labour, after a traumatic first experience with a hospital birth. Despite having a haemorrhage in both labours, and therefore being a high-risk candidate for a home birth, she described having had a positive experience due to her feelings of control and being listened to in the second birth.

Feelings of control were often described in terms of having a choice. Loss of choice was often described negatively by participants.

“I was under the impression that [...] if I had another section then that would rule out having any kind of natural delivery and I just didn’t like the idea of removing that element of choice.”

Birth after Caesarean 20

“Well, that was affected by one person I saw at some stage in the process, either a midwife or a doctor ... said, “You know, you’re, you’re free to make what decision you make, you decide about testing, but if you decide to have the tests, then you ought to take our advice about what happens afterwards, if something shows up on it.” And I thought no, you know. If something shows up about it, I don’t want to be pressured into making a decision to terminate.”

Antenatal Screening 22

Choice was not always seen as important or desirable, however. In cases of medical emergencies, such as this participant who had a forceps delivery due to fetal distress, choice was described as being a less pertinent concept in a situation that was becoming an emergency.

“I don’t think I had much choice about the forceps but then, by that stage, you know, they were getting worried, they were really quite worried about him and so, I suppose had I thought about it, I don’t remember it being presented to me as a choice but ... I don’t think that matters really. You know ... I didn’t feel that they had taken anything out of my hands, ... the most important thing is getting him out and making sure that he was okay.”

Birth After Caesarean 20

In this way, choice was not always a predictor of a positive experience and likewise lack of choice was not necessarily a predictor of an overall negative experience. Particularly when dealing with difficult situations, such as labour or pregnancy complications, participants who had positive experiences described feeling safe and trusting their clinicians.

“I just felt safe, I knew it was going to be over soon, I trusted this doctor completely and I didn't, I wasn't worried for me or the baby at all, whereas my husband I think was much, much worried.”

Antenatal Screening 9

The counter to this is a feeling of uneasy surrender, described below by one participant who was disabled and a wheelchair user. Participants described feeling acutely vulnerable in pregnancy and birth, and this could lead them to relinquish control beyond a level that felt comfortable. This led to feelings of anxiety.

“I am in shock still at how much I gave over to health professionals and actually they're professionals but they're not experts in me, only I'm an expert in me. And I can't believe that I surrendered so much [laughs] it really is a big source of surprise to me.”

Pregnancy 32

One area where participants differed was in their attitude to test results around screening, but, even here, a determining factor in whether they wanted the information centred on a sense of autonomy, control and self-determination.

“I'm very glad that we knew, because I think it would have been such a terrible shock, and at least it armed us with the facts to make a decision about where we were going to

have the baby. ...But I'm glad that we knew. I just can't imagine what it must be like to have a baby, to have those expectations of, you know, having a healthy baby. ... but we knew what to expect, and I'm not the kind of person that likes surprises. I like to be armed with all the facts and know how best to proceed, so."

Antenatal Screening 7

Overall, choice could be a blessing or a curse, depending on the context. However, autonomy is about more than just choice. Participants were looking for respect: for their choices, where relevant, but also for their bodily autonomy wherever possible. One participant who had chosen to give birth outside of guidance summarised this, when asked what advice she would give health care professionals:

"Recognise that not every woman is not going to fit into what you think should happen to-, a recognised clinical pathways. But everybody's coming from a different perspective. And she's going to make a choice for herself, and you're not making that choice for her. She is making that choice as long as you give her that, that information."

Near Miss 18

5.4.3.2 Fetal health and wellbeing

Participants' descriptions of their relationship to a particular pregnancy were complex, and related to how they considered fetal health and wellbeing. Although all pregnancies under discussion in the interviews analysed were (or became) "wanted" in that the pregnant person had not opted to terminate the pregnancy when finding out they were pregnant, individuals' attitudes to this pregnancy in particular varied widely, and depended on a range of factors.

Participants described a relationship that changed over time. This was characterised by certain turning points in the pregnancy, such as the first scan.

“But when I went in for my first scan and I seen it, that was it, I knew that I wanted this baby and I’d love this baby, do you know what I mean? But that, that, I think that was the turning point for me then, when I went and actually had my first scan”

Pregnancy 13

“It’s baby’s first photo. I mean the number of friends I’ve got who’ve you know, got those keepsake books and baby’s first photo is in fact the scan photo. Extraordinary.”

Antenatal Screening 22

This sense of a gradual strengthening of feeling shaped how participants who experienced loss felt about it. Those who experienced pregnancy loss described a range of feelings, but a common refrain was surprise at the depth of feeling.

“I think at the time I didn't quite realise how life-changing it was going to be. Again, I think the word 'miscarriage' stuck in my head. It was just one of those things that you just get over. And I just remember I was saying something like that to the midwife, that - you know - everything will be alright once we get over it. And I remember her saying, "You don't get over losing a baby, you learn to live with it.”

Late Miscarriage 17

By contrast, the prospect of loss in the context of screening for disability added nuance, revealing that the relationship that these participants had to their pregnancy differed in important ways to a child. It was a relationship built on potential and therefore subject to change. The relationship to the pregnancy was formative, rather than fixed, and evolved both over time and in response to new information, such as a diagnosis.

“I’d seen somebody talking about it - similar sort of situation – a lady had gone to have a CVS³ and was making the decision about whether she should have one. And the way it was conveyed to her was, “You’ve got to weigh up the risk of having a miscarriage versus having a baby with a serious deformity – which would you rather have?” So that was what kind of guided us in the direction to have the CVS. We felt that we needed to know, and the small risk of miscarriage by comparison was something that we were prepared to, to deal with.”

Antenatal Screening 7

Although this flexibility in relation to the pregnancy was by no means a universal view. Some participants felt that the risk of miscarriage associated with screening was unacceptable.

“From my point of view, I knew that I wouldn't, if I knew I was having a baby with Down's syndrome I would not have a termination and given that, why know? Now for some people they'd still want to know, they'd still want the information, but to get that information you have to have an amnio, and an amnio carries, you know, on a good day a one percent mis-, risk of miscarriage and I don't think I'd take that risk.”

Antenatal Screening 9

Participants described feeling a sense of parental responsibility – that is, they considered the potential quality of life of their child in their decision-making. However, unlike parenting a living child, that decision could include the option of termination. Participants who opted to terminate for medical reasons described that their prospective child’s quality of life was a key driver of that decision.

³ Chorionic villus sampling, a type of antenatal screening test that carries a small risk of miscarriage.

“And when we went to see the consultant he was able to give us some more information about the next procedure, which was also obviously very painful. But we knew it was something that we had to do for our baby. And whatever it took, as long as we knew that she wasn’t suffering, then we could get through it as a family.

[...]

I would have had to give up my work, but that would have been a small sacrifice. There were lots of things that would have changed, but if it meant that she would have had any sort of life we would have sacrificed them for her, like any normal parent would have done.

We loved her dearly, and we would have liked, liked to have done that for her if it meant she would have had a good life. But we, we felt she wouldn’t.”

Ending a Pregnancy 23

Participants described the subject of their ended pregnancy as a unique individual with an identity. Their loss was not replaced by a subsequent successful pregnancy, and they described ongoing grief and a process of mourning.

“I’ve got an absolutely huge family and at the same time there was five of us who were pregnant, and we all had boys and [son’s name] was just not with the rest of them. So, it does... it’s not easy because you always kind of think, you know [son’s name] ... he would have been five months now and it’s just like he’s not here. There should have been a baby crying here, there isn’t.”

Pre-eclampsia 13

“But what I didn’t realise at the time is that having another baby - as wonderful as he is, and you know, I wouldn’t change him for the world - but I thought that that would stop me feeling the way I do about [daughter].

But it, it - you know. It doesn't, and it hasn't. It's made a lot of things better. Because we felt that the family wasn't complete, you know, with two children. So he's completed our family. But yeah, I'll always - you know, there'll always be something missing.”

Late Miscarriage 8

Overall, participants described a relationship that was meaningful, and could be parental in nature, but that had different parameters from parenting a born child. Termination for medical reasons was framed as a parenting choice made for the quality of life of the fetus, as well as for the benefit of the wider family. Pregnancies were not interchangeable, each one was viewed as individual, regardless of whether it resulted in a living child.

5.4.3.3 Maternal health and wellbeing

Maternal wellbeing featured prominently in participant's decision-making and their perceptions of their experiences. Physical health was most commonly described in relation to labour and birth. This is a time when the physical toll of pregnancy on the body is typically at its most acute and dramatic. In particular, birth experience and birth trauma were often described in terms of their impact on the maternal body.

“I think the attitude ‘oh well does it matter? You’ve got a healthy baby’ is awful. You know, I hear people say that time and time again. Even Mums say that. And I say to them, “Actually you matter too.” And you’re right. A healthy baby does matter. And you know, obviously I wouldn’t have wanted anything to happen to either of my two. But the Mum matters too, and what she’s feeling and experienced absolutely does matter.”

Near Miss 18

“I’m just glad I didn’t end up having a caesarean, which wouldn’t have been disastrous and would’ve made it a much shorter, less arduous labour, probably, if, you know, the midwives could’ve bailed out earlier. And if the baby had shown any signs of distress, no doubt they would’ve done. But, you know, I think it bodes better for next time if you haven’t had a caesarean before.”

Antenatal screening 9

Those who described a good experience in labour and birth, in relation to their physical wellbeing, talked about feeling attended to by their clinicians, and feeling that their physical wellbeing was safeguarded during labour.

“The care at the hospital was, was brilliant. [...] They were just, just really on, on the case. They were taking my blood pressure all the time, you know, making, I got all the drugs and everything and making sure that I was okay.”

Pregnancy 10

Related to the theme of autonomy, loss of bodily integrity featured. Those who had experienced trauma described the difficulties of recovery, such as in this case of a participant who experienced near-fatal haemorrhage that resulted in a stay in the ICU.

I was told by the ICU consultant it would take a minimum of a year for my body to fully really recover from the trauma it went through. Now a year, two years on, I still get very stiff joints. I still get very, very bad lower back pain, because you know, I was on a steel operating table for best part of eight hours. You know, lying in beds for, I don’t know, for another two weeks, and then on the sofa for six weeks. [...] And I think the thing that you find frustrating is that you don’t know whether it’s because, because I’m 45 this year, I don’t know if it’s because I’m

getting older, or if it's just because I've just had a baby and you know, all the physiological effects that having a baby has on your anyway.”

Near Miss 19

Several participants described being disabled by pregnancy and labour. This was often unexpected by them, especially first-time parents, given participants' self-perception of themselves as young and healthy. This made the experience of having their physical health threatened during pregnancy and birth more jarring.

“I guess there's bits and pieces of it in your pregnancy books that you read and things like that, but I think I probably had the opinion that like that wouldn't, why would that happen to me? You know, I'm healthy, look at me, doing my exercise and all the rest of it. So I probably read it, skipped through it, and went oh yes, that's pre-eclampsia, that's nice it won't happen to me, I suspect.”

Near Miss 10

Wellbeing extended beyond the physical self. Most participants worked outside the home, but not all were able to continue doing so as a result of injuries to their physical and mental health brought on by their pregnancy experiences. This inability to work was described in negative terms with respect to women's sense of wellbeing. While women may choose to leave work for parenting reasons, the participants who stopped working in this study felt that this was not a choice they made willingly.

“I was off for three months, and then I actually decided to leave. Because I - again, it's something that I do feel a little bit bitter about, in hindsight. Because work were putting pressure on me to go back, and I just couldn't. I was pregnant with [my youngest son], and my one and only concern was to, to have the baby

healthily... And I just thought 'do you know, I'm not in the right place now to be able to go back to work'."

Late Miscarriage 8

Health predominated in conversations about maternal wellbeing, although non-health wellbeing is also important, particularly in relation to the ability to work. A supportive work environment was crucial in enabling women to return to work after a traumatic pregnancy, birth and/or pregnancy loss experience.

5.4.3.4 Family building

Each pregnancy exists both as an individual state, but also as a contribution to the goal of achieving the participants' desired family size and form.

Participants who experienced pregnancy loss – whether spontaneously or through termination – described the difficulty of losing not just the individual (or individuals in the case of multiples), but also their sense of hope and of making progress towards a desired goal.

"Because when you lose a baby, it's kind of also losing your hopes for the future. And we had very strong views about, that we would really like to have another, another baby."

Ending a Pregnancy 23

"I was absolutely adamant that I wanted to go ahead with the pregnancy, because I did strongly feel that I may not get another chance to have a baby. My husband was a little bit more, he wasn't reluctant, but he was a little bit more concerned, he wanted to think it through in detail, and he wanted to have more information from the doctors. And I think that's perfectly acceptable, you know. He wanted to be armed with all the

facts. I just thought, “This is a chance to have a baby, I want a baby. The baby may be ill, but there’s a good chance that, you know, it would lead a relatively normal life.””

Antenatal screening 7

“I got pregnant again quickly, which was just such a relief, because that was my major fear, was to not be pregnant again”.

Antenatal Screening 32

Participants who had experienced pregnancy loss often described a desire to conceive again, to ensure they still ended up with a living child. In this way the pregnancies were somewhat interchangeable – the goal was to have a certain number of living children, and a pregnancy loss did not negate that for the participants. In these cases each pregnancy was conceived in the hope of fulfilling a particular role in the family.

Terminations were considered in some cases due to incompatibility with life, but in others due to incompatibility with a particular type of family life that the participants envisioned – one that did not involve raising a child with a disability, or without an elevated risk of child mortality. Participants described their own capacity to provide care and a good life. One participant who was herself disabled described needing to make sure that they could meet the needs of their baby, given her own disability.

“It’s just that, it’s really the, the talking to friends about tests that you can now have in pregnancy, to see if your baby is okay or not, then we were very certain that we’d have all the tests we could possibly have, because we knew absolutely one hundred percent, if there was any chance of that baby, having any form of disability, that as a partnership we wouldn’t be able to cope. So it always felt very harsh and, like we were going for, the perfect child, and anything less than perfect wouldn’t do, but in reality that’s, that’s what it was like. We had to have a child that wouldn’t need any extra care like I do.”

In some cases, participants had a pregnancy loss and then had gone on to conceive again. They described feeling tension between mourning the child that could have been, and their love for their living child.

As also noted in the 'fetal health and wellbeing' lens, some participants also described a hope that the subsequent pregnancy would act as a fix for the lost one – but this could turn out not to be true. The subsequent pregnancy filled the gap in the family size that the first pregnancy was intended to fill, but did not undo the loss.

“It's always really difficult, as well - not difficult, but I feel sometimes a bit torn, because I love [daughter] and I love [my youngest son], but I could never have had them both.”

Late Miscarriage 8

“Well, I thought that getting pregnant was, you know, this was the magical answer, this is going to sort everything out. Even though we'd been having - I'd been having the counselling and everything, and it was going really well, and I was feeling much better about lots of things, and I got pregnant, which was like 'wow, you know, this is great'. But I think in hindsight, it may have been better to wait a little longer. Because I was just so anxious throughout the whole pregnancy”

Late Miscarriage 8

Decisions around pregnancy considered the entire family. The emotional impact on the father and any siblings was considered. In some cases, the experience of a traumatic pregnancy changed the family's plans entirely, by deciding not to have more children, as this would risk further harm or loss.

“I had to make the decision how I would have affected my other daughter, and how it would have affected my relationship with my husband. And I have to look at well if it did end up breaking my relationship with my husband then it’s broken up the family for my other daughter as well.”

Ending a Pregnancy 8

In these cases, the traumatic pregnancy reshaped the family’s identity and composition. The need to balance the desire for more children against the risk of loss or trauma pushed participants to change their plans entirely.

“After I had him, I was like oh I could do it again. Just like everything that had happened, but my husband’s just like absolutely not, he said, “You know I’ve thought I’ve watched you die twice. I’m not doing it again. We’re not. I can’t go through that. You can’t put me through it again.” And I only ever wanted two children anyway. I quite want a third but [laughs] he doesn’t, and you know, in a way I think it’s not fair to put him through that.”

Near Miss 18

5.4.3.5 *Social context*

The social context in which decisions took place did not come through as a strong driver of decisions directly; however, it strongly shaped participants’ *experiences* and *sense-making* of those decisions.

Language used by healthcare professionals was frequently raised as a reason participants felt they had had a good or bad experience. This was particularly common in cases of pregnancy loss, where the structure of the healthcare system sometimes dictated that participants experiencing loss were treated in a way that was discordant with their own

feelings about that loss. In the case of losses, including terminations, happening close to the point of fetal viability, this could result in a lack of empathy that added to an already traumatic experience.

“I know that the word 'miscarriage' is the word that is used for any babies born before 24 weeks. However, as I have said, it really doesn't give the parents the right preparation for what's going to happen. And I think it also minimises their loss. Which again, is not helpful. And just because a baby's born before they're viable doesn't mean that their life doesn't count.”

Late Miscarriage 17

“[I had a] very nice support nurse, who was very kind and considerate, but I felt he was very perhaps embarrassed or very unsure of himself. He, he didn't have any compassion for what we were about to go through at all. And he kept refer, referring to my baby as 'a fetus', which, I realised she was 21 weeks, but at-, she was my baby and I was giving birth to her. And I found that really upsetting and offensive.”

Ending a pregnancy 23

A common experience participants described was a feeling of isolation after a difficult conception, pregnancy, labour or pregnancy loss. People reported that their friends and family often did not know what to say, and reacted to the story of what the participant had been through in ways that were unhelpful, such as overly positive or negative, or that made assumptions about what should or could have been done.

“I find it hard when people used to say to me, 'oh I'm sorry, you know, to tell you I'm pregnant. I understand how you must be feeling.' I used to think, how could you ... Unless it happens to you, you don't know.”

Infertility 21

“And from my own point of view, I didn’t tell many people, I only told a few close friends that I was having the amniocentesis. Their reaction was, “Oh everything’s going to be fine.” And it’s sort of swept under the carpet, the fact that you were worried. You’ve had this test and you are worried and you don’t want people just to say, “Oh no, you’ll be fine and everything will be okay.” You want to be able to talk about, talk about it more in depth.”

Ending a Pregnancy 8

Participants who had experienced pregnancy loss also described their friends and family not mentioning it, which contributed to a feeling of isolation.

“Because after a couple of months, people thought I was fine, because I didn’t speak about it. But if I had have been speaking about it, then maybe - you know - I would have worked through the issues a bit, a bit more quickly. And then people don’t want to talk about it because they think it’ll upset you. Not knowing that that’s all you’re actually thinking about.”

Late Miscarriage 8

The stigma around termination can also contribute to isolation and augment feelings of guilt.

“We said to them [healthcare professionals], you know, “Our families would never agree to it; they would rather [son’s name] be delivered and he pass away there, than for the pregnancy to have been terminated,” because we’ve got quite traditional families and they don’t believe in that kind of thing or...and whatever was meant to be should have just been and I don’t think they would have been able to deal with the fact that ... the pregnancy was terminated.”

5.4.3.6 *Morality*

Morality here refers to the set of beliefs people shared relating to their personal ethics, moral compass and religious beliefs. These parts of people's identities shaped not only the decisions they made, but how they felt about what they had been through. They reflected the cultural context in which people lived and their social relationships, as well as their internal sense of right and wrong. Beliefs contributed positively to people's experiences by providing a sense of purpose and certainty in their decisions.

"As Christians, we, we said that whatever happened it was our child. And we would deal with whatever happened. So there was no, there was no thought of terminating or nothing like that at all."

Pregnancy 35

"And I like to think that me personally, that everything happened for a reason and for a purpose and that purpose was to be the family that we are now. And that sounds very new-age [laughs], I'm sorry, but that is something that I've always felt, that she had a purpose."

Ending a Pregnancy 8

Religious or spiritual beliefs were not always a source of comfort. As noted earlier, in one case, the pregnancy was terminated in part because of a risk to the life of the mother due to pre-eclampsia. After the termination, the mother described feeling regret for having done something that went against her religious beliefs, and that put her at odds with her family and community. This distress around the decision was expressed despite the advice from her clinicians that the baby would not have survived, and that continuing the pregnancy would quite possibly have been fatal for her as well.

"It's a secret and I struggle with that because nobody really knows the truth apart from me and my husband, and people say to me... because they think [son's name]

passed away naturally – and they think he passed away because he was really unwell and quite religious ... people said, "God didn't want to put you through that heartache of having to have a disabled child, and he's not in pain and God's taken that away," and I'm thinking of it, 'It isn't God, it's me that did that,' and I struggle with that so much.”

Pre-eclampsia 13

Another participant described an alternative effect of terminating a pregnancy, in this case because of a Downs syndrome diagnosis, on her spouse's religious beliefs. Rather than internalising the guilt, he blamed God for the loss.

