

Pregnancy research review

Policy report

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Preface

This report sets out the findings of a study – commissioned by the UK Clinical Research Collaboration and funded by NIHR and Wellcome Trust – that aimed to understand the pregnancy-research landscape in the UK, analyse the level of funding for pregnancy research in the UK, and understand the extent to which funded research addresses the research priorities identified by stakeholders. This report focuses on presenting the key policy-relevant messages emerging from the work. It is accompanied by a data and methods report that sets out the methods used for the study, and presents in detail the results of the study and the data it produced.

This policy report is likely to be of interest to research funders and policymakers, as well as those working in research or healthcare provision related to pregnancy. It may also be of interest to members of the public, particularly those with experience of pregnancy or pregnancy-related issues.

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PREGNANCY RESEARCH IN THE UK

£255 million
spent on pregnancy research
from 2013 – 2017 in the UK

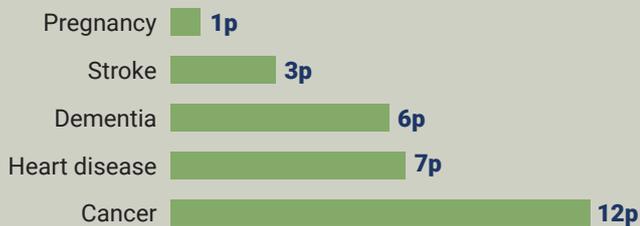


This equates to an annual average
spend during that period of
£51 million



By comparison, pregnancy-related care costs the NHS £5.8 billion per year.
For every £1 spent on pregnancy care in the NHS, around 1p is spent on research.

RESEARCH FUNDING FOR EVERY £1 SPENT IN THE NHS FOR DIFFERENT HEALTH CONDITIONS



Source: RAND Europe analysis, building on work of Luengo-Fernandez, Leal, and Gray (2015)

TOP 10 FUNDERS BY FUNDING AMOUNT, IN £1M (ADJUSTED TO 2018 VALUES) 2013-2017



Source: RAND Europe analysis



Litigation claims related to pregnancy are around **fifty times** current pregnancy research spend, estimated at **£2.5bn in 2018/19** (NHS Resolution 2019)

Priority areas for research, selected by all stakeholders



Preventing & managing **mental health** problems



Reducing & preventing **preterm birth**



Birth experiences and postnatal **mental health**



Inequalities in pregnancy outcomes by level of **deprivation**



Medications safe to take during pregnancy



Nausea and vomiting in pregnancy



Detecting & reducing the risk of **stillbirth**



Preventing & managing **pre-eclampsia**



Supporting **breastfeeding**



Long-term effects of **induction**



1 Introduction

1.1. Context and aims

It is essential to base decisions about research investment on the best available evidence, particularly when funding comes from a limited public purse. However, assessing priorities in health research can be challenging given the need to balance multiple factors, including societal needs, research capacity and potential return on investment. Understanding societal needs ideally involves gathering views from stakeholders with varying interests, experiences and expertise. Meanwhile, research outcomes and impacts can be unpredictable, creating uncertainty about the level of, and time frame for, return on research investment. Despite these challenges, clear, systematic processes for priority-setting can help ensure that funded health research has potential for impact and meets needs, and that resources are used fairly and efficiently.

Regarding pregnancy-related health, there is mounting evidence that more research is needed to improve outcomes for women and babies. Recent policies have emphasised the need to improve pregnancy care, while noting

a lack of research in key areas, including pre-conception interventions, screening tests, pregnancy treatments and models for perinatal care.¹ MBRRACE-UK (Mothers and Babies: Reducing Risk through Audits and Confidential Enquiries across the UK) has highlighted slow progress in reducing rates of extended perinatal mortality, with more research needed. The issue is not new; a 2009 review concluded that UK maternal and perinatal health research is underfunded compared to other conditions, with the UK devoting a lower proportion of funding to this area than other English-speaking countries.²

In 2014, the Chief Medical Officer recommended a review of research needs and expenditure in pregnancy in the UK.³ The objective of this study was to deliver that review, and generate a sound evidence base on UK pregnancy research needs and priorities, and how that compares to the current funding landscape.