“My husband was baptised and confirmed at 21 and he thought that was important because he'd been asked to be a godparent and he thought that was a very important thing for him to be. But following what had happened, he became very, “Well, if there is a God then he's not very nice, I don't like God anymore.””

Ending a Pregnancy 8

The feeling of being deserving or undeserving also came across from participants who did not ascribe to a religion. This was particularly described by those who had experienced pregnancy loss, an experience that could conjure a sense of fault – that one's behaviour may have been the reason for the loss.

“In some ways I was relieved to know what the problem had been; that they thought that this was why I had been having miscarriages, that this was why the baby had so many handicaps, that it was nothing that I'd done. There was nothing I could have done any differently so it wasn't my fault because, prior to that, I think I'd just completely messed myself about thinking oh it was that glass of wine, it was eating

that cheese, it was something that I'd done that had caused this and then it turned out to be just me, and the way that my genetic make-up is. And there was nothing I could do about that at all."

Pregnancy 11

Participants reported complex feelings around deserving support or sympathy. Following the path that was recommended clinically, or even that was necessary for the life of the mother, did not negate feelings of guilt or of having failed a social test.

"Because you've made the decision to terminate, maybe at certain points it felt like, 'Well, we don't deserve any sympathy. You've got to just get back to being you again.' Whereas I think if it'd had been a miscarriage or something had have happened spontaneously then I think maybe it would have been slightly different."

Ending a Pregnancy 8

5.5 DISCUSSION

5.5.1 Summary

The results highlight the complexity of decisions that pregnant people and their partners and families face. I have framed this complexity through the concept of lenses of decision-making. A lens is a device that changes one's perception of an object through physical manipulation: it can make an object appear closer or push it farther away; it can strip out or add features; or add colour or highlight certain aspects of the image. Likewise, the lenses conceptualised here take an objective clinical decision point and perceive it differently depending on the features and circumstances of the person making that decision. Like the physical optical device, these decision lenses can overlap. Applying two lenses simultaneously may cause some features to be emphasised, and in other areas they may conflict, causing the image (or decision) to become less clear.

The autonomy lens reflects feelings of personal control and safety. The maternal health and wellbeing lens is closely related, and also emphasises maternal safety and bodily integrity, as well as one's ability to function in the way they prefer, including through being able to work.

The fetal health and wellbeing lens captures the maternal relationship to the fetus, and their value as an individual. The family building lens draws attention to the role a pregnancy has within the parents' family building plans, and the impact it will have on family members: the non-pregnant partner, siblings, and, to a lesser extent, the extended family.

The social lens highlights elements of the decision that affect one's family, friends, colleagues and social interactions, including with healthcare professionals. It highlights concepts like shame or isolation, and the effects that social support have on one's wellbeing.

Linked to this is the moral lens, which emphasises the broader ethical and moral frameworks that guide decision-making. Both the social and moral lenses are intensely personal and socially shaped, and contribute to the perception of decisions as being good or bad, rather than merely clinically recommended.

Some factors that influence decision-making fit neatly into one of these categories – the relationship between siblings, for example, shows up primarily when using the family lens. By contrast, the concept of physical safety crosses health and wellbeing, autonomy, the social lens through clinical relationships, and family through its potential impact on the decision to conceive again.

This framing illustrates that even seemingly straightforward clinical decisions can become fraught depending on the personal circumstances of the pregnant person.

In some cases, the context might not change the decision, but it can greatly affect the distress associated with the outcome. This is particularly seen in adverse clinical

situations, where a sense of isolation can cause significant emotional harm, or where the decision conflicts with a person's moral or religious beliefs.

By applying these non-clinical lenses, we can observe that there is overlap between cases that are often socially seen as very separate, such as those who experience a miscarriage and those who choose to terminate a pregnancy. Terminations for unwanted pregnancies were not included in this analysis, but some participants did report ambiguity upon discovering that they were pregnant. To decide to proceed with an unplanned pregnancy and then later be confronted with the decision to terminate for medical reasons, as one participant was, highlights the difficulty of dividing people into discrete boxes with fixed, preferable outcomes.

In this analysis, pregnancy loss in particular is neither replaced by a subsequent pregnancy, nor is it completely akin to having or losing a living child. Participants reported a tension, or even guilt, surrounding the baby they do not have and the baby they went on to have subsequently, in cases where participants reported that the second was conceived primarily because of the loss of the first. In these cases, the first still held an important place in parents' lives. In this context, the experiences and traumas of a pregnancy loss are not erased by its coming to an end or by the fulfilment of a desired family size.

Participants described that getting to achieve the original vision for one's family was important and fulfilling, but the vision was ultimately flexible. Families could end up with more or fewer children than they had originally planned for. Disability was also something that affected families unexpectedly, for example in the case of one participant whose child was disabled due to prematurity. In some cases, disability was a reason to terminate, but in others it represented survival in the face of unlikely odds, or the chance to have a child at all.

Ultimately, the building of a family is an unpredictable business, and deviations from one's initial plans could be positive or negative. Traumas endured in the course of

pregnancy and birth leave a lasting legacy and can reshape one's preferences entirely. Family sizes may be curtailed by pregnancy and birth trauma – whether physiologically, through an emergency hysterectomy, for example, or socially, through deciding that more pregnancies are unconscionable, either for the pregnant individual or their family.

5.5.2 Vignettes

One way of explaining the contribution of each lens to decision-making is through the use of hypothetical vignettes in which each lens is the only driver of decision-making. In each case, imagine that two individuals are identical in their preferences and characteristics relating to every other lens.

Autonomy: place of birth

Two low-risk individuals make different decisions between home and hospital birth. They have the same risks to their and their baby's health at each location, but one feels safer at home, in familiar surroundings, and one prefers the security of hospital.

Maternal health and wellbeing: mode of delivery

Two low-risk individuals are deciding how to give birth. One opts for elective c-section, due to anxiety regarding the risks to her own health of vaginal delivery. The other opts for vaginal delivery, being anxious about the recovery time after a c-section.

Fetal health and wellbeing: alcohol consumption

Two individuals are deciding whether to consume alcohol at a social occasion. One decides not to, out of concern for the health of the fetus. The other decides to drink, reasoning that the risk is small.

Family building: termination of unexpected pregnancy

Two individuals fall pregnant unexpectedly. Both have one older child. In one case, the individual feels her family is complete and decides to terminate the pregnancy. In the other, the desire is for two children in total, and so they proceed with the pregnancy.

Social context: decision-making after Trisomy 21 diagnosis

The pregnancies of two individuals are diagnosed with Trisomy 21 (Downs syndrome). One has a friend whose child has the diagnosis. She decides to proceed with the pregnancy, with reassurance from her friend. The other does not know anyone with Downs syndrome, and decides to terminate the pregnancy due to anxiety about her ability to care for a disabled child.

Morality: antenatal screening for anomalies

Two individuals receive a high-risk result on their initial antenatal screening. One believes that it is morally wrong to risk miscarriage by engaging in further diagnostic testing (CVS or amniocentesis). The other does not, and decides to have the additional testing.

In each vignette, it is possible for the decision to be made differently if the other lenses differed between each individual. But if the two individuals were identical in terms of the other five lenses, then their different preferences with respect to the lens in question are sufficient for them to make different choices. This illustrates the unique contribution of each lens to decision-making.

5.5.3 Reflexivity

The aim of this study was to understand pregnant people's preferences for different outcomes and experiences, with a view to contributing to the health economic understanding of pregnancy.

I approached this analysis as a health economist. Consequently, the development of the codes and themes into lenses reflected my own knowledge and experience of the literature, as well as the data presented here. There are a near-infinite number of concerns and considerations that go into each person's individual decision-making, which they may or may not articulate in an interview account, and there are many circumstances not represented in this data set.

As the themes developed during the analysis, I was aware of my ultimate goal, which is an improved health economic understanding of pregnancy. I was informed by my understanding of how health is measured in CUA, as well as my understanding of methods for evaluating wellbeing and utility. This framing led to the decision to anchor the analysis around what matters to pregnant people when making decisions about health and healthcare in pregnancy. This was done to ensure coherence between the qualitative themes and the established principles of economic evaluation. The final lenses reflect my interpretation and presentation of the codes and themes accordingly.

This context shaped which codes and sub-themes were developed into their own lens, and which were subsumed. For example, fear and anxiety are common drivers of decision-making, and variants on them were coded many times. In the process of developing the themes, though, they were common across all the lenses, and did not exist as an independent driver of decision-making. Fear, for example, could be expressed within all the lenses: fear of losing the baby, or one's own health, or not becoming a mother, or of behaving immorally, and so on. The lenses are therefore more specific to pregnancy, and more fundamental human emotions are captured within them and span across them, rather than being categorised separately.

Additionally, over the course of conducting this analysis, I experienced some of the issues raised in my personal life, including infertility, pregnancy and miscarriage. These experiences will have shaped how I viewed the analysis. I discussed these experiences with my supervisor throughout the analysis and considered how and when they were affecting my approach, in order to minimise risk of bias.

5.5.4 Context

The broad sociological literature that already exists in pregnancy tends to focus on either processes and experiences of healthcare, or people's experiences with a particular diagnosis. These studies aim to understand a particular experience deeply from a

sociological or ethical perspective, with a view to shaping either clinical research or policy priorities (116).

By comparison, qualitative health economics is a relatively nascent field. Various uses and approaches within health economics have been proposed and explored (228–230).

Qualitative studies are commonly conducted in service of stated preference studies such as discrete choice experiments (208), although there is a push towards its use more broadly within economic evaluation (122). There are also qualitative studies that examine the process by which economic evaluations are used in resource allocation decisions, in which the policy makers and health economists are the subject of study, rather than the investigators (231,232).

The secondary analysis presented here has deliberately been kept very broad in scope, to allow the space for the complex ethical challenges of pregnancy to be explored with minimal constraint. This approach has common ground with conceptual mapping exercises used in qualitative health economics, in which a critical interpretive synthesis is conducted to identify and conceptualise the range of experiences that matter to patients during engagement with healthcare services (233,234).

I have identified one secondary analysis of experiences in pregnancy conducted for the purpose of health economic evaluation (200). This analysis was of women's experiences and preferences surrounding NIPT. That study was conducted in Canada and aimed to analyse women's experiences using the theory of capabilities (197), which has been posited as an alternative to utility theory for cost-effectiveness analysis (124,199). Because the study conducted its analysis more deductively, based on a pre-specified list of relevant capabilities, the findings are somewhat different to the ones outlined in this chapter.

Areas of overlap include: control over one's one body and one's environment; concern for the baby; bodily health and integrity; and caretaking of other children and the wider family. Being narrower in clinical scope, the NIPT study did not cover other aspects of pregnancy, such as balancing maternal and fetal wellbeing in the case of maternal

morbidity. Some findings from my analysis also did not feature, such as social experiences and isolation, the notion of building a family, or the role of personal morals. This study affirmed the challenge I aim to address of reconciling decision-making in pregnancy with standard health economic methods.

Another relevant study is the VALENTIA study of antenatal screening, which combined qualitative and quantitative approaches to review relevant outcomes used in economic evaluation of antenatal screening (235). A deeper discussion of this study is presented in Chapter 7 (7.3.2.1).

5.5.5 Contribution to the thesis

The findings from this analysis substantially shaped the ultimate direction of the thesis. The process of engaging in qualitative research required me to critically evaluate the intellectual biases and assumptions that I had internalised during my training and career as a health economist. Coming from a quantitative background, I had existing ideas around what an appropriate result of the analysis would look like. These tended towards black-and-white thinking around the inclusion and exclusion of outcomes, and is evidenced in the structure of my systematic review (Chapter 3) and an early publication (44). The process of engaging with qualitative analysis forced me to confront the limitations of the approach I had envisaged, and led me to take a broader interpretation of what might be considered relevant to the analysis.

In particular, the inclusion of non-health outcomes such as autonomy and morality became essential to the overall conceptualisation of decision-making in pregnancy. Taken together, the lenses provide an overarching concept of pregnancy, outlining the many complex considerations that feed into individual's preferences and perception of an outcome as positive or negative.

In later chapters, these lenses are contextualised within health economic theory and practice, and developed into a framework to guide both scoping of economic evaluations and to highlight areas of future research. This framework development is a necessary

interim step before more quantitative methodological development can take place, given the complexity of interaction between health and non-health lenses.

5.5.6 Strengths and limitations

This analysis is novel in that it contributes to the health economic understanding of what is important in pregnancy. It identifies how values, beliefs and concerns map across a range of experiences of pregnancy. By making use of a wide range of existing datasets, it incorporates a diverse range of experiences, likely more than would be possible through primary data collection. The analysis contributes to a growing qualitative literature within health economics around the conceptualisation of health and patient experiences.

This analysis had a number of limitations. Secondary analysis is limited by its nature to participants that were recruited for original studies. Although I had a large number of participants to sample from, and therefore could sample for a diversity of experiences and characteristics, there are cases and situations that were not in the datasets and therefore could not be included. Similarly, the interviews used were collected over many years; in some cases, clinical practice and even prevalent social norms have changed, and so the findings may not represent the current experiences of pregnant and birthing people.

An additional limitation is that the analysis is restricted to what participants discussed in the context of the original interview. Compared to a primary data collection study, where there would have been opportunity to ask follow up questions of participants, this is a limitation of secondary analysis.

5.5.7 Conclusion

This chapter used qualitative research methods to identify what matters to pregnant people when making decisions about their health and healthcare. The themes identified were refined into a set of lenses that can be used to deconstruct decisions into six concepts that drive decision-making. In the next chapter, the lenses will be placed into the context

of existing health economic principles to analyse their applicability within economic evaluation.

6 CONTEXTUALISING THE OUTCOME LENSES WITHIN ECONOMIC EVALUATION

6.1 INTRODUCTION

Chapter 5 identified a range of influences on and determinants of decision-making in pregnancy. I introduced the concept of lenses: broad concepts that shape how people view the decisions they face. The value of the lenses is that they allow decisions and preferences to be deconstructed into their component parts. These lenses have been developed drawing on people's descriptions of their own circumstances and feelings around decisions in pregnancy.

As outlined in earlier chapters, outcomes in pregnancy do not easily fit within existing frameworks of outcome measurement and valuation in economic evaluation. The inclusion of both maternal and fetal outcomes in analysis is a particular challenge, especially where interventions that may be positive for one member of the maternal-fetal dyad may negatively affect outcomes for the other. There is also the question of how to value fetal outcomes while safeguarding maternal autonomy.

As illustrated in Chapter 5, there are also outcomes and considerations applicable in pregnancy that are not captured by existing health-related outcome measures, but that are relevant to pregnant people's decision-making. These include: maternal autonomy; the social context of pregnancy; the importance of an individual's moral and religious beliefs to certain decisions; and the interaction between a pregnancy and the wider family unit.

The qualitative analysis illustrated that pregnant people face decisions in pregnancy that do not fit into a QALY-maximisation framework. Examples of these seen in the qualitative interviews include: ambiguity around whether to keep or terminate a pregnancy; how to time the space between pregnancies; and where and how to give birth. There are also

outcomes that may be partially captured by the QALY, but that nonetheless raise issues with measurement or valuation, such as the effects of birth trauma on maternal mental health.

6.1.1 Aim

The aim of this chapter is to contextualise the lenses in terms of existing economic evaluation approaches and methodology. In order to move from a more exploratory qualitative analysis into a specific set of tools that can guide economic evaluation, it is necessary to interrogate the potential compatibility between the lenses and existing economic evaluation frameworks.

6.2 CONTEXTUAL ANALYSIS

For each lens, I have outlined below the core concepts that define it (Table 6.1). I have then compared those concepts to existing CUA and economic evaluation approaches. Finally, I have summarised potential methods by which the lens could be incorporated into CUA.

Lens	Definition
Autonomy	Having a sense of control, safety, and bodily integrity during pregnancy, labour and birth.
Maternal health and wellbeing	Mental and physical health, quality of life, and capacity to live the life you want.
Fetal health and wellbeing	The mental and physical health of this baby throughout its life. The health of the unique individual who will result from this pregnancy.
Family building	The role of the pregnancy within the family. The wellbeing of the spouse, siblings, and wider family.
Social	How the pregnancy affects the social interactions of the pregnant person, including with healthcare professionals. The positive and negative social interactions resulting from the pregnancy, including mutual support, community, judgement, stigma and isolation.
Moral	The personal moral and religious beliefs of the pregnant person. Being able to make choices and act in accordance with those beliefs.

Table VI. *Definitions of the lenses*

6.2.1 Autonomy

6.2.1.1 Core concepts

The autonomy lens captured a general sense of feeling safe, in control, and with a sense of self. Pregnancy as a concept is laden with social and cultural expectations. People want to transition to motherhood or parenthood in a way that is in accordance with their identity and preferences. This process is known as matrescence, and encompasses the physiological, psychological and cultural transformation that happens during pregnancy and birth (236,237). They make choices about the kind of pregnancy and birth they want to have accordingly. We see this in interviews with participants talking about their birth preferences. When these choices are taken away, or the medical situation necessitates a change in the birth plan, this can be distressing. Some participants were willing to take substantial health risks in order to facilitate the kind of birth experience that they chose.

Pregnancy is a time of change, both in physical and emotional terms. Most commonly, pregnancy is associated with becoming a mother, but it can also indicate other changes in identity, such as becoming a parent to additional children, or being a surrogate for someone else.

In this landscape of change, one's sense of self can be disrupted. Participants reported a sense of alienation from their changing body, and this was amplified in cases where they experienced invasive medical care or complications.

Autonomy also referred to a sense of feeling safe. Whether an experience was viewed positively or negatively sometimes depended on how safe the person described feeling in the moment – rather than their role in making a decision or not. Feelings of safety were facilitated by good communication and being respected. As the interviews reflected, sometimes people just wanted to know that they were in good hands, and therefore could relax or focus on other considerations beyond a responsibility for decisions.

6.2.1.2 Relevance to economic evaluation

The most relevant analogue to autonomy within the medical framework is probably the concept of informed consent. Patients have a right to refuse treatment, and are entitled to be fully informed of the risks and benefits of an intervention before agreeing to it.

However, this only covers a small portion of the concept of autonomy identified here.

The concept of autonomy identified here illustrates a paradox that is encountered in the medical model of pregnancy: why would a patient choose a less safe option?

Here we see that pregnancy is much broader than a health condition. It represents a time of transition, and a reshaping of one's identity. Pregnant people grapple with this shift in a variety of ways, but one way is through the way they perform their pregnancy, including the choices they make about the kind of birth they plan. Disruptions to this plan are therefore distressing, and people can be willing to make significant health trade-offs to facilitate their preferences.

We also see the need for a sense of safety and control during pregnancy and birth. A sense of loss of control is associated with birth trauma (92), and so removing control from a patient, even in the interests of safety, may conversely result in a poor maternal outcome.

6.2.1.3 Including this lens in economic evaluation

This lens affects both the context in which decisions are taken, and in the potential results of the decision itself.

Preserving a patient's autonomy and sense of control may affect the framing of a decision problem. Consider, for example, a local decision maker that is deciding whether to fund midwives to provide home births. If home birth carries a greater risk to maternal and fetal health outcomes, then it may not be cost-effective relative to other birthplace settings.

However, the ability for patients to choose their place of birth may be essential to maintaining their autonomy and sense of control, and is encouraged within the NHS as a key decision to make during pregnancy (238). An example of CEA of birthplace settings is discussed in Chapter 7 (239).

Denying these choices and freedoms within the health system may lead to risky behaviours such as free birthing, where pregnant people give birth without medical supervision of any kind (240). Incorporating adverse outcomes such as these may be one way of quantifying the value of this freedom. Measuring the mental health harm of birth trauma may provide a way to account for loss of autonomy in economic evaluations of pregnancy experiences.

Finally, autonomy captures the desire people have for reproductive autonomy. This raises a broader question for decision makers: what is the purpose of the health system? In pregnancy, it may be to facilitate reproductive autonomy as well as to maximise health.

Autonomy is not measured within many common preference-based measures of HRQoL. It is not included as a domain in the EQ-5D (31), HUI3 (241) and SF-6D (242). These measures are based on HRQoL, and so the domains are limited to physical and mental

health effects. By contrast, autonomy is included as an attribute in the capability-based ICECAP measures, expressed either as being independent (243), having choices (244), or control (199).

Capturing autonomy within an evaluation in pregnancy and birth may be challenging. Outcome measures usually reflect health states, rather than experiences. For example, the ICECAP measures ask about a person's capacity to make choices for themselves, or to live independently. The loss of autonomy in pregnancy and especially during birth is less about their permanent health state and more about their sense of autonomy and safety during the process of pregnancy, labour and birth. In this case, birth experience measures may be more valuable in capturing autonomy quantitatively (245), but these measures are not compatible with economic evaluation.

Additionally, autonomy may need to be considered earlier in the analysis and decision-making process. To facilitate autonomy, it may be necessary to frame the analysis such that autonomy, and, in particular, the right to make decisions about care, is enshrined throughout, even where there are impacts to cost-effectiveness.

6.2.2 Maternal health and wellbeing

6.2.2.1 Core concepts

This lens refers primarily to maternal health outcomes, although non-health outcomes, such as being able to work, also feature.

Physical health is acutely affected by pregnancy. This was most strongly described in relation to labour and birth, but it begins in early pregnancy and continues post-partum. Pregnancy can also be a disabling event, either temporarily or permanently, and this can be a jarring experience for a population that is often young and healthy.

There are also mental health effects. Perinatal depression and anxiety is common, affecting around 1 in 4 pregnant and post-pregnant people globally (246). Pregnant people are a vulnerable population, and this can have a negative effect on mental health. Labour

and birth can also be traumatic experiences. While most births are relatively smooth, labour and birth can become dangerous very quickly. Any kind of emergency health event can be traumatic, and this includes pregnancy and childbirth.

Maternal wellbeing was also discussed in terms of ability to work. Those who had a difficult experience in pregnancy, or experienced pregnancy loss, often struggled to work. Many wanted to, but found that an unsupportive work environment became too much of a barrier.

6.2.2.2 Relevance to economic evaluation

The physical health effects of pregnancy fit relatively comfortably within CUA. Pregnancy causes symptoms and health effects that are captured by preference-based measures such as the EQ-5D – pain; usual activities; mobility; self-care; and anxiety and depression, which captures some of the mental health effects harms associated with pregnancy and birth (31).

However, quality of life studies in pregnancy are relatively uncommon compared to other health conditions. This may be because pregnancy is often seen as a temporary condition and therefore not measured in terms of its effects on HRQoL, even though these can be long-lasting and endure beyond the pregnancy itself. A small number of patient-reported outcome measures have been developed (247), but to my knowledge no preference-based measures exist specifically for pregnancy. A number of studies have measured HRQoL in pregnancy and postnatally, using the EQ-5D or SF-6D (248–255).

The systematic review (Chapter 3) identified that maternal health outcomes are often excluded from CUAs in pregnancy (46%), and, where they are included, HRQoL effects are generally tied to specific long-term conditions, rather than capturing reduced HRQoL during the period of pregnancy itself. The maternal mental health effects of pregnancy or birth are rarely captured in CUAs.

This lack of measurement may result from a number of factors. Pregnancy occupies a unique status culturally; treated within the health system but not regarded in itself as a health condition. In this way the maternal health and wellbeing lens intersects with the autonomy and morality lenses in considering the normative question what makes a “good” pregnancy and birth experience. By not presenting pregnancy symptoms as a health decrement, but instead a normal life experience, health economists might avoid riding roughshod over these other values in the interest of maximising QALYs. The risk to this approach is that pregnant patients suffer unnecessarily due to a desire to avoid overtreatment.

This lens also captures certain economic metrics of wellbeing, notably the ability and desire to work. Complications from pregnancy, as well as loss of pregnancy, can impede a pregnant person’s ability to return to work. This outcome would not ordinarily be captured in a CUA conducted from a healthcare perspective, but would be relevant to evaluations conducted from a societal perspective, albeit on the cost side. The ability to work might also be a relevant non-health outcome relating to people’s overall wellbeing.

6.2.2.3 Including this lens in economic evaluation

Incorporating the maternal health lens as an outcome in CUA is theoretically relatively straightforward. It is possible to measure HRQoL during and subsequent to pregnancy, although capturing the full range of outcomes, notably the mental health effects of negative pregnancy and birth experiences, may be challenging, in keeping with difficulties associated with capturing mental health outcomes within preference-based measures of HRQoL more broadly. While anxiety and depression are captured within instruments such as the EQ-5D, outcomes such as psychosis are poorly captured (256).

The tension between measuring and validating harms from pregnancy, and the cultural narrative of pregnancy as an ordinary phase of life may present a challenge to measuring HRQoL. That pregnancy is a culturally unique experience does not negate the tangible difficulties and harms of its lived reality in some cases. Undervaluing negative health

effects in pregnancy risks underinvestment in healthcare resources that could meaningfully improve pregnant people's HRQoL. On the other hand, the medicalisation of pregnancy and birth have brought their own harms, both in terms of loss of autonomy (1.4.2.2) and excess intervention (257). Balancing the benefits of intervention against the less tangible harms of overmedicalisation requires care.

6.2.3 Fetal health and wellbeing

6.2.3.1 Core concepts

The fetal wellbeing lens captures the pregnant person's concerns for the wellbeing and quality of life of the fetus.

The first caveat is that this lens refers to situations in which the pregnant person intends to proceed with the pregnancy, rather than terminating for personal reasons unrelated to the health of the pregnancy. It should be noted, however, that concepts of "wantedness" or "planned-ness" are not always useful in describing a person's attitude to a particular pregnancy (258). Within the dataset used in Chapter 5, there were unplanned pregnancies and participants who experienced initial ambivalence towards their pregnancy. The fetal wellbeing lens captures people's concern for the wellbeing of the fetus and proto-child.

The fetal wellbeing theme identified that people's attitude to the fetus, and their personification of it, evolves over time. This evolution is complex, but many participants expressed a sense of hierarchy, where the relationship to the fetus was perceived to be stronger as the pregnancy progressed, and therefore loss or bad news at later stages was perceived to be more harmful. There is wide individual variation in this, as emotional attachment is deeply personal, but the analysis supported this as a general trend. This is also supported by prior literature, which identified the concept of a pregnancy becoming more real over time (259).

Concern for fetal wellbeing was influenced by the wider context of the pregnancy. Prior pregnancy experience (for example, infertility or miscarriage) and the pregnant person's

age, disability, and cultural and religious beliefs all shaped the individual's attitude to their pregnancy and perceived relationship with the fetus.

Concern for fetal wellbeing and the quality of life of the future child was prominent in the analysis. Pregnant people and their partners who are confronted with the possibility of a diagnosis that might affect their child's quality and/or length of life described thinking deeply about what constituted reasonable levels of suffering, what it might mean to live a "normal" life. In the qualitative analysis, participants who terminated a pregnancy for medical reasons did so because they believed it to be in their child's best interests, either because the diagnosis is sufficiently harmful to render life not worth living, in their opinion/expectation, or because they do not feel equipped to provide the care necessary to ensure a good life for the child. Even though it is the pregnant person who makes the decision to end the pregnancy, the grief of that loss can be substantial. Termination may be the optimal choice for this pregnancy, but this does not negate the experience of loss (260). There is also distress associated with receiving a negative diagnosis, regardless of the decision taken (261). Likewise, pregnancy loss through miscarriage and stillbirth can result in grief for the pregnant person and wider family.

The decisions made pertaining to fetal wellbeing suggest that it does differ from how a parent would respond to a living child. The very option of termination for medical reasons, based on a perception of HRQoL and ability to provide care, implies that the fetus is perceived differently not only by the health system, but also by the pregnant person.

Finally, the fetal wellbeing lens captures the concept of value intrinsic to the person that the fetus has the potential to become. This could also be thought of as the societal value of the fetus as an individual. This was not captured in the qualitative research, which focussed on the pregnant person's relationship to the fetus. In the studies identified in the systematic review (Chapter 3), studies that included fetal QALYs in their analysis were acknowledging and valuing the personhood of that fetus. They were quantifying the

wellbeing of that person, in their own right, rather than as an appendage of the pregnant person. Above, I have outlined the fetal wellbeing lens through the eyes of the parents, but this is also the lens that captures, where relevant, the personhood of the fetus themselves.

6.2.3.2 Relevance to economic evaluation

This lens pertains to a set of outcomes that are commonly included in CUA: fetal health outcomes. The qualitative analysis indicates that these outcomes are important to the pregnant person, and the loss of a fetus during pregnancy, regardless of the medical circumstances, is a source of grief.

However, in the interviews, even pregnant people themselves indicated that there were differences between fetal wellbeing and childhood wellbeing. The potentiality of a fetus changes the risk calculation for decision-making. We can observe this in decisions taken around antenatal screening, where some tests, such as amniocentesis or chorionic villus sampling, carry a risk of miscarriage but provide information on the future quality of life of the proto-child. The relationship that the pregnant person has to the pregnancy changes over time and in response to their circumstances.

However, pregnant people in interviews also described feeling harmed by medical language that dehumanises or diminishes their pregnancy, such as referring to the products of conception, particularly in late miscarriage. The fetus is both an idea but also a physical presence, and the physical presence is valued by the pregnant person in itself.

6.2.3.3 Including this lens in economic evaluation

Together, this supports the idea that fetal health outcomes should be valued within economic evaluation. Even where termination for medical reasons is chosen, the loss of the fetus is real and valid, and the harm of losing a pregnancy is not fully cancelled out by replacement with a subsequent pregnancy.

Nonetheless, fetal wellbeing rests largely on potentiality. Whether the loss should be valued for its own sake, as an individual life, rather than as a spillover effect onto the pregnant person, is an outstanding question.

A solution to this may be in considering whether societal preferences support valuing fetal health outcomes. The health effects of loss on the pregnant person are undeniable, but the wider societal harm of fetal loss is unclear. The economic costs of miscarriage and stillbirth have been estimated (95,262,263), but the broader value placed by the general public on reducing fetal loss, relative to other health outcomes, has not been quantified. Valuations of avoiding fetal loss, through preference elicitation, might provide additional insight into the societal value placed on reducing fetal loss.

Finally, it is necessary to consider how valuing fetal loss can be integrated with supporting reproductive rights. These are not automatically in conflict – as demonstrated by the complexity exhibited here – but they are nuanced, and unintended consequences could be very harmful. This relates again to the important interactions outlined by the lens approach. Society may value fetal loss highly, but reproductive autonomy (captured by the autonomy lens) is an essential right. This stance is reinforced in the Universal Declaration of Human Rights, among other international legal documents, which grant human rights explicitly from the point of birth, and have been summarised as “no one has the right to subordinate another in the way that unwanted pregnancy subordinates a woman by requiring her to risk her own health and life to save her own child” (83). Health economists must be careful to avoid unintended outcomes that undermine this autonomy.

6.2.4 Family building

6.2.4.1 Core concepts

Colloquially, people often describe choosing to conceive a child as “growing their family”. This framing illustrates a fundamental point, which is that pregnancy is, for most people, a necessary precursor to their goal of having a family comprising a desired number of

children. A pregnancy that ends without the birth of a living child therefore represents a lost opportunity to achieve this aim. The family building lenses captures this component of people's preferences.

When viewed purely through this lens, pregnancies are more interchangeable than is presented in the fetal health and wellbeing lens. Participants whose pregnancy ended generally reported a desire to conceive again, in order to build the family they wanted.

While a pregnancy may not be replaceable when viewed through the lens of fetal wellbeing, the family lens is instead concerned not with the individual pregnancy, but with fulfilling the desired picture of a future family. This could result in tension, where interviewed individuals described mourning their miscarried child, for example, but also acknowledging that if that child had lived, their subsequent living child would not have been conceived.

This extends beyond pregnancy loss and into decisions around termination for medical reasons. Terminations for medical reasons may be due to a condition that is incompatible with life, such as acrania, but it can also be due to conditions where survival is possible but with a lifelong disability, such as Trisomy 21 (264). In these cases, desire for a particular kind of family shapes people's choices around termination. Many parents opt to terminate a pregnancy that has been diagnosed with one prenatally. A parent's personal threshold for their capacity to care for a child with a disability can vary from person to person. It can be shaped both by preferences for a particular type of family, but also by concern for the wellbeing of the family as a whole, including that of other children or the spousal relationship. These factors feature whether the parents choose to continue the pregnancy or to terminate. In the case of parents who continue the pregnancy, this diagnostic information can enable them to prepare for the higher needs of a disabled infant.

Finally, this lens also accounts for loss of reproductive capacity⁴. This loss can result from a physical health loss, such as an emergency hysterectomy during labour, or from a mental health loss borne of a traumatic experience in pregnancy that renders someone unwilling to undergo another pregnancy. In these cases, maternal wellbeing is in tension with family building preferences.

6.2.4.2 Relevance to economic evaluation

This lens is explicitly concerned with a non-health outcome. While parenting and family size have a complex relationship to wellbeing, and this may include a relationship to health (for example, parents may hope that by raising children, they will have someone to care for them in old age), it is not a health outcome in a way that would be recognised within standard health outcome measures.

The inability to meet one's desire to have a family may result in mental health harm. This again raises the question of whether the mental health harm can be fully captured with existing preference-based measures. More broadly, and perhaps more pertinently, there is a question surrounding whether fertility (the ability to reproduce, which includes the ability to carry a pregnancy to term) is the concern of the health system.

6.2.4.3 Including this lens in economic evaluation

Family building is concerned with the size and composition of one's family, and is a strong driver of decision-making in pregnancy. In many ways, it is the foundational lens since it captures the decision to reproduce in the first place.

Taking a view strictly reflecting only HRQOL, if the family lens did not exist then the motivation for becoming or staying pregnant, in spite of its associated maternal health decrements, would be negative.

⁴ Or gain, in cases where the underlying cause of pregnancy loss can be treated, such as antiphospholipid syndrome (71)

The family lens also reflects the existing composition of the family and the impact of a new baby on the wellbeing of existing members. In this situation, there can be a tension between the fetal wellbeing lens and the family building lens. Two people with the same fetal diagnosis and the same perception of fetal quality of life can make different decisions, based on factors such as the impact on siblings or existing disability within the family.

Family building could be considered to be an outcome, or possibly a capability: whether one has the capability to obtain the family composition they prefer. There are nuances – family preferences can evolve over time and in response to diagnoses and experiences.

However, family building is a non-health outcome and, as with the fetal wellbeing lens, the question remains of how much the health system is willing to pay for new life. This topic is much-discussed when related to fertility interventions, and this literature is discussed in Chapter 7 (7.5.1).

6.2.5 Social context

6.2.5.1 Core concepts

The social context lens captures how the pregnant person's social interactions affect and are affected by the pregnancy. This includes effects on their interactions and relationships with friends, family and healthcare professionals.

Pregnancy is a social and cultural experience as much as a health one. This is illuminated in the previous chapter through the frequent discussion of the social effects of a negative pregnancy experience. Isolation was frequently described as a consequence of a negative pregnancy experience, whether that be a miscarriage, termination, fetal diagnosis, traumatic birth or other experience.

Pregnant and postnatal people described in the interviews feeling unable to talk about their experiences with friends and family, and, when they did, they often did not receive

support or feedback that met their needs. Unmet social needs surrounding grief and trauma left people feeling alone, dismissed, and unable to move on.

This extends to interactions with healthcare professionals. If healthcare professionals use language that does not match the emotional experience of the patient, it can further entrench animosity and augment their existing grief. By contrast, an empathetic interaction with a healthcare professional can mitigate against worsening an already difficult experience.

The social context did not come across as a strong driver of decision-making in and of itself, but it does shape how people feel about their experiences. This reflective impact could augment the effects captured in other lenses, such as maternal wellbeing.

6.2.5.2 Relevance to economic evaluation

How the social context affects economic evaluation is complex. Economic evaluation typically relies on societal preferences to value health outcomes, with health states valued using preferences from the general public. Therefore preferences for a particular set of outcomes are determined in part by the social understanding of these outcomes. There is a tension in this, where the ex-ante perception of a condition can differ from its lived experience, either for better or worse (265). Reasons for this include a poor understanding of the condition by the general public, or conditions where patients report high levels of adaptation to their new health state (20,266,267). Negative experiences in pregnancy may also fit this pattern, given the reported feelings of isolation described by participants experiencing these phenomena in the qualitative analysis, but quantitative evidence is lacking.

The predominant finding of this lens was the common experience of isolation among those experiencing a negative pregnancy outcome. This lens therefore highlights some of the reasons particular outcomes may be overlooked or undervalued in economic evaluation. A societal underappreciation of the severity of an outcome will contribute both

to isolation of the person experiencing it, and undervaluation of that outcome in health valuation and medical decision-making.

6.2.5.3 Including this lens in economic evaluation

This lens serves to highlight some of the issues that may be overlooked during the process of scoping a decision problem and the relevant possible outcomes. A major challenge of CUA in pregnancy is accounting for the social and cultural components of pregnancy, which are not typically considered relevant to economic evaluation and resource allocation. In pregnancy, however, they are key drivers of patient preferences and outcomes.

Social context and social support have been recognised in capability-based approaches to health valuation (124). In the ICECAP-A measure, this is described in terms of attachment (243).

6.2.6 Morality

6.2.6.1 Core concepts

Morality, belief systems and concepts of right and wrong are closely associated with many of the decisions taken in pregnancy. Pregnancy raises ethical questions around bodily autonomy, but also moral and spiritual questions around when life begins, and under what circumstances it is acceptable to end a pregnancy. These are not just questions for philosophers, or even doctors. They are considered and grappled with by almost every individual.

People making decisions in pregnancy are inevitably guided by their moral compass. Participants described a variety of beliefs, and how those beliefs shaped their decisions. One's sense of right and wrong can influence both the decision one takes, and how one feels about that decision. Guilt and regret are profound emotions that can result when one does not feel one's actions matched up to their beliefs and principles.

6.2.6.2 *Relevance to economic evaluation*

Many areas of healthcare present ethical challenges, but these are rarely of direct relevance in economic evaluation. Ethically thorny decisions are made at the level of the regulator or the doctor, in terms of which treatments will be made available to patients. The patient then has the right to refuse any treatment, even when it is the most effective or cost-effective option.

CUA requires us to define the possible outcomes of an intervention. Within this modelling is an assumption that each possible health state associated with an outcome can be assigned a utility, representing a best estimate of the underlying HRQoL associated with that outcome. A range of values may be used to represent uncertainty, but the statistical assumption is that there is a true value that can be approximated, and that applies across patients with enough consistency that we can be confident our decision is correct. Where patients are heterogeneous in the effectiveness of an intervention, this could cause a decision to be inefficient, if an intervention is cost-effective for one subgroup of patients but not another (268). We also assume that patients will value health outcomes broadly similarly, such that a given health state is associated with a higher HRQOL than an alternative health state at the population level, although studies have shown that preferences are heterogeneous (269,270).

Both of these assumptions break down for some areas of pregnancy. For example, there are patients for whom carrying a pregnancy to term is the worst possible outcome, and patients for whom it is the best. This divergence can apply regardless of the health status of either the pregnant person or the fetus. While this is an extreme example, versions of it exist in other parts of antenatal care, such as birthplace choices.

Capturing the effects of this heterogeneity is complex. Capturing heterogeneity in patient outcomes in economic evaluation is an area of ongoing research. Estimates of effectiveness can be made more uncertain at the subgroup level due to smaller sample sizes and greater uncertainty (271). There are also cases where subgroups are themselves

unobservable, such as in the case of personalised medicine (272). Methods in development in these areas may have value in pregnancy, particularly for morality, where the influence of a patient's set of beliefs on their preferences is unlikely to be recorded in clinical studies.

6.2.6.3 Including this lens in economic evaluation

Considering the moral lens in economic evaluation requires addressing the two key points outlined above: heterogeneity of personal belief, and ensuring resource allocation decisions taken are ethical with respect to those beliefs. For the former, consideration may need to be given to the composition of the patient population being sampled for health outcome measurement and valuation, reflecting the heterogeneity of individual beliefs. For the latter, explicit discussion of the relevant moral and ethical concerns relating to a particular decision problem is needed throughout the process of economic evaluation and resource allocation. This discussion could shape the scope of the evaluation, such as through the selection of relevant comparators, and any subgroup analysis necessary to capture the impact of patient beliefs on cost-effectiveness.

6.3 OUTCOMES VERSUS RIGHTS

The lenses outlined above fall into two broad categories. The first set are lenses that can be plausibly quantified. These include maternal wellbeing, fetal wellbeing and family building. There may be issues with resolving conflict between these various kinds of outcome, but it is relatively straightforward to quantify the outcomes associated with each lens. Maternal and fetal wellbeing are both at least somewhat compatible with existing CUA, and family building relates to an outcome that is quantifiable relative to some ideal standard. That is, although outcome measures relating to achieving a desired family size and structure do not currently exist, developing them would not fundamentally challenge concepts of outcome measurement.

The other category are lenses that relate to individual rights and freedoms. These lenses (autonomy, morality, social context) pertain to non-health outcomes, and more than this, they capture experiences and concepts that are harder to quantify (such as isolation or stigma) or even that are not inherently quantifiable.

To take one lens: autonomy. It might be possible to quantify the harms that come from a loss of autonomy in childbirth or pregnancy: the lifelong effects of birth trauma on physical and mental health, for example. But in fact, quantifying that harm would be challenging, and there remains the possibility that we might find that the quantified and measured harms are insufficient to render granting autonomy as the optimal choice. In fact, the mere fact that autonomy is routinely violated in maternity services indicates that clinicians regularly consider the benefits of autonomy to be insufficient when weighed against the goals of their care (60).

In fact, autonomy is less a component of healthcare than a prerequisite for it. The need for informed consent is the backbone of medical ethics. One cannot be compelled to undergo treatment, however urgent or life-saving, if one has the capacity to refuse it and does so. This also applies in maternity services, and applies even when the fetus's life is the one at risk. In both British and international law, fetal rights begin at the moment of birth, and not before (273). Pregnant people and those in labour have the right to refuse any intervention done to them, whether for their own benefit or for the fetus.

It would therefore be inappropriate to simply come up with a value for the harms of loss of autonomy and add it to an existing cost-effectiveness calculation. Even if intervention is drastically more cost-effective than not, the right to refuse treatment applies. For much of pregnancy, this is irrelevant. The qualitative findings demonstrate that some patients refuse screening or intervention, and that is their right. In those cases, the system is working correctly.

Where things get more complicated is in situations where refusing care might involve a resource allocation decision. Such an example is the choice to give birth at home. In order

to facilitate safe home birth, midwives and medical equipment, and possibly medical transportation, must be made available. However, in the UK, a person in labour cannot be compelled to give birth in a hospital, any more than a person with chest pain can be compelled to attend hospital. Where homebirth is not facilitated by the health system, pregnant people sometimes choose to give birth at home without medical supervision, called a freebirth (274).

It would be simple to frame birthplace choice as a simple cost-effectiveness question: what is the most cost-effective option for low-risk pregnant people to give birth? But the result would not allow for autonomy and informed consent. The result might push everyone in labour to have a home birth, or everyone to be in a midwife-led unit, or in hospital.

Regardless of the result, it would remove autonomy from those in labour.

Instead, it may be necessary to add a framing step to the analysis: pregnant people have the right to choose where they give birth, whether that be within a clinical setting, or at home. Given this, what is the optimal distribution of resources to maximise health outcomes while preserving this autonomy? Through this example we can see that rights-based lenses may need to be applied differently to outcome-based ones.

One methodology where autonomy might be captured is in birth experience measures. A birth experience measure captures patients' perceptions of their care, but does not capture health outcomes (245). Where health outcomes are equal, a birth experience measure provides a justification for funding systems that facilitate feelings of safety and control. In other words, they support autonomy.

However, it is unclear how to integrate birth experiences with health outcomes. It may be that birth experiences evidence contributes to the framing portion of a CEA, to a minimum standard that interventions must reach.

Morality similarly relates to the ability to accept or refuse care according to a fundamental freedom that is not inherently health-related. The impact of moral and religious beliefs on

the politics of pregnancy is profound. This conflict is also seen in personal decision-making, with people's preferences fundamentally shaped by their beliefs. Accounting for morality in economic evaluation is similar to autonomy in its requirement to safeguard individual choice, and would need to be accounted for similarly.

The social context lens is slightly different. There may be aspects that are quantifiable, such as feelings of isolation and lack of support. Capability-based measures often include an item on attachment (199,244) or feeling supported (275), and that could be applicable here. How to capture concepts such as stigma, or the long-term social costs of negative experiences during pregnancy or after pregnancy- or baby-loss, would benefit from further investigation.

6.4 WHICH LENS WHERE?

Not every lens applies equally strongly to every decision. While all the lenses have relevance to most decisions in some form, the qualitative analysis found that some lenses predominated when evaluating a particular situation or decision.

For example, interviews that discussed ending a pregnancy for medical reasons frequently talked about the impact of their baby's diagnosis on the broader family. The effects on siblings, spouse, and the family life they envisioned were discussed. Other lenses that predominated in this decision included morality and fetal wellbeing. By contrast, autonomy featured less heavily, although it was still noted occasionally, for example when an individual expressed concern that their choice could be taken away from them.

Autonomy instead featured extremely prominently in decisions relating to labour and birth. Participants considering their birth choices in a subsequent pregnancy after previous caesarean section discussed their desire for autonomy and control very often. Family building was much less relevant to these decisions. While the safety of the baby was important in these decisions, pregnant people in the interviews assumed that they would have a living baby on the other side of birth.

6.4.1.1 *Quantification versus deliberation*

As outlined above, the rights-based lenses do not easily lend themselves to quantification. They also cover non-health considerations, which makes them controversial to integrate into CUA, even where quantification is possible. This is because adding additional (beneficial) non-health outcomes into an economic evaluation essentially lowers the cost-effectiveness threshold for that intervention, compared with others that do not include those additional outcomes (276).

Therefore, while the rights-based lenses capture essential components of decision-making, it may not be appropriate to capture them within an economic evaluation itself. In the UK, resource allocation decisions involve a deliberation stage. To take the example of NICE, the evidence for each appraisal is reviewed by a committee, who take the ultimate decision (277). This committee consists of clinicians, patient representatives and health economists. While the process for reviewing evidence is highly standardised, the committee has latitude in their deliberations. An example of this was seen in the deliberations presented in Chapter 4 for rhesus disease prophylaxis (**4.3.2**), where the committee ultimately made the decision around an appropriate valuation for late fetal loss. Similarly, it may be that rights-based considerations are more appropriately integrated into deliberations, rather than incorporated into economic evaluation itself.

6.5 CONCLUSION

In this chapter, I have summarised the lenses and explored relevant concepts within economic evaluation for each one. I have grouped the lenses into outcome-based and rights-based. This categorisation is based on whether the lens is associated with a clearly defined, measurable outcome, or whether the concepts it pertains to are less clearly measurable, but that nonetheless form a substantial part of how participants described their decision-making.

This chapter aimed to derive from the themes of Chapter 5, presented as lenses, a concrete set of definitions that can be applied to economic evaluation concepts, and to consider how they could be incorporated into economic evaluation. In the next chapter, I will explain how the lenses could be used to analyse a decision problem with a view to improving the consistency of economic evaluations. I will also outline the uncertainties raised by the lenses, and the research questions posed by these uncertainties.

7 IMPLEMENTING THE FRAMEWORK: APPLICATIONS IN METHODS AND APPLIED RESEARCH

7.1 INTRODUCTION

In previous chapters, I introduced six lenses that were developed using secondary analysis of interviews pertaining to healthcare experiences in pregnancy (Chapter 5). I then outlined these lenses and explained how they relate to methods and concepts used in economic evaluation (Chapter 6).

The lenses were developed following qualitative analysis of the preferences expressed by participants when describing their experiences of making decisions in pregnancy. A wide range of pregnancy decisions were included, both clinical and cultural, and participants came from a variety of backgrounds and experienced a range of medical conditions and events in pregnancy and labour. The themes identified during the analysis were developed into the lenses in order to capture the way in which people balance their priorities. The term “lens” is used to evoke the sense that each one shapes how the decision is viewed, and that they can be combined to give a new perspective on a situation. The lenses are necessarily broad and seek to reflect a wide range of possible preferences within a situation.

In this chapter, I have developed the lenses into a preliminary framework, which can be used to systematically identify the relevant outcomes associated with a condition or decision problem. In the next section I introduce the framework. Subsequently, I apply it to three published studies and identify the outcomes that are included and excluded from their analyses. In the following section, I review the methods identified in Chapter 4 and investigate to what extent each method is able to address the issues and outcomes listed in the framework. In the final section, I pose a number of research questions that are raised by the framework and offer possible approaches for addressing these.

7.1.1 Framework development

Chapters 3 and 4 identified a lack of consistency in how outcomes are reported and evaluated within CUAs of pregnancy. While there are a wide range of existing methods that have been used in pregnancy, there does not appear to be a standardised approach to capturing outcomes.

The first step to introducing consistency is to understand what outcomes and considerations are essential to an economic evaluation of pregnancy. The qualitative analysis showed what outcomes are important in pregnancy, and what preferences shape pregnant people's decision-making. Through the analysis, I developed the lenses which together capture a range of outcomes and considerations that influence and inform pregnant people's decisions.

In Chapter 6, I contextualised the lenses within economic evaluation concepts. I discussed the health and non-health outcomes each lens captured, and considered how these are considered within economic evaluation.

Developing the framework consisted of condensing each of the lenses into a concise definition, with examples of relevant associated outcomes. Each lens can be considered separately, although interactions between each should also be considered.

7.2 INTRODUCING THE FRAMEWORK

7.2.1 The framework

The framework is presented as a table with a simple definition for each lens, example outcomes, and considerations to reflect on (Table 7.1). A version of the framework with guidance on how to use it is presented in Appendix 7.1.

The purpose of the framework is to provide a structured document that outlines the key concepts identified in the thesis (the lenses). Each lens has been refined into a simple concept, intended to prompt researchers to think about the outcomes that relate to it, as

well as any additional considerations that have a bearing on the decision problem at hand. The framework could be used at the scoping stage, or when critically appraising an existing economic evaluation.

The framework presented here is preliminary. It is derived from the qualitative research (Chapter 5) and contextualisation (Chapter 6), and requires further development, which is discussed in Chapter 8. As a result, although it could be used for scoping, its primary purpose in this thesis is to illustrate current limitations within economic evaluations of pregnancy, by highlighting outcomes and considerations that are not routinely included. It also brings to light outstanding research questions to address these considerations.

Lens	Definition	Outcomes	Non-measurable considerations or modifiers	Possible methods
Autonomy	Having a sense of control, safety, and bodily integrity during pregnancy, labour and birth.	<i>Birth experience measures.</i> <i>Feelings of safety and control during birth.</i> <i>Diagnostic information from screening.</i> <i>Alignment of planned birth with experienced birth (eg, hospital transfer or emergency c-section during labour).</i> <i>Rate of PTSD-FC.</i> <i>Capability for chosen infant feeding approach.</i>	<i>Are some outcomes being used as proxies for “good” outcomes? Eg, rate of normal birth.</i> <i>Is it possible to directly measure feelings of safety?</i>	Capabilities Birth experience measures Mental health outcomes
Maternal health and wellbeing	Mental and physical health, quality of life,	<i>Short and long-term morbidity</i> <i>Maternal mortality</i>	<i>Are there any long-term health outcomes associated with the intervention?</i>	Preference-based measures Spillovers

	and ability to live the life you want.	<i>Mental health</i> <i>Ability to perform usual activities</i> <i>Ability to care for the baby</i> <i>Grief</i> <i>Pre- or post-natal hospitalisation</i> <i>Spillovers from neonatal outcomes.</i>	<i>Is the time horizon sufficient to capture these?</i>	Pregnancy-specific HRQoL measures Birth experience measures Economic outcomes (eg, employment)
Fetal health and wellbeing	The mental and physical health of the baby who received the intervention <i>in-utero</i> over the lifecourse. The health of the unique individual who will result from this pregnancy.	<i>Short and long-term morbidity</i> <i>Infant disability</i> <i>Perinatal mortality</i> <i>Pregnancy loss</i> <i>NICU admission</i> <i>Prematurity</i>	<i>Consider gestational age at pregnancy loss.</i> <i>How are fetal outcomes being valued?</i> <i>Higher than maternal ones? Lower? What normative judgements are implied by this.</i>	Spillovers Separate weighting of fetal QALYs Child-specific HRQoL measures Non-health outcomes (eg, education)
Family building	The role of the pregnancy within the family.	<i>Infant disability</i> <i>Family spillover effects</i> <i>Reproductive capacity</i>	<i>Are there spillovers to partner and any siblings?</i>	Spillovers to parents and siblings Separate weighting of fetal QALYs

	The wellbeing of the spouse, siblings, and wider family. Ability to conceive the desired number of children.	<i>Pregnancy loss</i>	<i>If there is pregnancy loss or termination, is there likely to be subsequent conception?</i>	Child-specific HRQoL measures
Social context	How the pregnancy affects the social interactions of the pregnant person. The positive and negative social interactions resulting from the pregnancy, including mutual support, community, judgement, stigma and isolation.	<i>Maternal mental health</i> <i>Hospitalisation</i> <i>Continuity of care</i> <i>Relationship with healthcare professionals</i> <i>Access to support from friends and family</i> <i>Isolation and stigma</i>	<i>Is there stigma associated with particular diagnoses?</i> <i>Are some interventions/outcomes likely to lead to isolation? For example, hospitalisation.</i> <i>Are there normative judgements implied by the way the intervention is administered? For example that a positive anomaly diagnosis should be terminated.</i>	Capabilities Condition-specific measures (eg, mental health)
Moral	The personal moral, ethical and religious beliefs of the pregnant person.	<i>Attitude to termination</i> <i>Decisions around antenatal screening</i> <i>Birthplace preferences</i>	<i>Are there relevant laws governing the intervention?</i> <i>Is it possible to measure the impact of beliefs on decision making?</i>	Capabilities Framing and scoping to enable decision making in accordance with beliefs

	Being able to make choices and act in accordance with those beliefs.			
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Table VII. *The lens framework with definitions, example outcomes, additional considerations, and possible relevant methods. The outcomes, considerations and methods are non-exhaustive. (NICU, neonatal intensive care unit; PTSD-FC, post-traumatic stress disorder following childbirth).*

7.3 ILLUSTRATIVE EXAMPLES

A key purpose of the framework is in evaluating whether all relevant outcomes have been considered. Here I have applied the framework to three published studies, reviewing their included outcomes and consider whether additional outcomes and considerations could or should have been included. The three studies were selected as they related to clinical decisions that were highlighted in the qualitative analysis as being especially consequential. These are:

1. Balancing maternal and fetal outcomes and safety in high-risk pregnancies;
2. Choices during birth;
3. Antenatal screening.

Below, I describe each study and then apply the lens framework to review the reported consequences. For each example, a completed framework table is included to illustrate which outcomes were included in the project, and any considerations or outcomes that have not been included.

7.3.1 Balancing safety in high-risk pregnancy: the case of pre-eclampsia

People who develop pre-eclampsia in pregnancy are at risk of developing cardiovascular complications such as stroke and eclampsia, which can be fatal (4, 9). Pre-eclampsia also increases the risk of long-term adverse cardiovascular outcomes, including hypertension and stroke (73). If a pregnant person develops hypertension during pregnancy, or if they had pre-existing hypertension, this is closely monitored and managed during pregnancy, but if it becomes more severe it can become necessary to deliver the baby earlier than normal. The question of when to deliver can become thorny: the earlier the delivery, the safer for the pregnant person but conversely riskier for the baby, who may have to be delivered preterm. This conflict is especially acute before 30 weeks' gestation, and can make evaluating interventions particularly ethically troublesome, as improving outcomes for the baby may carry increased risks for the pregnant person, and vice versa.

7.3.1.1 *The PHOENIX trial*

The PHOENIX trial was a randomised controlled trial (RCT) that aimed to evaluate the clinical and cost-effectiveness of earlier initiation of delivery compared with usual care in pregnant people in the UK with late preterm pre-eclampsia, defined as developing pre-eclampsia between 34 and 37 weeks' gestation (79).

Usual care for these patients is expectant management until 37 weeks, and then initiation of delivery (either by induction or c-section) at 37 weeks. Earlier initiation of delivery may be called for if the clinical situation grows more severe. The study intervention (earlier planned delivery) involved aiming to initiate delivery within 48 hours of participants being randomised.

The trial randomised 901 participants. There were two co-primary outcomes, one maternal and one perinatal. The maternal outcome was a composite outcome of maternal morbidity and mortality and a recorded blood pressure of at least 160 mm Hg at least once post-randomisation. The perinatal primary outcome was a composite of perinatal or neonatal death within 7 days of delivery, or neonatal unit admission before discharge. There was also a long-term perinatal primary outcome at two years. Additional maternal HRQoL outcomes were collected using the EQ-5D-5L at 6 months and two years post-partum.

The intention-to-treat analysis found that the incidence of the maternal primary outcome was significantly lower in the planned delivery group (adjusted relative risk (ARR) 0.86 [95% CI 0.79–0.94]). The incidence of the perinatal primary outcome was significantly higher in the planned deliver group (ARR 1.26 [1.08–1.47]). The increase in the perinatal primary outcome was driven by an increase in neonatal unit admissions, largely due to prematurity.

7.3.1.2 Assessing the cost-utility of birth timing

A CUA was conducted alongside the trial (279). This evaluated planned delivery compared to expectant management over a 24-month time horizon. The perspective for costs was the English NHS. Costs and outcomes after one year were discounted at 3.5%.

Resource use was obtained from hospital records up until discharge, and then self-reported by participants for themselves and their babies between discharge and 6 months, and then at 24 months with a six-month recall period.

Outcomes were included as QALYs derived from the EQ-5D-5L crosswalked to the EQ-5D-3L (280), administered to participants on randomisation, and at 6 months and 24 months after delivery. In the case of maternal death, HRQoL was assumed to decline linearly from the previous EQ-5D measurement until the point of death. Infant outcomes were included and were combined with maternal outcomes additively. Infant HRQoL was assumed to be 1. If the infant died then HRQoL was 1 until the month of death, and 0 after. A QALY decrement of 0.00753 was applied for each day the infant spent in hospital (281).

The analysis found that planned delivery dominated expectant management (cost less but improved outcomes). The authors speculated that the cost savings were driven by reducing the amount of antenatal care and monitoring needed in the planned delivery arm, due to the shorter time to delivery, with no substantial differences in costs associated with neonatal care.

7.3.1.3 Applying the framework to outcome measures

The primary health outcome of the CUA was maternal HRQoL as measured by the EQ-5D. Maternal and infant mortality were also included as a QALY loss, but only up to a two-year time horizon. These outcomes fit with two of the lenses: maternal- and fetal- health and wellbeing. QALYs were not extrapolated beyond the two-year time horizon, therefore long-term health outcomes for the birthing person or baby were not included, and the effects of mortality were limited to a loss of two life years.

The fetal health and wellbeing lens was only included to the extent that infant mortality was included, along with a QALY decrement for hospitalisation. The QALY decrement for hospitalisation captures the effects on the baby of being in hospital, but it also could have been used to capture the spillover effects of hospitalisation on the rest of the family. This would have captured the intervention's effects on the family-building lens, as the need for early hospitalisation can negatively affect the wellbeing of parents, as well as affecting the health and educational outcomes of siblings (185). In the RCT, the poorer perinatal outcomes associated with planned delivery were strongly driven by the increased neonatal admission rate associated with prematurity.

Fetal HRQoL was not included due to the lack of available measures for infants under 2 years of age (281). However, the short time horizon meant that any long-term health effects associated with the increased rate of prematurity were not included in the analysis. Prematurity is associated with HRQoL impacts that persist throughout the life course (50,282). Taken together, there is a risk that negative fetal health outcomes may have been underestimated in this analysis.

Rights-based lenses were not included in the analysis. In the qualitative analysis, birth experience was a strong influence on people's experiences of and reflections on pregnancy, and was associated with both physical and mental health effects, including the decision to have more children. Birth experience measures could be used to capture things like maternal autonomy during labour, which was not discussed in this study. Making decisions about birth, including its timing, is both highly consequential and deeply personal, and the effect of planned delivery versus expectant management on birthing people's experiences may be substantial.

Table 7.2 outlines the outcomes included in terms of which lens they relate to. It also lists additional outcomes and considerations that were not included in this analysis.

Lens	Definition	Outcomes included	Considerations not included in the study
Autonomy	Having a sense of control, safety, and bodily integrity during pregnancy, labour and birth.	Mode of delivery	Maternal preferences for mode and timing of delivery.
Maternal health and wellbeing	Mental and physical health, quality of life, and ability to live the life you want.	QALYs over a two-year time horizon, using EQ-5D	Long-term health outcomes. Impact of infant disability due to prematurity on maternal health and wellbeing.
Fetal health and wellbeing	The mental and physical health of this baby throughout its life. The health of the unique individual who will result from this pregnancy.	Neonatal mortality QALY decrement for hospitalisation	Long-term health outcomes. Disability due to prematurity.
Family building	The role of the pregnancy within the family. The wellbeing of the spouse, siblings, and wider family.	Not discussed	Impact of prematurity and hospitalisation on the family. Impact of early delivery on subsequent pregnancy.
Social context	How the pregnancy affects the social interactions of the pregnant person. The positive and negative social interactions resulting from the pregnancy, including mutual support, community, judgement, stigma and isolation.	Not discussed	Impact of prematurity and hospitalisation on social networks and support. Interactions with healthcare workers; how well supported new parents felt.
Moral	The personal moral, ethical and religious beliefs of the pregnant person. Being able to make choices and act in accordance with those beliefs.	Not discussed	Personal beliefs around place and mode of birth. Tolerance of risk to baby versus to self.

Table VIII. *Applying the framework to the PHOENIX study*

Choice of birthplace

One of the biggest choices pregnant people face relating to their birth experience is the question of where to give birth. In the UK, low-risk pregnant people can consider a number of settings in which to give birth. Obstetric units (OU) within a hospital are the traditional hospital birthplace. They are encouraged for patients with high-risk pregnancies, and are the location where the most intervention is available, including inductions and more intensive forms of pain relief, including epidurals. They are also the location where caesareans take place. Patients are transferred here from other locations if complications arise that require obstetric intervention.

Midwife-led units (MLU) are, as the name suggests, locations where care is managed by midwives rather than obstetricians. Some forms of pain management are available, such as gas and air. Patients in MLUs will deliver vaginally without significant intervention, and, if intervention is needed, they will be transferred to an OU. MLUs can be either alongside an OU within a hospital, or freestanding.

The third option is a home birth. In this scenario, a small number of midwives, usually one or two, stay with the labouring person at their home. Gas and air is available, but more intense interventions are not, and transfers to OU are common due to complications arising, at around 21% (238). Home births are generally offered as an option for low-risk births, but they are sometimes also requested by higher-risk patients who have had a negative experience in hospital. Reasons for choosing a home birth include the feeling of safety and security that comes from being in a familiar environment.

Where someone chooses to give birth influences their likely experience substantially. It affects: the type of healthcare professional who will be providing care (whether led by obstetricians or midwives); the kinds of interventions available, including pain relief; and the rates of different kinds of intervention, such as caesarean births (238).

Despite a policy of birthplace choices, only a small proportion of women in England give birth outside of OUs. In 2022, 1.9% of pregnant people gave birth at home (283). National data on the proportion of people giving birth in MLUs are not routinely collected, but in 2018 it was estimated that 14% of births took place in MLUs, and that 76% of NHS trusts had at least one MLU available (284). This leaves an estimated 84% of births taking place in OUs.

7.3.1.4 The Birthplace Choices study

The Birthplace Choices study was part of the Birthplace in England cohort study, which aimed to assess the risks and benefits of giving birth in different settings (OU, freestanding MLU, alongside MLU, and home birth), for pregnant women who were at low risk of complications during birth at the onset of labour (285–287).

The Birthplace in England cohort study analysed outcomes for 64,538 low-risk women. The primary outcome was a composite of perinatal mortality and specific neonatal morbidities. Secondary outcomes included neonatal and maternal morbidities, maternal interventions, and mode of birth. Women choosing a home birth tended to be older, white, and lived in a more socioeconomically affluent area, and were less likely to be nulliparous (27% of those planning home birth, versus 54% of those planning OU birth).

There were no significant differences in the odds of the primary outcome (perinatal mortality and neonatal morbidity) between birth settings. There was a significant increase in the odds of the primary outcome (perinatal mortality and neonatal morbidity) in nulliparous, low-risk women planning a home birth compared with an OU birth (adjusted odds ratio 1.75). Women planning a birth in a non-OU setting experienced a significantly lower chance of receiving an intervention during birth (between 12 – 24%, compared with 42% in an OU). Other maternal outcomes did not vary significantly by planned birth setting (238). Rates of transfer during or after birth to an OU were much higher for nulliparous women (36 – 45%) than multiparous (9 – 13%).

The Birthplace Choices sub-study had two components: first, to assess the cost-effectiveness of different birth settings for low-risk deliveries, based on the findings of the cohort study; and additionally to understand the factors that influence pregnant people's decision-making around intended place of birth, and what their information needs are, in order to facilitate healthcare commissioning decisions that support choice (288). The outputs of this project were a CEA (239) and a qualitative study (289).

7.3.1.5 Assessing the cost-effectiveness of birthplace choice

The aim of the economic evaluation was to assess the cost-effectiveness of each birth setting (home birth, freestanding MLU and alongside MLU) for low-risk pregnancies compared with standard care, defined as planned birth in the OU.

The economic evaluation took the form of a study-based CEA, using data from the cohort study. A health system perspective was taken and the time horizon was up until the pregnant person was discharged from care. If additional care was needed in the immediate post-partum period, this was included.

Three estimates of cost-effectiveness were made, using different measures of effectiveness. These were drawn from the outcomes of the cohort study. These were: cost per adverse perinatal outcome avoided; cost per adverse maternal morbidity avoided; and cost per additional "normal birth", which was defined as birth without induction of labour, epidural or spinal analgesia, general anaesthetic, episiotomy, forceps, ventouse, or caesarean section.

The analysis found that all non-OU settings resulted in cost savings compared to planned OU births. Adverse perinatal outcomes avoided were equivalent in non-OU settings, other than for nulliparous pregnant people, in whom it was they were slightly lower, indicating a higher risk of adverse perinatal outcomes. Maternal morbidity was lower in non-OU settings, and probability of a normal birth was higher. For the three outcomes, OU birth was dominated by all other settings for both maternal morbidity avoided, and additional normal birth.

For adverse perinatal outcome avoided, the two MLUs dominated OU birth, being cheaper and more effective. Home birth in this case was cheaper but less effective, giving an incremental cost-effectiveness ratio (ICER) of £7,950,356 per adverse perinatal outcome avoided. The ICERs here was large due to the very small differences in effectiveness (0.00007 cases avoided at a cost of £590). ICERs were presented relative to planned OU births, rather than relative to other birth settings.

7.3.1.6 Applying the framework to outcome measures

The three measures of effectiveness reported in this study reflect three outcomes of interest: the health of the baby; the health of the pregnant person; and facilitating a “normal birth”. The low-risk population of interest encompasses people for whom any of these birth settings would be within medical guidance.

When mapping the measures of effectiveness to the lens framework, adverse perinatal outcomes maps to fetal health and wellbeing, and adverse maternal morbidity maps to maternal health and wellbeing.

The “normal birth” outcome is more complex to capture. As explained in Chapter 1, there have been policy aims to reduce birth interventions where possible, and particularly c-sections. Many birthing people plan for a low-intervention labour, and the need for intervention is often seen colloquially as something to be avoided. This was highlighted by several participants in the qualitative analysis.

There are several reasons why a “normal birth” might be set as a policy goal. First, a low-intervention delivery suggests one where serious complications have been avoided. In this case, a “normal birth” may be a proxy for a straightforward delivery where both pregnant person and baby have not experienced adverse clinical outcomes, or been put at serious risk of them. In this case, the value of a “normal birth” outcome is that it captures cases where the labouring person or baby were put at risk of an adverse outcome, even if that outcome was avoided due to an appropriate intervention. However, there is a chance of double counting if normal birth is valued in addition to adverse outcomes, without

accounting for the fact that most adverse outcomes will occur in births that involved intervention. Additionally, not all interventions are associated with an adverse outcome. For example, an epidural may be a personal choice made solely to improve the pregnant person's experience of birth.

The other interpretation is that a "normal birth" is capturing some non-health benefit. In the qualitative analysis, "normality" particularly came up in relation to social context. People wished to experience what they perceived to be the norm during pregnancy and birth, and those who did not experienced feelings of isolation. "Normal" can also reflect a moral stance, in contrast to abnormal. This pattern, where a characteristic becomes a marker of one's being normal or abnormal, in relation to others, forms the foundation of the concept of stigma (290). As a result, one might seek a "normal" birth in order to fulfil one's sense of the morally right approach to birth. Losing that experience through the need for intervention could lead to a sense of shame and failure.

Another relevant lens here may be autonomy. In a low-intervention birth, the birthing person may feel they retain greater control over their body. This is in contrast to some types of intervention, such as an epidural, where sensation is reduced; an instrumental delivery, where the baby is pulled and/or rotated, as well as pushed, from the body; and a c-section. A "normal" birth may in this case capture the value of retaining autonomy during labour. An example of this was seen in the qualitative analysis, where a participant opted for a home birth in order to avoid a repeat of her high-intervention first birth, despite being high risk for post-partum haemorrhage.

However, it is not possible from the analysis to ascertain exactly what the value of "normal birth" is considered to be in this context. It has the potential to capture many of the lenses that are absent from the clinical effectiveness measures, but without a definition this cannot be stated with certainty.

On the other hand, there is a risk that in elevating "normal" birth as a proxy for autonomy and morality, more pertinent outcomes will be overlooked. Instead of assuming that a

“normal birth” is associated with greater autonomy, experience measures could be used to capture birthing people’s feelings of safety and control directly. This would also avoid the weakness that, in emphasising an intervention-free birth as “normal”, patients who require or request intervention are further isolated, potentially stigmatised and at risk of internalising feelings of failure or moral inadequacy.

Lens	Definition	Outcomes	Considerations not included in the study
Autonomy	Having a sense of control, safety, and bodily integrity during pregnancy, labour and birth.	Mode of delivery Place of delivery Rate of normal birth	Are there circumstances under which “normal birth” is not desirable? Effects of hospital transfer or changes in mode of delivery on maternal mental health.
Maternal health and wellbeing	Mental and physical health, quality of life, and ability to live the life you want.	Adverse maternal morbidity	Long-term maternal health outcomes.
Fetal health and wellbeing	The mental and physical health of this baby throughout its life. The health of the unique individual who will result from this pregnancy.	Perinatal mortality and adverse outcomes	Long-term fetal health outcomes. Infant disability.
Family building	The role of the pregnancy within the family. The wellbeing of the spouse, siblings, and wider family.	Not discussed	Family spillovers from maternal or perinatal adverse outcomes. Family effects from mode of delivery.
Social context	How the pregnancy affects the social interactions of the pregnant person.	Not discussed	Social effects of mode of delivery (eg, stigma surrounding birth method).

	The positive and negative social interactions resulting from the pregnancy, including mutual support, community, judgement, stigma and isolation.		
Moral	The personal moral, ethical and religious beliefs of the pregnant person. Being able to make choices and act in accordance with those beliefs.	Rates of normal birth	Moral framing around mode and place of birth, and the role of intervention.

Table IX. *Applying the framework to the Birthplace Choices study*

7.3.2 Antenatal screening

Antenatal screening refers to the set of screening tests carried out during pregnancy with the aim of identifying health conditions that could affect the health of the baby. There are also screening tests conducted to identify maternal health conditions such as gestational diabetes and pre-eclampsia, but here I focus on screening to identify fetal anomalies and health conditions.

Antenatal screening is an evolving field, with the advent of non-invasive prenatal genetic testing (NIPT) increasing the range of conditions that can be identified (291). In the UK, the NHS conducts screening to identify patients at risk of three chromosomal abnormalities: trisomies 13 (Patau's syndrome), 18 (Edward's syndrome), and 21 (Down's syndrome). All three conditions cause serious health problems in the baby, affecting both length and quality of life. Babies born with trisomies 13 and 18 rarely survive past the first year. While individuals with trisomy 21 can in many cases live well into adulthood, the condition is associated with a range of complex health conditions and is a serious disability. As a result, the majority people whose babies are confirmed to have one of these conditions choose to terminate the pregnancy, in countries where it is legal to do so (292).

The decision to terminate as a result of a diagnosis identified via screening presents a challenge to CUA because the range of optimal outcomes can vary to an extreme degree. An individual might choose to proceed with the pregnancy or to terminate, and both choices may be the optimal one for them, depending on their personal circumstances and beliefs. There is no curative treatment available for a chromosomal abnormality, so the aim of screening is to provide information to enable the parents to make an informed decision. This includes whether to terminate or proceed with the pregnancy, and to be able to prepare for the birth of a baby with significant needs.

This set of possible outcomes confounds the use of QALYs in evaluations. If an evaluation considers the QALYs associated with the birth of the baby in the analysis, the choice to proceed with the pregnancy maximises QALYs, as long as the HRQoL associated with the

condition is greater than zero. If fetal outcomes are excluded, the choice to terminate will always dominate, due to the maternal health decrement associated with being pregnant, the ongoing healthcare costs of the child, and possibly the parental spillover effects of caring for a disabled child (293). The current CUA framework does not have a process for how to consider both of these options to be optimal choices, depending on parental preferences, or to account for the value to the parents of the diagnostic information itself.

7.3.2.1 The VALENTIA study

The VALENTIA study aimed to investigate how to value the benefits and harms of antenatal and newborn screening programmes in health economic assessments (235). The project comprised two component studies.

First, a systematic review identified the benefits and harms reported in economic evaluations of antenatal and newborn screening programmes (294). The second study consisted of a qualitative analysis of pregnant people's experiences of antenatal and newborn screening. This included: a secondary qualitative analysis; primary interviews with pregnant or previously pregnant individuals and other stakeholders; and a literature synthesis (235). The findings from the two studies were then mapped to check for consistency and to identify whether any relevant outcomes identified in the qualitative study were missing from those identified in the systematic review, and vice versa.

While the other two studies discussed earlier in this chapter are economic evaluations, the VALENTIA study summarised the outcomes of a large number of prior studies. This provides the opportunity to compare and contrast those findings with the framework I have developed. The findings from VALENTIA relate to both antenatal and newborn screening, whereas the framework is limited to just interventions during pregnancy, so I focus only on the antenatal component.

7.3.2.2 Benefits and harms identified in VALENTIA

The systematic review identified 337 economic evaluations of antenatal or newborn screening interventions. The reported benefits and harms were identified and categorised using a thematic framework approach. A bespoke checklist was developed to identify benefits and harms, loosely following the aims and process of screening. This included: the stage of the screening pathway; information on different phases of the screening programme, confirmatory diagnosis and treatment; and the consequences of each possible test result, including incidental findings. Themes and subthemes were developed using integrative descriptive analysis, until a taxonomy of benefits and harms was identified:

1. Outcomes related to diagnosis of screened-for condition – eg, cases detected, cases averted, additional confirmatory tests performed.
2. Life years and health status adjustments – eg, QALYs and psychological benefits and harms, to pregnant person, baby, or family members.
3. Treatment – eg, adverse reactions caused by treatment, or conditions prevented by timely treatment.
4. Long-term cost associated with caring for a child with the screened-for condition.
5. Overdiagnosis – the costs and health consequences of incidental findings that require additional investigation.
6. Pregnancy loss, both spontaneous and due to termination.
7. Spillover effects to parents and siblings as a result of the condition.

This taxonomy was then compared with the findings of the qualitative research project, which used a variety of methods to identify pregnant people and their partners' experiences of screening, including a meta-ethnography of published papers and a secondary analysis of existing interviews to analyse their experiences of antenatal and newborn screening, as well as primary data collection involving parents, healthcare professionals and other stakeholders.

The synthesis found a large degree of overlap between the taxonomy and qualitative research, but with some key points of divergence. The taxonomy identified long-term impacts on productivity as an outcome, but this was not captured in the qualitative research. Both overdiagnosis and harms from unnecessary treatment were also absent from the qualitative research. In the qualitative research, important outcomes identified that were not present in the taxonomy included: the value of the information itself; the challenge of ensuring that choices are truly informed; representations of conditions and disabilities, including the implication that if something is being screened for, it must be a negative outcome; and relatedly, the suggestion that offering screening is an endorsement of its normative value, which could lead to patients feeling pressured.

The project made a number of recommendations for the economic evaluation of antenatal and newborn screening. It noted the importance of considering the moral implications of valuing outcomes from antenatal screening within CUA, particularly as it relates to valuation of prenatal life. The study also emphasised the limitations of standard approaches to HRQoL measurement when capturing outcomes such as the timeliness of information, the value of that information, and the harms of overdiagnosis. The recommendations emphasised the value of CBA or CCA-based approaches to allow for the inclusion of these outcomes.

7.3.2.3 Applying the framework to outcome measures

The taxonomy developed in the VALENTIA project provides a broad overview of the state of outcome measurement in economic evaluations of antenatal (and newborn) screening. As identified in the systematic review (Chapter 3), antenatal screening is rarely captured in CUA due to the difficulty of valuing health outcomes in this context, and, as a result, CEA and CCA are widely used (235). This results in the range of non-health outcomes reported in the taxonomy, including cases detected, cases averted, and overdiagnosis. While these outcomes can be valuable in terms of evaluation, they do not carry inherent positive or negative outcomes for individuals. Whether they improve or decrease health

and wellbeing depends on the impact of testing and treatment, and on individual preferences.

Among the outcomes that directly affect health and wellbeing, three categories are identified: life years and health status adjustments; pregnancy loss; and spillover effects. These do not fully overlap with the outcomes-based lenses, but there is agreement. In the taxonomy, life years and health status for both pregnant person and baby are combined, whereas the lenses separate them into maternal health and wellbeing, and fetal health and wellbeing. Similarly, pregnancy loss is captured in the lens framework not as a single outcome, but as an outcome that affects both family building and fetal health and wellbeing. Spillovers are incorporated as one component of family building, and may capture important outcomes in other lenses, such as maternal health and wellbeing.

The rights-based lenses do not feature in the taxonomy, but there is noticeable overlap with the additional items identified in the qualitative research. The emphasis on the normativity of screening and the portrayal of screened-for conditions and their associated disabilities speaks to both the social context of screening, and the morality around parents' decision-making.

One lens that appears to be absent from, or only latently present within both the taxonomy and the qualitative findings, is autonomy. This may be most applicable to the finding that parents value the information for its own sake; that it enables families to envision and plan for their future. This concept of planning and considering the effects of screening over time was the focus of another qualitative paper within VALENTIA, although its analysis was limited to newborn screening and so is less applicable here (295).

VALENTIA comprehensively identified measures of effectiveness associated with antenatal screening. By comparing the outcomes identified with the lens framework, I have identified a number of points of overlap, and also areas where some lenses are

absent. It is notable that where lenses were missing in the VALENTIA taxonomy, these were somewhat reflected in the VALENTIA qualitative findings.

Lens	Definition	Outcomes	Considerations not included in the taxonomy
Autonomy	Having a sense of control, safety, and bodily integrity during pregnancy, labour and birth.	Psychological benefits and harms of information.	The value of antenatal diagnostic information. Feeling informed and supported when making screening decisions. Ability to plan for the future.
Maternal health and wellbeing	Mental and physical health, quality of life, and ability to live the life you want.	Life years and health status adjustments – eg, QALYs and psychological benefits and harms, to pregnant person, baby, or family members. Health consequences of incidental findings. Adverse reactions caused by treatment, or conditions prevented by timely treatment.	Mental health effects of pregnancy loss or termination. Physical harms of screening.
Fetal health and wellbeing	The mental and physical health of this baby throughout its life. The health of the unique individual who will result from this pregnancy.	Life years and health status adjustments – eg, QALYs and psychological benefits and harms,	Quality of life effects of disability. Pregnancy loss due to termination.

		to pregnant person, baby, or family members. Adverse reactions caused by treatment, or conditions prevented by timely treatment.	
Family building	The role of the pregnancy within the family. The wellbeing of the spouse, siblings, and wider family.	Life years and health status adjustments – eg, QALYs and psychological benefits and harms, to pregnant person, baby, or family members. Spillover effects to parents and siblings as a result of the condition.	Timing and spacing of pregnancies. Concept of replaceability, where an additional baby is conceived following a loss. Impact on partner of loss.
Social context	How the pregnancy affects the social interactions of the pregnant person. The positive and negative social interactions resulting from the pregnancy, including mutual support, community, judgement, stigma and isolation.	Not included.	Normalisation of screening by healthcare professionals. Possible social pressure to make a certain choice.

Moral	The personal moral, ethical and religious beliefs of the pregnant person. Being able to make choices and act in accordance with those beliefs.	Pregnancy loss due to termination.	Options to facilitate choices made in line with beliefs (eg, perinatal hospice).
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Table X. *Applying the framework to the taxonomy identified in the VALENTIA study. Additional concepts identified in the qualitative research are not included in the listed outcomes, but have been considered in the “considerations” column.*

7.3.3 Summary of findings

The above examples illustrate how the lens framework can be used to prompt analysts to consider whether they have included relevant outcomes. Outcomes can then be included or excluded based on other factors, such as the evidence available, but readers will be able to follow and critique the logic and methods.

This process also draws attention to methodological gaps in this field. For example, the antenatal screening example opens the possibility of terminating a wanted pregnancy. There is currently no consensus on if, and how much, society and the healthcare system is willing to pay to reduce that outcome. Similarly, the timing of birth, as is considered in pre-eclampsia cases, may affect the outcomes of the pregnant person and baby in different ways. How to balance these diverging outcomes remains unclear. Finally, facilitating maternal autonomy during birth is crucial, but may sometimes come with the risk of worse health outcomes for the baby. How to protect autonomy within resource allocation decision-making remains to be determined. These examples, and others, will be discussed further below.

7.4 RELEVANT METHODS

In Chapter 4, I outlined methods and approaches that were potentially relevant to pregnancy. Having developed the framework, it is illustrative to consider which methods might meet the challenges presented by the lens approach, and which concepts are not addressed by current methods.

7.4.1 Cost-benefit analysis

Throughout this thesis, the problem of attempting to value outcomes in pregnancy within a health framework has been prominent. Only two lenses of six explicitly refer to health, maternal and fetal wellbeing. CBA could provide an alternative approach, by considering pregnancy and the value of new life on its own terms. Economic models of fertility might provide guidance on how to measure such benefits. In practice, this is unlikely to be a

viable solution given the structure of antenatal care, however. Currently pregnancy interventions are funded from a healthcare budget, and changing this would amount to a substantial reorganisation of maternity care. CBA could allow benefits related to the other four lenses to be included, such as the value of autonomy and impact on the family, by valuing these without requiring them to have an effect on health outcomes. CBA still involves trading off one set of outcomes against another, so would not address the challenge of non-measurable rights-based lenses, such as morality.

7.4.2 Spillovers

Spillovers provide a mechanism by which one of the crucial concepts within pregnancy can be evaluated: that of the spillovers from pregnant person to fetus, and vice versa. Spillovers provide a way to account for the effects of treating one or either patient onto the other. Typically, spillovers refer to a patient who is treated, and the impacted individuals who are untreated, but whose health is affected by the health of the patient (family or informal carers) (62). In pregnancy, both mother and baby are treated, sometimes for the benefit of both, sometimes only for the benefit of one, and sometimes to the detriment of the other. Within the framework, this captures the impacts of an intervention on both the maternal and fetal health and wellbeing lenses.

Spillovers in their current use are well-suited to situations where the post-birth consequence of an outcome is being measured (for example, the health effects on the baby of maternal mortality, or the health effects on the family of disability in the baby). A variant of spillovers was identified in the systematic review: maternal disutility due to fetal morbidity and mortality (**3.3.2.3**). In this case, the concept of a spillover was used as a way of measuring the harm resulting from poor fetal outcomes without needing to value the future fetal life itself. Spillovers may provide a mechanism by which the interaction between maternal and fetal health outcomes can be measured.

Spillovers are receiving increasing attention in the field of pregnancy, but caution is needed in their application. Spillovers assume one treated patient, and then indirect

impacts on those around them. In pregnancy both the pregnant person and the fetus are treated. While treatment may primarily be targeted at the fetus, consent is always obtained from the pregnant person, and in many cases treatment is intended to benefit both. Furthermore, even the framing of pregnancy as being two individuals is controversial philosophically (55–57). Spillovers potentially engrain a perspective that limits flexibility regarding the nature of when life begins and how to value fetal outcomes. Finally, spillovers do not address how to balance competing interests, such as when treatment to benefit one risks the health of the other. This is a source of ongoing discussion within spillovers research, particularly in the context of end-of-life care, where extending the life of the patient may reduce the health of the carer (296).

Where spillovers have potential value is in the family building lens: considering the impact of pregnancy outcomes on the wider family, including spouses, siblings and extended family members. The impact on siblings was particularly prominent in the qualitative analysis, but is rarely addressed within pregnancy evaluations.

7.4.3 Separate weighting

Separate weighting, as used in a previous NICE decision (297), refers to downweighting fetal QALYs such that the QALY value of averting a fetal loss is lower than it would be for saving the life of a born patient. In the case in question, the value assigned of 10 QALYs was constructed in reverse: for the intervention to be cost-effective the value needed to be 10 QALYs, and the committee considered that on balance this value was likely to be accurate.

Separate weighting enables future lives to be valued, but at a lower value than existing lives. Such a distinction is important in recognising that fetal lives are dependent on the maternal body to be brought into existence, and that the wellbeing and autonomy of the pregnant person is paramount. Separate weighting still considers the fetus as independent from the pregnant person, for valuation purposes. It provides acknowledgement that there is a societal preference for new people being born, and that those people being born is a

societal good, rather than just a benefit to the parents and family. Separately weighting fetal QALYs could ensure that fetal QALYs do not outweigh maternal ones (depending on the weighting). This is a simple way of protecting pregnant people, by ensuring that no intervention would be cost-effective where maternal mortality would be considered a reasonable trade-off for reduced fetal loss. Separate weighting captures aspects of the family building and fetal health and wellbeing lenses, and attempts to balance them against maternal wellbeing and autonomy.

7.4.4 Capabilities

Capabilities have also been explored in the context of pregnancy, specifically for NIPT (200,298). As with other areas of healthcare, the value of a capabilities-based approach here is in reflecting preferences and outcomes beyond HRQoL. Prevailing CEAs might capture cost-per-case detected, but, as demonstrated above, detecting the case is not analogous to any particular positive or negative outcome. The optimal outcome might vary from patient to patient for non-health reasons, and therefore it is not possible to assign a value to that detection that perfectly corresponds to societal preference, because society is not agreed on what that detection means. This risks unethical decision-making and inefficient resource allocation. A capabilities approach might instead allow the range of possible benefits and harms to be considered on their own terms, rather than trying to identify a mental or physical health effect associated with, for example, loss of autonomy. In the study cited, the authors consider that a pregnant woman might value the capability to raise a disabled child, or the capability to refuse a test that carries a risk of miscarriage. Their developed list of capabilities included some that map closely to the lenses above (Table 7.5): “bodily integrity” and “control over the environment” both allude to autonomy, “affiliation” relates to social interactions and community, and “life” referred both to maternal life and to fetal life. This capabilities approach centres the pregnant person and her capability with respect to pregnancy, and does not consider the fetal life as having additional value. It is the only approach listed here that considers aspects of the rights-based lenses within its outcomes.

Capability	Possible relevant lens
Life	Fetal health and wellbeing
Bodily health	Maternal health and wellbeing
Bodily integrity	Autonomy
Senses, imagination and thought	Moral, autonomy
Emotions	Autonomy
Practical reason	Autonomy
Affiliation	Social context, moral
Control over one's environment	Autonomy
Caretaking	Family building

Table XI. *Capabilities identified in the NIPT study compared against the lenses*

7.4.5 Multicriteria Decision Analysis (MCDA)

MCDA has the advantage that the many components of pregnancy outcomes identified here could be valued separately. The three outcome-based lenses could be quantified separately, although quantifying rights-based lenses presents difficulties outlined above. If such measurement was developed (for example, through the use of birth experiences measures), then they could also be represented in MCDA. MCDA does not provide guidance on how these outcomes could be reconciled or combined, particularly in cases where outcomes are in tension, but it may improve transparency, and provide a mechanism for combining outcomes, such as if implementing a separate weighting approach.

7.4.5.1 Summary

The five methods discussed here each address some component of the issues raised by the framework. Of the methods above, a capabilities approach offers a way to account for the majority of lenses within a single method. Autonomy, the social context and morality are all features that relate more to one's capabilities than one's functioning. Absent from the

capabilities approach is a recognition of the independent value of fetal life, and this may be a limitation. MCDA, spillovers and CBA offer routes to account for multiple, possibly conflicting outcomes within an analysis, although their use would require a normative judgement on how to balance these outcomes. Applying a weight to fetal QALYs addresses the issue of valuing fetal loss or harm independently, recognising the value of that life, but it also makes a judgement of that value that is independent of the pregnant person's wishes, albeit one that recognises a distinction between the born and the unborn.

7.5 OUTSTANDING RESEARCH QUESTIONS

While I argue in the previous sections that the framework provides a tool for analysis, it also illustrate gaps in the methodological literature. Below I address three key questions that draw on the qualitative analysis and framework, and highlight normative questions that cannot be answered solely through the application of current methods, but that which must be addressed through research and consensus-seeking.

7.5.1 Valuing future lives

One of the most prominent lenses found in the secondary qualitative analysis, and in the subsequent decision problems outlined earlier in this chapter, is the family building lens.

This lens captures the effects of losing a pregnancy, or of not being able to have the baby one wanted. It also captures the effects on the family of these outcomes. It relates to, but differs from, the fetal wellbeing lens in that it speaks not to the outcomes of a particular individual pregnancy, but of the role of an additional baby being born within the family as a whole. This lens captures intentions such as the desire to conceive again after losing a pregnancy. In that case, the wellbeing of the fetus is irretrievably lost, so the fetal wellbeing lens cannot be changed. Instead, the pregnant person is seeking to fill the role within the family by having a new child. The loss of the first baby is irreplaceable, but the role they would have filled within the family remains vacant – although it may change slightly, for example as the potential age gap between siblings grows.

This is clearly not a health outcome. While the mental wellbeing of the parents may be affected by the presence or absence of a new baby, that is not the extent of their contribution. Instead, we have entered the realm of personal fulfilment, and the societal preference for new lives being created. Society continues on the basis of new members being born, who will in time perform roles in society such as worker, family member, carer, friend, and so on. There are social and economic benefits that result from additional births, as well as costs.

At the same time, we also have the fetal wellbeing lens. In cases of pregnancy loss, this lens captures the loss of the individual who would have been born. In the case of disability, it captures the quality of life and wellbeing of the individual who is born. While the family building lens captures the new baby's role within the family, the fetal wellbeing lens captures them as an individual, whether extant or potential. This can be thought of as the difference between someone's name, which is unique to them, and their job title, which could be performed by multiple individuals.

The challenge of outcome valuation in pregnancy is in properly capturing both of these outcomes. This differs from a related area of research, the evaluation of assisted reproductive technology (ART). Evaluation of ART is a growing area of research, where the outcome of interest is in the rate of live births. This is compatible with the family building lens; the outcome of interest is new babies being born to families at the desired time. The harm associated with treatment failure is the grief of not being able to have a child, as well as the side effects of treatment. There is also a societal preference in favour of new people being born, and so an additional value to recognise the value of new human life on its own terms may be appropriate (105,106,299).

Economic evaluation of ART has expanded rapidly in recent years. The majority estimate cost-effectiveness in terms of cost-per-live birth, with only very few using generic outcomes such as QALYs (110). Cost-per-live birth estimates avoid the evaluation making a judgment as to the value of an additional birth.

A number of approaches have been attempted to value new life created through ART. Examples include valuing new lives in terms of their future productivity and tax contribution (300), or by setting the cost-effectiveness threshold relative to the cost of an additional round of in-vitro fertilisation (IVF) (301). One novel method developed is the use of WTP estimates derived from the general public via a DCE in order to conduct a cost-benefit analysis on the public's WTP through taxation to support public IVF provision. This approach seeks to base its estimate of cost-benefit on the public's preferences for providing IVF, potentially incorporating public preferences relating to new births and the support of couples or individuals experiencing infertility (302).

Outstanding issues remain in the ART literature. Time horizons often extend only to birth, but costs and health consequences can persist across the whole life course, such as in the case of childlessness, or multiple births (303). There is also a question of the validity of assigning QALYs to future lives. It has been argued that QALYs cannot be assigned to future lives, because an intervention that creates them does not improve them. Since the purpose of QALYs is to model health improvement, assigning value to their creation is inappropriate (106). This is disputed, both in the health economic literature, but also the value and ethics of creating future lives remains a disputed question within philosophy and bioethics (304).

By contrast, the valuation of outcomes in existing pregnancies needs to take into account the loss of current pregnancies, and the diagnosis of conditions that may result in severe disability. The grief here is for a specific individual (and their imagined future) who ceases to be when the pregnancy is lost. Given the nature of that grief, there may be a case for asking whether that individual's life should be valued not just as a source of parental grief, but also as an individual whose life is ended, albeit before it began. If this is the case, then valuing future lives in pregnancy analysis may differ from that valued in ART evaluation. However, ART evaluation provides some possible routes forward for measuring the value

of a future life, whether using QALYs (304), in terms of macroeconomic value (107), or in accordance with societal preferences for funding the creation of new lives (302).

Alongside these arguments in favour of valuing fetal life in evaluations is the desire to protect maternal autonomy and the right to end a pregnancy when needed or desired. Under human rights law, life (and therefore the entitlement to said rights) begins explicitly at birth (83). If value is to be placed on future lives for their own sake, rather than just as a cause of maternal and familial harm, then we must be careful not to undermine that autonomy.

Much of the philosophical literature relating to the nature of pregnancy is concerned with whether a pregnant person constitutes a single individual or multiple, and how this evolves through pregnancy (55,56,259). In the issues raised above, I propose that similarly, the issues of outcome valuation in pregnancy fits neither a model of pregnancy as a single individual, nor multiple, but somewhere in between. Philosophically, this fits closely with the process view of pregnancy, in which pregnancy is not a substantive state, but instead a bifurcating process (57).

7.5.2 Accounting for rights-based lenses

The broad concept of rights-based lenses was outlined in Chapter 6 (6.3). In this section I will present a number of situations in which the rights-based lenses become pertinent, and outline relevant research questions that would need to be addressed in order to evaluate such situations.

7.5.2.1 *Maternal consent during pregnancy and childbirth*

As illustrated by the birthplace choices example above, maternal autonomy during pregnancy and childbirth is paramount but also presents complexities to evaluations. How to safeguard both maternal autonomy while facilitating the safety of both the pregnant person and the baby remains an issue of discussion in the field of medical ethics (for an example, see (84,305)).

7.5.2.2 *Disability rights*

Disability rights are relevant in two ways in pregnancy. First, in the desire and ability of disabled people to become pregnant. This right has historically been oppressed in many communities around the world, either through stigmatisation (306) or through a policy of sterilisation alongside other identities targeted by eugenics movements for being socially undesirable, such as race or socioeconomic status (307). Disabled people frequently experience pregnancy, but their access to appropriate care can be impeded by discrimination and misunderstandings by healthcare professionals (308). Disabled people face higher risks of morbidity during pregnancy, in part due to a lack of appropriate support (309).

Second, disability rights are relevant in consideration of babies being born with disabilities. Some forms of antenatal screening aim to identify fetal anomalies that result in disabilities. As discussed above, methods for valuing screening has historically included outcomes such as cost-per-case averted. In other words, the valued outcome is a decrease in the number of disabled babies born.

Antenatal screening has been identified as a potential route by which discriminatory practices are embedded within healthcare (310,311). In the qualitative research (Chapter 5), concerns were voiced by some participants that they would feel pressured to terminate a pregnancy that was identified as having an anomaly resulting in disability, and that this fear affected their screening choices. How disability is characterised within economic evaluations has the ability to perpetuate discrimination, if not carefully managed (312).

Disability advocates have raised concerns over the use of the QALY and its potential to devalue the lives of disabled people. Health-related utilities for disabled people are usually lower than the general population, and their lifespan often shorter. An additional year of life accruing to a disabled person will therefore equate to fewer QALYs gained than that same year accruing to an able-bodied person (313).

7.5.2.3 *The intersection of morality/religion and healthcare*

Similarly, personal moral or religious beliefs add complexity to health outcome valuation by changing people's preferences in sometimes drastic ways. People's personal beliefs can affect their attitude towards antenatal screening and termination, disability, and acceptance of intervention during labour and birth, to name a few examples. The effects of morality on clinical decisions and patient preferences can be nuanced and are rarely straightforward. They add a complexity that is rarely present in other areas of healthcare.

Morality and personal beliefs could be considered as a facet of autonomy more broadly, and indeed the response may be the same: the framing of problems to allow for and respect the possible moral choices individuals may make. However, the moral side of people's interactions with their pregnancy and the antenatal care system is particularly potent, and therefore worth outlining separately.

7.6 DISCUSSION

The lenses were developed by grouping the themes with the intention of understanding how people make decisions. A challenge I faced was that decisions in pregnancy are often talked about in terms that can appear externally to be inconsistent (such as expressing a pro-life morality but opting to terminate a pregnancy), or where preferences differ over time (such as being unsure whether to continue with a pregnancy and then grieving a subsequent miscarriage). These examples are extreme, but smaller versions of dilemmas, potential contradictions and ambivalences were present in many situations that participants described. The lenses allowed for complexity within people's preferences. Lenses are not mutually exclusive drivers of decisions, like domains in a stated preference study or HRQoL measure. They can overlap and amplify each other, retaining the nuance identified in the analysis. An example of this is the autonomy and maternal wellbeing lenses: birth trauma is commonly reported as being associated with a sense of loss of control. Therefore, by prioritising maternal autonomy, it may be possible to improve maternal physical and mental health, post-birth. Nevertheless, the many facets of

maternal wellbeing cannot be entirely contained within the lens of autonomy, and vice versa, so although the two lenses interact, they also clearly reflect separate concepts.

The lenses are also not automatically quantitative. In Chapter 6, I subdivided the lenses into outcomes-based (maternal wellbeing, fetal wellbeing, and family building) and rights-based (autonomy, social context, and morality). CUA includes some aspects of outcome-based lenses already, and they lend themselves more readily to being quantifiable, although some aspects may be missed during quantification. Rights-based lenses reflect fundamental rights that pregnant people have, and these cannot be easily quantified. It would be ethically difficult to trade a patient's right to autonomy, for example, against their or their baby's wellbeing.

In the construction of QALYs, HRQoL estimates are derived from preference-based measures in which each health state is valued by obtaining utility estimates derived from a choice exercise carried out by a representative sample of the general population (20). However, estimates used in QALYs, such as the EQ-5D, are strictly based on a notion of health in which health amounts to a negative decrement compared with one's personal definition of "best imaginable health". In practice, this limits quality of life domains to strictly personal criteria, and pregnancy and fertility may not register. This leads to the limitations in the use of CUA in pregnancy outlined in earlier chapters.

In this context, the framework provides an alternative, more holistic view of the concept of health in pregnancy. By deriving the lenses from people's descriptions of the preferences that shaped their decision-making, the lenses are congruent with current methods of health valuation, but conceptualise a broader range of considerations that analysts need to be aware of in order to include all relevant outcomes.

It also opens the possibility of considering non-health outcomes where necessary. The inclusion of non-health outcomes in economic evaluation is generally considered to be outside the scope of analysis if a healthcare system perspective is taken. If the inclusion of a non-health outcome increases the ICER of an intervention relative to a fixed cost-

effectiveness threshold, then its funding may come at the expense of other health outcomes, leading to a reduction in the productivity of the health system overall (314). However, the complex definition of pregnancy, and its status as a (non-)health condition itself, complicates the notion of a clean dividing line between health and non-health outcomes. The qualitative analysis demonstrated that some non-health outcomes are intrinsic to the decisions people make in pregnancy. While their valuation is uncertain, their existence is unquestionable. Given this, including certain non-health outcomes may make decision-making more consistent with societal preferences. The framework provides a structured tool to assess whether all relevant outcomes and concepts have been considered, either during the scoping stage of an economic evaluation, or in critical appraisal. Table 7.1 summarises the framework, by defining each lens and providing example context. In subsequent sections, I demonstrated how this framework can be applied to studies, and used to identify outstanding research questions.

7.6.1 Limitations

This is a provisional piece of work, and therefore contains a number of limitations. First, the framework is drawn from a single piece of qualitative research. Validation involving primary qualitative research, PPI, and input from relevant stakeholders (clinicians, decision makers, patient representatives) is needed to ensure its completeness and usability.

The framework derived from these lenses is intended to demonstrate the range of outcomes and considerations that need to be included for an analysis to reflect the goals of both patients and the healthcare system, and therefore to reduce bias in evaluations by over- or under- valuing effectiveness. The framework provides a guide to scoping the decision problem and important outcomes, but is not a tool for outcome measurement in itself. It is not a preference-based outcome measure, or a set of attributes for a stated preference study, although it could be used to inform the development of such tools. The

framework in its current form simply provides a guide to relevant outcomes and consequences for researchers to consider.

The framework is derived from qualitative analysis of interviews with participants discussing pregnancy. In considering the health economic applicability of each lens, adaptations have had to be made to ensure compatibility and relevance to current methods. This means that the current names of each lens may not perfectly reflect their current applicability to health economic methods. An example of this is the fetal health and wellbeing lens, which within the framework is limited to capturing the physical health outcomes of the fetus across its life course, but within the qualitative analysis (Chapter 5) and contextual analysis (Chapter 6) reflected a broader set of concepts relating to personhood, the parent-child relationship, and the intrinsic value of future lives. Further development and refinement of the framework, with input from relevant stakeholders, will be necessary to finalise the content of this lens.

7.7 CONCLUSION

This chapter has comprised three sections. First, an illustration of how the framework can be used to evaluate outcomes within a number of clinical areas. Second, a review of potential methods in light of their ability to address issues raised by the framework. Finally, a summary of the outstanding ethical and methodological questions raised by the framework

Together, these provide a demonstration of the potential value of the preliminary framework. They also summarise a number of issues still standing as barriers to progress in the field of economic evaluation in pregnancy.

In the next and final chapter, I will summarise the findings of the thesis, place them in the context of the literature, and outline the strengths and weaknesses of the thesis. I will also describe future research directions needed.

8 DISCUSSION

The aim of this chapter is to summarise the findings of the thesis, place them into context within the wider literature, discuss limitations, and outline future research required.

8.1 SUMMARY OF FINDINGS

The aims of the thesis were as follows:

1. To understand the current state of CUA in pregnancy.
2. To identify relevant outcomes in pregnancy using qualitative methods.
3. To consider how those outcomes might be integrated into health economic approaches.
4. To build a framework based on those outcomes to guide the development of new methods to better integrate pregnancy resource allocation into the wider decision-making process.

The overarching goal of the project was to advance the health economic understanding of pregnancy. Below I summarise the main findings.

8.1.1 Chapter 3: How are maternal and fetal outcomes incorporated into cost-utility analysis? A systematic review

The systematic review was developed to address aim 1: to understand the current state of CUA in pregnancy. The review identified 129 CUAs covering a wide range of clinical areas across all areas of pregnancy.

The primary findings of the review were that maternal and fetal health outcomes are not reported consistently. CUAs frequently excluded either maternal or fetal outcomes from the analysis, and the justification for this was rarely presented. More concerningly, there was little consistency within clinical areas. Within the same clinical area, some CUAs excluded fetal outcomes, and some maternal ones. This finding indicates that there is a

lack of standardisation within CUAs in pregnancy. This could lead to biased and inconsistent decision-making.

A secondary aim of the review was to identify methods used for combining maternal and fetal health outcomes. Four methods were identified, but by far the most common was simple addition of maternal and fetal QALYs. This approach essentially treats the fetus as a separate human being receiving treatment, and does not distinguish between the born and unborn. The second most common (but much rarer approach) was to not include fetal QALYs at all, and include fetal outcomes only in terms of their effects on maternal utility. Some studies used both, which amounts to a spillover model, where fetal health outcomes are quantified both for their own sake, and also for their effect on the health of the pregnant person.

8.1.2 Chapter 4: Are there existing methods that could be used to evaluate outcomes for economic evaluations in pregnancy?

This narrative review identified a range of methods and approaches that had either been applied in pregnancy or that were possible candidates for use in pregnancy. Candidates were methods that had features that addressed some of the challenges identified in Chapter 1.

In total, six methods were identified. Some have been considered in pregnancy already, such as capabilities and weighting, but for others (MCDA, spillovers) they have not been applied, or have been used to answer a slightly different question (such as the effects of pregnancy on the wider family, rather than within the dyad). No method addressed all the issues identified in Chapter 1. Instead, different methods offered approaches to handling different issues.

8.1.3 Chapter 5: What influences people's decision-making in pregnancy? A qualitative analysis

This chapter provided the first step in seeking to develop a new approach to economic evaluation. The aim was to understand what is important to pregnant people making decisions (primarily but not exclusively healthcare decisions) during pregnancy. I focused on decision-making in order to remain compatible with the basic assumptions of health preferences. However, the analysis took a broad approach to understanding the challenges pregnant people face, without imposing the norms of health economics pre-emptively. Given none of the methods identified in Chapter 4 were perfectly compatible with the challenges identified in Chapter 1, I anticipated that a new approach would be needed, and this provided the opportunity to explore the wider context of decision-making in pregnancy.

The secondary qualitative analysis resulted in the development of a set of lenses – ways of separating out the key components of decision-making. These were developed from the themes identified in the analysis, and relate to observations surrounding what is important to people when making decisions in pregnancy. I observed that decisions in pregnancy are multifaceted and that people facing similar decisions can make very different choices based on factors that exist outside the usual concepts of health. The development of the lenses provided a way of deconstructing people's preferences to show how these seemingly contradictory positions can be held coherently and rationally.

8.1.4 Chapter 6: Contextualising the outcome lenses within economic evaluation

This chapter contextualised the findings of the qualitative research within health economics, and laid the groundwork for the framework described in Chapter 7.

The lenses were not developed within an explicitly health economic framework, although they were developed with the intention of grounding the analysis in health economic ways

of thinking. The purpose of the contextual analysis was therefore to explicitly relate each of the lenses to health economic concepts, specifically concepts relating to CUA.

Through this analysis, I subdivided the lenses into two categories: outcome-based lenses and rights-based lenses. Outcome-based lenses include maternal and fetal health and wellbeing, and family building. These lenses lend themselves more simply to CUA, in that the associated outcomes are quantifiable. These lenses would still be challenging to include in an economic evaluation, in particular how they relate to each other. For example, there are health conditions such as pre-eclampsia which can place maternal and fetal wellbeing in tension, or certain diagnoses following antenatal screening can place fetal wellbeing at odds with the goals of family building.

Rights-based lenses are difficult to quantify. They relate to concepts that are either prerequisites for ethical care, or that cannot easily be quantified. Capability based measures of wellbeing may be useful for valuing these outcomes. Additionally, accounting for them may require additional steps in the analysis: a framing exercise to account for autonomy, morality and the social context may be helpful in ensuring that the evaluation is compatible with these lenses.

8.1.5 Chapter 7: Implementing the framework: applications in methods and applied research

This chapter described a preliminary framework based on the lenses that can be used to better account for relevant outcomes in economic evaluation in pregnancy. There are three parts to the chapter.

In the first part, I reviewed three relevant studies: the PHOENIX trial of early delivery for pre-eclampsia; the Birthplace Choices study; and the VALENTIA study of antenatal and newborn screening. For each study, I identified the relevant outcomes involved in the decision problem, and compared these to the framework (in the case of VALENTIA I used the existing taxonomy and qualitative findings). This comparative process highlighted both the strengths of each analysis, and identified gaps in the included outcomes.

Secondly, I used the framework to explore the strengths and weaknesses of the methods identified in Chapter 4. Each method was appropriate for evaluating at least one lens in the framework, but none could comprehensively address all of the issues raised.

Finally, I used the framework to outline areas of further research that are required in order to make the inclusion of all relevant outcomes feasible. This includes the valuation of future lives and the balancing of maternal and fetal outcomes, in light of both the valuation of future lives and the prerequisite of maternal autonomy.

8.2 CONTRIBUTION

This thesis primarily contributes to the literature relating to how outcomes are measured and valued in economic evaluations of pregnancy. The literature has primarily been concerned with the inclusion or exclusion of fetal health outcomes in CUA. Previous studies have identified that the decision to include or exclude fetal QALYs can materially affect cost-effectiveness estimates (82) and that studies have included or excluded these outcomes in a non-systematic way, leading to the potential for bias (81).

The growing literature on outcome measurement and valuation in the context of ART grapples with the question of when and in what context it is reasonable to value future lives (7.5.1). In this case, the lives in question are pre-conception, and purely hypothetical at the point of the intervention. This contrasts with the setting considered here, where a pregnancy is already in progress⁵. While legally a fetus does not have a right to medical care (273), the philosophy and medical ethics literature concerning the moral and ethical case for care during pregnancy suggest a more complex picture (1.4.2). In earlier chapters, I have described some of the many forms of healthcare that are provided to pregnant people solely in order to improve the health and life chances of the fetus. This

⁵ Although even here, the impact of intervention in the current pregnancy on future pregnancies is still pertinent. For example, anti-D treatment for Rhesus negative pregnant people is primarily to prevent haemolytic disease in subsequent pregnancies.

indicates that fetal health outcomes are already considered to be of value to the health system, and to wider society.

However, fetal outcomes make up only part of the picture. In the systematic review (Chapter 3), I identified that existing CUAs often exclude maternal health outcomes. This may be justifiable if maternal health is unaffected by an intervention, but this is a strong assumption given that all interventions are by necessity administered to the pregnant person. Even if they are not the intended beneficiary, any adverse effects will also fall on them. This is even before one considers the spillover effects of negative health outcomes for the fetus. While fetal outcomes are widely discussed, in this thesis I have also tried to address the question of how to properly include maternal outcomes.

In line with this, the qualitative secondary analysis (Chapter 5) takes a broad approach to the question of ‘what are the relevant outcomes in pregnancy?’ by asking what is important to people with lived experience when making decisions during their pregnancies, across a range of clinical contexts. This approach follows prior studies that have sought to use qualitative research to build a concept of the relevant features of a condition, in order to develop new methods for outcome measurement and valuation (124,200,243,244). The qualitative research is not specifically focussed on outcome development, and in this way sits alongside qualitative health economic studies that have developed frameworks and conceptual models for complex health conditions and clinical contexts, including end of life care (315) and clinical genetics (316).

The work in this thesis adds to the theoretical discussion around pregnancy, and tries to bridge the gap between the theoretical discussion and economic evaluations by providing a preliminary framework of outcomes and requirements, built on the concept of lenses through which decisions can be viewed. The framework requires further development, but in Chapter 7 I use it to show how it can be used to deconstruct decision problems into their relevant outcomes and considerations. It also illuminates outstanding research

questions relating to the interaction between different outcomes and the normative questions around valuation of non-health outcomes.

Key within the framework is the inclusion of both outcomes-based and rights-based lenses. This weaves together the key issues of how to include both maternal and fetal outcomes, the challenges surrounding the inclusion of fetal outcomes, and the ethical quandaries raised by the state of pregnancy, including the need to safeguard maternal autonomy, including moral autonomy, and the complex social context in which pregnancy exists.

Taken together, the findings of this thesis amount to a new way of thinking about economic evaluation of interventions during pregnancy. While prior research has focussed on the inclusion or exclusion of fetal outcomes, the analysis here shows that pregnancy is a life experience in which the health outcomes of the baby within a specific pregnancy make up only one component (albeit an important one that drives much crucial decision-making). Creative thinking will be required to address the many issues raised, especially the issues relating to the role of the family, of one's ethics and social context, and of considering the baby's future quality of life in decisions.

While the findings of this thesis are at an interim stage, the framework provides a structure for researchers to consider how an intervention affects the full range of experiences and outcomes encountered in pregnancy. This provides a foundation for future research and sets a challenge for others to engage with these findings.

8.3 FUTURE RESEARCH

This project has indicated many avenues for further research. The current outputs are the presentation of a set of lenses that frame the outcomes and considerations that are relevant to an economic evaluation of interventions in pregnancy, and a framework built on those lenses. These together indicate the need for new methods and approaches in this field, reflecting the full range of relevant considerations.

8.3.1 Reporting standards

The systematic review in Chapter 3 highlighted inconsistencies in how outcomes are measured in CUAs of pregnancy. There were gaps in reporting in many studies, particularly to do with the assumptions made about whether to include or exclude outcomes. While 72 papers excluded either maternal or fetal outcomes from the analysis, only 4 explained the decision to exclude and justified the assumption that the excluded outcomes were unaffected by the intervention.

Other assumptions that were often not stated explicitly included the assumption that fetal life years were lived in full health, with an assigned HRQoL of 1. In total 63% of studies did not report any sources for HRQoL values. Sources for life expectancy were similarly missing in almost half of cases.

There is a need for guidance to ensure transparency in reporting and consistency in approaches. The choice to include or exclude outcomes can substantially affect cost-effectiveness estimates (81,82). Concerningly, the systematic review did not find consistency in which outcomes were included or excluded even within studies evaluating interventions in the same clinical area.

The lack of nuanced HRQoL estimates and over-reliance on the assumption that pregnant people and babies are living years of life in perfect health may also be due to the lack of HRQoL estimates in these populations. There are now a small number of estimates of utility during pregnancy (for example, 68,69), and the valuation of child health is an area of active development (318).

Delphi methodology has been used in health economics in the development of guidelines and checklists, and could here be used in the development of a reporting standard for economic evaluations of pregnancy (319,320). This methodology systematically gathers perspectives from a range of experts on a subject, using a structured process in which opinions are solicited, feedback is shared, the questions are refined, and gradually

consensus is sought (321). This methodology may also have applicability in the development of other guidance within this field.

In the interim, authors should be explicit in the assumptions made around health valuation and the inclusion or exclusion of outcomes. Data sources may be limited, particularly regarding the long-term health consequences of conditions during pregnancy and birth, so explicitly stating any assumptions made, and the sources of evidence used, is crucial.

The development of reporting standards in this field would be immediately beneficial by increasing transparency and providing both guidance and accountability surrounding these assumptions.

8.3.2 Development and validation of the framework

A crucial next step would be to seek external input to develop the framework. This input could come from patients, clinicians, health economists and other stakeholders.

Qualitative validation could involve focus groups with pregnant people and those with experience of pregnancy to explore each of the lenses further and seek areas of consensus and disagreement.

Workshops with key stakeholders including clinicians, patient representatives and members of decision-makers such as NICE would be valuable in the qualitative development and validation of the framework.

8.3.3 Quantitative research

The framework is currently a qualitative piece of work. As discussed in Chapters 6 and 7, the quantification of outcomes in pregnancy is controversial and may not always be appropriate, as in the case of rights-based lenses. However, where quantification is possible, it improves the transparency and consistency of decision-making, and is therefore a desirable goal of further research.

Quantitative research questions could include the valuation of fetal health outcomes, both morbidity and mortality. Quantification of the harm of fetal loss, at different points of pregnancy and in a range of clinical contexts, would be particularly valuable. This could be done using stated preference methodology, such as discrete choice experiments.

8.3.4 Quality of life instruments

There is also a need for the development of preference-based quality of life instruments that are applicable in pregnancy. Condition-specific measures exist, such as birth-experience measures, and generic preference-based measures such as the EQ-5D address some outcomes in pregnancy. However, many aspects of pregnancy identified here are not fully captured by existing instruments. Family building and autonomy in particular are crucial drivers of preferences and decision-making but are not captured in current measures.

8.1 LIMITATIONS

This project contains a number of limitations. The thesis is heavily built on literature reviews. However, pregnancy is a very broad clinical area, and this makes it difficult to conduct truly comprehensive searches. Where possible I built search strategies on existing, validated searches (such as the PEDE database (136)) but it is possible some papers may have been missed, particularly if studies primarily referred to a clinical condition of pregnancy (for example, pre-eclampsia) rather than pregnancy itself. Similarly, the collation of relevant methods in Chapter 4 relied heavily on forward and backward citation searching, due to the lack of an obvious, comprehensive search strategy that would fulfil the identification criteria, and so studies may have been missed if they did not link to existing literature.

The qualitative analysis was conducted using previously collected data. This meant I was not able to ask my own questions of the participants, either to ask for clarification or to pursue topics further as they came up. This may have led to some findings being missed,

as I was solely reliant on what interviewers asked and participants chose to share in the context of the initial research question. Additionally, as previously noted, the breadth of pregnancy experiences is vast and interviews were not available for analysis on every topic or context. Nonetheless, I sought to include a diversity of experiences, allowing my analysis to be one of attunement to different experiences around decision-making in pregnancy, rather than claiming to be exhaustive. Relatedly, the lenses and framework have also not been validated. I therefore cannot confirm whether the framework is valid in a broader population. Further development and validation would be valuable.

The project also lacks a quantitative component. Many of the issues raised are quantitative in nature: how much value should be applied to fetal outcomes and in what circumstances, in particular. The qualitative approach has been valuable in setting the context into which quantitative research can be performed, but currently the outputs from this thesis are limited in their applicability in economic evaluation, and this is an area for future research.

Finally, as doctoral research this has been a solitary project. A more collaborative approach might have thrown up new ideas and challenged my own assumptions further. This project relied exclusively on my own perspective, with input from PPI, supervisors and other advisors, and will have been strongly shaped by that perspective.

8.2 CONCLUSION

This thesis makes the case that how pregnancy is understood and approached in economic evaluation needs to be rethought. Existing evaluations have relied on a conceptual model of pregnancy that is not consistent with either pregnant people's preferences, the clinical understanding of pregnancy, or the philosophical literature on the relationship between pregnant person and fetus. This has led to inconsistent inclusion of outcomes, and assumptions being made with respect to outcomes that are often unfounded, and at worst unethical.

This thesis presents a new preliminary framework of pregnancy outcomes and considerations, built on qualitative research and grounded in health economic approaches. This is intended to facilitate further development within the field of economic evaluation of pregnancy, and to help researchers working in this area consider how best to account for all relevant outcomes in their analysis.

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APPENDIX

CHAPTER 3: DATA EXTRACTION ITEMS FROM THE SYSTEMATIC REVIEW

Appendix 1. Data extraction items

Category	Item	Definition	Responses
Citation	First author		
	Year		
	Title		
	Journal		
	Funding category	Broad funding category	Industry, public sector, charity
	Excluded?		Yes, no
	Exclusion reason		
Background	Country		List
	Stage of use	When the intervention is used (gestational weeks to be converted to trimester)	First trimester, second, third, labour, throughout
	Intervention type		List

	Intervention category		List
	Condition	What condition is modified by the intervention (or, where the intervention is not condition-specific, list the context of the intervention)	List
	Condition category		
	Intervention target	Mother, fetus, both	Defined according to whether the condition being treated affects the clinical health outcomes of the mother or not.
	Individual data	Analysis based on individual patient data	Yes, no
	Model	Analysis based on decision model	Yes, no
	Time horizon	Time horizon used	List
	Discount rate outcomes	What discount rate is used for outcomes	List
Evaluation methods	Outcome	QALY, DALY, LYG, case (list)	List
	Maternal outcomes?	Were maternal outcomes included in the CE estimate?	Yes, no
	Maternal mortality?	is maternal mortality accounted for in the QALY?	Yes, no

	Maternal short-term morbidity?	Are short term QoL outcomes included?	Yes, no
	Maternal long-term morbidity?	Are long term QoL outcomes included?	Yes, no
	Maternal life expectancy	Maternal life expectancy	List
	Utility method	Questionnaire, direct elicitation, other	List
	Fetal outcomes?	Were fetal outcomes included in the CE estimate?	Yes, no
	Fetal mortality?	Is fetal mortality accounted for in the QALY?	Yes, no
	Fetal morbidity?	Is fetal morbidity accounted for in the QALY?	Yes, no
	Fetal life expectancy	Fetal life expectancy	List
	Utility method	Questionnaire, direct elicitation, other	List
	Healthy utility = 1?	Are healthy outcomes assigned a utility of 1?	Yes, no
	Excluded outcomes justified?	If either maternal or fetal outcomes are excluded, is a justification provided?	Yes, no
	Maternal /fetal outcomes weighted?	Are fetal outcomes weighted or discounted in some way different to maternal outcomes?	Yes, no

	More than one outcome?	Is more than one outcome measure reported in the results?	Yes, no
	Weights varied in sensitivity analysis?		Yes, no

Appendix table 1. Data extraction items. (*CE*, cost-effectiveness; *DALY*, disability-adjusted life year; *LYG*, life-year gained; *QALY*, quality-adjusted life year; *QoL*, quality of life).

Appendix 2. Summary of included studies and outcomes reported.

Outcomes are included if they are converted into QALYs or DALYs and used to calculate a cost-effectiveness ratio.

First Author	Year	Funding	Country	Time of use	Intervention type	Maternal outcomes	Fetal outcomes
Adam	2005	WHO	Asian and African LICs	Throughout	Various	Yes	Yes
Albright	2017	Not reported	USA	Third trimester	Screening	No	Yes
Atkins	2016	Non-profit, Industry	USA	Not reported	Vaccination	Yes	Yes
Avram	2019	Government	USA	Labour	Screening	Yes	Yes
Bak	2019	Not reported	USA	Second trimester	Ultrasound	Yes	Yes
Baker	2004	Industry	USA	Second trimester	Screening	No	Yes
Beigi	2009	Government	USA	Not reported	Vaccination	Yes	Yes
Bickford	2013	Government	Canada	Third trimester	Preventive treatment	No	Yes
Binkin	1989	Government	USA	Third trimester	Screening	Yes	Yes
Bowser	2018	Non-profit	Nigeria	Throughout	Antenatal care	Yes	Yes

First Author	Year	Funding	Country	Time of use	Intervention type	Maternal outcomes	Fetal outcomes
Bristow	2016	Industry	Malawi	Not reported	Screening	No	Yes
				Second			
Broekhuizen	2018	Government	Europe	trimester	Behavioural	Yes	No
				Second			
Bullard	2018	Not reported	USA	trimester	Abortion ban	Yes	Yes
				Second	Preventive		
Cahill	2011	Not reported	USA	trimester	treatment	Unclear	Yes
Chaillon	2019	Industry	USA	Throughout	Screening	Yes	No
					Preventive		
Chilcott	2003	Government	UK	Third trimester	treatment	No	Yes
			Ghana, Kenya, Malawi,		Preventive		
Choi	2017	Government	Mozambique, Tanzania	Throughout	treatment	Yes	Yes
Chowers	2017	Not reported	Israel	Not reported	Screening	No	Yes
Chung	2001	Government	USA	Labour	Delivery method	Yes	Yes
				Second			
CipriaNo	2010	Government	Canada	trimester	Screening	Yes	Yes
ClenNon	2019	Not reported	USA	Throughout	Surrogacy	Yes	Yes

First Author	Year	Funding	Country	Time of use	Intervention type	Maternal outcomes	Fetal outcomes
Colbourn	2007	Government	UK	Third trimester	Screening	No	Yes
Culligan	2005	Not reported	USA	Labour	Delivery method	Yes	Yes
Dalziel	2010	Government	Australia, New Zealand	Throughout	Supplementation	No	Yes
Dosiou	2012	Government	USA	First trimester	Screening	Yes	No
				Second			
Einerson	2016	Not reported	USA	trimester	Screening	No	Yes
			Bangladesh, Burkina				
Engle-Stone	2019	Not reported	Faso	Throughout	Supplementation	No	Yes
				Second			
Evers	2019	Not reported	USA	trimester	Screening	No	Yes
Fan	2014	Not reported	USA	Not reported	Screening	No	Yes
				Second			
Fasawe	2013	Not reported	Malawi	trimester	Antivirals	Yes	Yes
				Second	Preventive		
Faye	2018	Government	Senegal	trimester	treatment	Unclear	Unclear
				Second			
Feldhaus	2016	Government	Nepal	trimester	Supplementation	Yes	Yes

First Author	Year	Funding	Country	Time of use	Intervention type	Maternal outcomes	Fetal outcomes
Fobelets	2018	Government	Belgium, Germany, Italy, Ireland	Labour	Delivery method	Yes	Yes
Fobelets	2019	Government	Germany, Italy, Ireland	Labour	Delivery method	Yes	No
Ginsberg	2013	Not reported	Israel	Third trimester	Screening	No	Yes
Giorgakoudi	2018	Charity	UK	Not reported	Vaccination	Yes	Yes
Goodacre	2018	Government	UK	Not reported	Clinical decision rule	Yes	No
Goodman	1999	World Bank	Low income country (unspecified)	Throughout	Preventive treatment	No	Yes
Goodman	2017	Non-profit	Ghana	Labour	Quality improvement	Yes	Yes
Grosse	2008	Government	USA	Throughout	Supplementation	No	Yes
Guo	2012	Government	China	Not reported	Vaccination	Unclear	Yes
Harris	2004	Government	USA	First trimester	Prenatal testing	Yes	Yes
Hersh	2018	Not reported	USA	Throughout	Screening	Yes	Yes
Hersh	2019	Not reported	USA	Third trimester	Delivery method	Yes	Yes
Hong	2010	Government	China	Not reported	Screening	No	Yes

First Author	Year	Funding	Country	Time of use	Intervention type	Maternal outcomes	Fetal outcomes
Hopkins	2008	Not reported	Canada	second trimester	Screening	No	Yes
Hoshi	2018	Government	Japan	Not reported	Vaccination	Yes	Yes
Ishikawa	2016	None	Namibia, Kenya, Haiti, Vietnam	Not reported	Screening	No	Yes
Jain	2016	Not reported	USA	Second trimester	Screening	No	Yes
Jentink	2012	None	Europe	Throughout	Anti-epileptic Treatment	No	Yes
Jit	2010	Government	England, Wales	Second trimester	Vaccination	Yes	Yes
Jo	2019	Charity	Bangladesh	Throughout	Antenatal care	Unclear	Yes
Jones	2019	Government	UK	Throughout	Behavioural	Yes	Yes
Kaimal	2015	Industry	Not reported	First trimester	Prenatal testing	Yes	No
Kashi	2019	Not reported	Pakistan, India, Bangladesh	Throughout	Supplementation	Yes	Yes
Killie	2007	Not reported	Norway	Second trimester	Screening	No	Yes

First Author	Year	Funding	Country	Time of use	Intervention type	Maternal outcomes	Fetal outcomes
Kim	2018	Government	South Africa	Not reported	Tuberculosis treatment	Yes	No
Kingkaew	2016	Government, Non-profit	Myanmar	Throughout	Antenatal care	Yes	Yes
Kuznik	2012	Industry	Uganda	Second trimester	Antivirals	No	Yes
Kuznik	2013	Industry	Sub-Saharan Africa	Not reported	Screening	No	Yes
Kuznik	2015	Government, Industry	Asian and Latin- American LMICs	Not reported	Screening	No	Yes
Lee	2016	Not reported	USA	Third trimester	Delivery method	Yes	Yes
Lee	2018	Government	South Korea	Third trimester	Antivirals	No	Yes
Little	2005	Not reported	USA	Third trimester	Antivirals	Yes	Yes
Lugner	2010	Not reported	Netherlands	Not reported	Screening	No	Yes
Lugner	2013	Government	Netherlands	Third trimester	Vaccination	Yes	Yes
Marseille	1998	Government	Sub-Saharan Africa	Third trimester	Antivirals	No	Yes
Mbonye	2008	Government, Charity	Uganda	Second trimester	Preventive treatment	Yes	Yes

First Author	Year	Funding	Country	Time of use	Intervention type	Maternal outcomes	Fetal outcomes
McCabe	2010	Government	USA	Third trimester	Antivirals	No	Yes
		Government,					
Memirie	2019	Charity	Ethiopia	Throughout	Various	Yes	Yes
				Second			
Miller	2013	Not reported	USA	trimester	Screening	No	Yes
				Second			
Mission	2012	Government	USA	trimester	Screening	Yes	Yes
				Second			
Mistry	2013	None	UK	trimester	Screening	Yes	Yes
Mone	2018	Government	Ireland	First trimester	Screening	No	Yes
Mrus	2000	Not reported	USA	Labour	Delivery method	Yes	Yes
Mrus	2004	Government	USA	Labour	Screening	Yes	Yes
Musci	2005	Government	USA	Not reported	Screening	Yes	No
Myers	2011	Industry	USA	First trimester	Vaccination	Yes	Yes
				Second			
Odibo	2006	Not reported	USA	trimester	Screening	No	Yes
Odibo	2009	Not reported	USA	Not reported	Surgery	No	Yes

First Author	Year	Funding	Country	Time of use	Intervention type	Maternal outcomes	Fetal outcomes
OhNo	2011	Government	USA	Not reported	Preventive treatment	Yes	Yes
Oostdam	2012	Government	Netherlands	Second trimester	Behavioural	Yes	No
Oster	2014	Industry	USA	Third trimester	Vaccination	No	Yes
Owusu-Edusei	2011	Not reported	Sub-Saharan Africa	First trimester	Screening	Yes	Yes
Owusu-Edusei	2014	None	China	Not reported	Screening	Yes	Yes
Pilgrim	2009	Government	UK	Third trimester	Preventive Treatment	No	Yes
Plunkett	2004	Government	USA	Labour	Delivery method	Unclear	Yes
Plunkett	2005	Government	USA	Not reported	Screening	Yes	Yes
Rowley	1998	Government	USA	Not reported	Screening	Yes	Yes
Sabin	2012	Government, Charity	Zambia	Labour	Training	No	Yes
Saramago	2018	Government	UK	First trimester	Screening	No	Yes
Schackman	2007	Government, Charity	Haiti	Second trimester	Screening	No	Yes

First Author	Year	Funding	Country	Time of use	Intervention type	Maternal outcomes	Fetal outcomes
Scott	2018	Government	USA	Labour	Screening	No	Yes
				Second	Preventive		
Shah	2011	Government	Nigeria	trimester	treatment	No	Yes
Shmueli	2012	Government	Israel	Not reported	Screening	No	Yes
					Preventive		
Sicuri	2010	Charity	Mozambique	Not reported	treatment	Yes	Yes
Sicuri	2011	Not reported	Spain	Not reported	Screening	No	Yes
				Second			
Sinkey	2018	Not reported	USA	trimester	Screening	Yes	Yes
Subramaniam	2019	Not reported	USA	Labour	Sterilisation	Yes	No
Svefors	2018	Government	Bangladesh	First trimester	Supplementation	No	Yes
Tasillo	2019	Not reported	USA	First trimester	Screening	Yes	No
				Second			
Terris-Prestholt	2003	Charity	Tanzania	trimester	Screening	No	Yes
				Second	Preventive		
Thung	2005	Not reported	USA	trimester	treatment	No	Yes
Thung	2005	Not reported	USA	Not reported	Screening	No	Yes

First Author	Year	Funding	Country	Time of use	Intervention type	Maternal outcomes	Fetal outcomes
Tilden	2015	Charity, Government	USA	Labour	Delivery method	Yes	No
Torrance	1984	Not reported	Canada	Third trimester	Preventive treatment	No	Yes
Trevillion	2020	Government	UK	Third trimester	Behavioural	Yes	No
Tuite	2011	Government	Canada	Second trimester	Screening	No	Yes
Tweya	2016	Not reported	Malawi	Not reported	Preventive treatment	No	Yes
Van Bellinghen	2018	Industry	Australia	Third trimester	Vaccination	Unclear	Yes
van den Akker-van Marle	2005	Government	Netherlands	Third trimester	Preventive treatment	No	Yes
VanDeusen	2015	Government	Ghana	Throughout	Antivirals	Yes	Yes
van't Hooft	2016	None	Netherlands	Labour	Fetal monitoring	No	Yes
Vickerman	2006	Government, Charity	Tanzania	Not reported	Screening	No	Yes
Wang	2019	Government	China	Throughout	Antivirals	Yes	Yes

First Author	Year	Funding	Country	Time of use	Intervention type	Maternal outcomes	Fetal outcomes
Wastlund	2019	Government	UK	Third trimester	Screening	Yes	Yes
Watson-Jones	2005	Government, Charity	Tanzania	Not reported	Screening	No	Yes
Werner	2015	Not reported	USA	Second trimester	Screening	No	Yes
Werner	2015	None	USA	Throughout	Preventive treatment	No	Yes
Wilkinson	2000	Not reported	South Africa	Not reported	Preventive treatment	No	Yes
Willcox	2017	Charity	Ghana	Labour	Training	No	Yes
Willcox	2019	Government, Charity	Ghana	Throughout	Antenatal care	Yes	Yes
Wymer	2014	Not reported	USA	Labour	Delivery method	Yes	Yes
Yieh	2018	Government	USA	First trimester	Preventive treatment	No	Yes
Zeng	2018	Not reported	Zambia	Throughout	Funding model	Yes	Yes
Zhang	2019	WHO	Cambodia	Not reported	Screening	No	Yes

First Author	Year	Funding	Country	Time of use	Intervention type	Maternal outcomes	Fetal outcomes
Zulliger	2014	Charity	South Africa	Throughout	Preventive treatment	No	Yes

Appendix table 2. Summary of included studies and outcomes reported. (LMIC, low- and middle-income country; UK, United Kingdom; USA, United States of America; WHO, World Health Organization)

CHAPTER 4: ADDITIONAL SEARCHES

Appendix 3. MCDA searches conducted in Pubmed

Search conducted 12 June 2025

Terms: (multicriteria decision) AND ((pregnan*) OR (gestation) OR (gravid) OR (antenatal) OR (birth))

No restrictions on publication date or language.

Results:

18 results found

11 results after abstract review

The majority of studies reviewed (n=6) used MCDA in the development and validation of risk assessment models to support clinical decision making.

One study used MCDA to develop a decision support tool for public health decision making. Specifically, for the ranking of potentially teratogenic medications in terms of their risks to pregnancy, for the purposes of deciding which drugs to prioritise for additional monitoring and risk mitigation.

(<https://link.springer.com/article/10.1007/s40264-024-01488-4>)

One study used MCDA in the development of a deprivation index, but did not specifically focus on pregnancy. ([https://ij-](https://ij-healthgeographics.biomedcentral.com/articles/10.1186/s12942-015-0004-x)

[healthgeographics.biomedcentral.com/articles/10.1186/s12942-015-0004-x](https://ij-healthgeographics.biomedcentral.com/articles/10.1186/s12942-015-0004-x))

One study used MCDA in the development of a resource allocation tool for decision prioritisation, but did not specifically focus on pregnancy.

(<https://pubmed.ncbi.nlm.nih.gov/35673026/>)

One study used MCDA in the development of a resource allocation tool for decision prioritisation, but the setting was postnatal care.

<https://bmchealthservres.biomedcentral.com/articles/10.1186/s12913-018-3430-1>

Two studies were identified that used MCDA in resource allocation decisions in pregnancy

(<https://bmcpregnancychildbirth.biomedcentral.com/articles/10.1186/s12884-022-04481-w>)

CHAPTER 5: SCREENING FRAMEWORK FOR QUALITATIVE INTERVIEWS

Aim: The aim of the screening process is to identify the interviews that I am going to analyse in depth. The aim of the secondary analysis is to explore how women conceptualise their fetus/baby and what choices they face and how they feel about those choices.

What I'm expecting to find/looking for:

- Discussion of what kind of choices women face (clinical, lifestyle, personal, etc), and how they feel about those choices and perceive them in their wider context (eg, do they feel like choices at all).
- Language relating to their baby, and how they think about it in relation to personhood. Is it a baby or a fetus or is it not really mentioned? For example, what pronouns or nicknames are used.
- Emotions relating to being pregnant and anticipating the future.
- Anything else that's listed in the context of decision making or planning which might be important to women (eg, the opinions of health care workers or family members, presence of existing children, public health campaigns, etc)
- Maternal physical and mental health – including threats to it.

What I'm less interested in:

- Discussion of clinical information. The specific types of conditions being experienced.
- The experience of partners.

Categorising interviews:

Interviews will be sorted into one of three categories:

1. Highly relevant – where large amounts of text reference the above points of interest, or feel relevant to the overall question

2. Maybe relevant – where some of the points above are addressed, or something catches my interest as potentially worth looking into
3. Unlikely to be relevant – very little discussion of the points above.

CHAPTER 7: EXAMPLE FRAMEWORK

Scoping a decision problem

This document is intended to guide researchers who want to use the framework with scoping of a decision problem, or critically appraise an existing economic evaluation.

The lenses are built on qualitative analysis conducted from the point of view of pregnant people. It can be applied to economic evaluations informing policy decisions to ensure patient preferences are reflected. However, there may be additional considerations or exclusions depending on the perspective of the decision maker the analysis is intended to inform.

The framework can be applied to economic evaluations of various forms, including cost-utility analysis, cost-effectiveness analysis, and cost-consequence analysis. The aim is not to prescribe a methodology, but to encourage researchers to consider all possible outcomes and evaluate the normative judgements implied by those outcomes.

For each lens, list:

- All clinical and quality of life outcomes or relevant experiences that are associated with that lens.
- Additional considerations presented by the lens to the decision problem:
 - Non-measurable outcomes or experiences
 - Relevant legal restrictions, if applicable (for example, laws governing termination)
 - Ethical concerns pertaining to a relevant population (for example, disability rights or equity considerations)
- If critically appraising an existing analysis, the considerations column can also be used to discuss missing outcomes.

For each outcome or consideration, consider

- Whether it will be affected by the intervention in question. If not, it can be safely excluded.
- Whether it is a measurable outcome. If so:
 - what methods are available to quantify the effect?
 - Is the outcome compatible with the perspective being used?
 - If not, could it be included as a secondary or scenario analysis?
 - Are any outcomes likely to be affected in opposing directions by the intervention?
 - For example, scheduled induction may improve fetal outcomes but increase the chance of instrumental delivery.
 - Consider how to handle this, for example through scenario analysis.
- If non-measurable, does the consideration place any constraints on the scope of the analysis or alter the frame of reference of study?
 - For example, are there any options that must be included or excluded on ethical grounds.
- Consider what normative judgements are implied by the outcomes selected.
 - For example:
 - Reducing caesarean births implies a preference for vaginal delivery.
 - Reducing births after antenatal screening implies a preference against the birth of disabled babies.
 - Assigning a lifetime of QALYs to fetal outcomes implies that pregnancy loss is equivalent to neonatal death.
 - Normative judgements are inevitable, and should be acknowledged within the evaluation.

Lens	Definition	Outcomes	Non-measurable considerations or modifiers	Possible methods
Autonomy	Having a sense of control, safety, and bodily integrity during pregnancy, labour and birth.	<i>Birth experience measures.</i> <i>Feelings of safety and control during birth.</i> <i>Diagnostic information from screening.</i> <i>Alignment of planned birth with experienced birth (eg, hospital transfer or emergency c-section during labour).</i> <i>Rate of PTSD-FC.</i> <i>Capability for chosen infant feeding approach.</i>	<i>Are some outcomes being used as proxies for “good” outcomes? Eg, rate of normal birth.</i> <i>Is it possible to directly measure feelings of safety?</i>	Capabilities Birth experience measures Mental health outcomes
Maternal health and wellbeing	Mental and physical health, quality of life,	<i>Short and long-term morbidity</i> <i>Maternal mortality</i>	<i>Are there any long-term health outcomes associated with the intervention?</i>	Preference-based measures Spillovers

	and ability to live the life you want.	<i>Mental health Ability to perform usual activities Ability to care for the baby Grief Pre- or post-natal hospitalisation Spillovers from neonatal outcomes.</i>	<i>Is the time horizon sufficient to capture these?</i>	Pregnancy-specific HRQoL measures Birth experience measures Economic outcomes (eg, employment)
Fetal health and wellbeing	The mental and physical health of the baby who received the intervention <i>in-utero</i> over the lifecourse. The health of the unique individual who will result from this pregnancy.	<i>Short and long-term morbidity Infant disability Perinatal mortality Pregnancy loss NICU admission Prematurity</i>	<i>Consider gestational age at pregnancy loss. How are fetal outcomes being valued? Higher than maternal ones? Lower? What normative judgements are implied by this.</i>	Spillovers Separate weighting of fetal QALYs Child-specific HRQoL measures Non-health outcomes (eg, education)
Family building	The role of the pregnancy within the family.	<i>Infant disability Family spillover effects Reproductive capacity</i>	<i>Are there spillovers to partner and any siblings?</i>	Spillovers to parents and siblings Separate weighting of fetal QALYs

	The wellbeing of the spouse, siblings, and wider family. Ability to conceive the desired number of children.	<i>Pregnancy loss</i>	<i>If there is pregnancy loss or termination, is there likely to be subsequent conception?</i>	Child-specific HRQoL measures
Social context	How the pregnancy affects the social interactions of the pregnant person. The positive and negative social interactions resulting from the pregnancy, including mutual support, community, judgement, stigma and isolation.	<i>Maternal mental health</i> <i>Hospitalisation</i> <i>Continuity of care</i> <i>Relationship with healthcare professionals</i> <i>Access to support from friends and family</i> <i>Isolation and stigma</i>	<i>Is there stigma associated with particular diagnoses?</i> <i>Are some interventions/outcomes likely to lead to isolation? For example, hospitalisation.</i> <i>Are there normative judgements implied by the way the intervention is administered? For example that a positive anomaly diagnosis should be terminated.</i>	Capabilities Condition-specific measures (eg, mental health)
Moral	The personal moral, ethical and religious beliefs of the pregnant person.	<i>Attitude to termination</i> <i>Decisions around antenatal screening</i> <i>Birthplace preferences</i>	<i>Are there relevant laws governing the intervention?</i> <i>Is it possible to measure the impact of beliefs on decision making?</i>	Capabilities Framing and scoping to enable decision making in accordance with beliefs

	Being able to make choices and act in accordance with those beliefs.			
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Appendix table 3. *A completed version of the framework, with example outcomes for each item and prompts of additional considerations. The outcomes and considerations are non-exhaustive. (NICU, neonatal intensive care unit; PTSD-FC, post-traumatic stress disorder following childbirth; QALY, quality-adjusted life-year).*

Lens	Definition	Outcomes	Non-measurable considerations or modifiers	Possible methods
Autonomy	Having a sense of control, safety, and bodily integrity during pregnancy, labour and birth.			
Maternal health and wellbeing	Mental and physical health, quality of life, and ability to live the life you want.			
Fetal health and wellbeing	The mental and physical health of this baby throughout its life. The health of the unique individual who will result from this pregnancy.			
Family building	The role of the pregnancy within the family.			

	The wellbeing of the spouse, siblings, and wider family.			
Social context	How the pregnancy affects the social interactions of the pregnant person. The positive and negative social interactions resulting from the pregnancy, including mutual support, community, judgement, stigma and isolation.			
Moral	The personal moral, ethical and religious beliefs of the pregnant person. Being able to make choices and act in accordance with those beliefs.			

Appendix table 4. A clean version of the framework provided for users to complete with their own economic evaluation or study