The main research questions of this study were:

1. What is the current level of spend on pregnancy research in the UK?
2. What is this spent on, in terms of type of research and topic?

1 Policies such as NHS England's *National Maternity Review* (2016), the *Strategic Vision for Maternity Services in Wales* (Welsh Government 2011), the Scottish five-year plan *The Best Start* (Scottish Government 2017), Northern Ireland's *Strategy for Maternity Care* (Department of Health, Social Services and Public Safety 2012) and NIHR's *Better Beginnings* (NIHR 2017).

2 Fisk and Atun (2009).

3 Chief Medical Officer (2015).

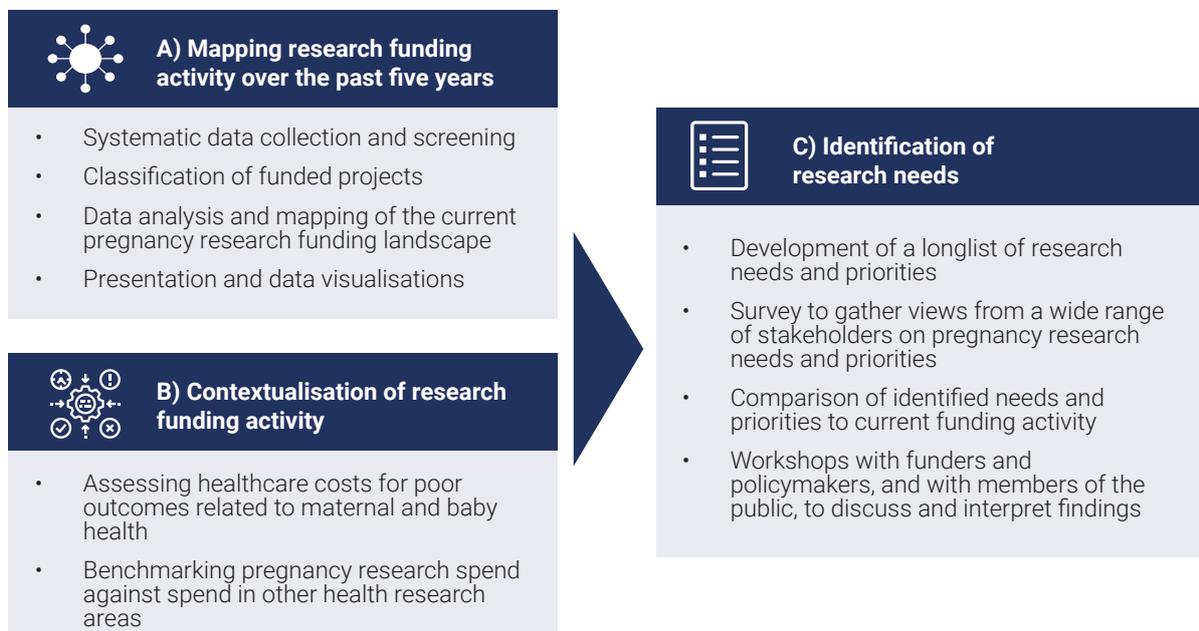
3. How does the current pregnancy research spend in the UK compare to other health research areas?
4. What are the main priorities for future pregnancy research in the UK?

For the purposes of this study, we took a broad definition of pregnancy to encompass not just the period of being pregnant and giving birth, but also spanning conception, contraception, the antenatal period and postnatal outcomes and experiences linked to the process of being pregnant and giving birth, for both women and their families. We also took a broad scope in terms of what is classified as pregnancy research, covering all topics, disciplines and research approaches in which the ultimate aim of the research is to improve outcomes for pregnant women or women trying to become pregnant, and their families.

1.2. Approach

Our approach consisted of three tasks – A, B and C – as illustrated in Figure 1. Task A was focused on mapping the publicly and charitably funded research related to pregnancy in the UK. We identified pregnancy-related research by searching existing databases and requesting data from funders. We then screened these data, looking at award titles and abstracts, to remove irrelevant funding awards and classify awards that were relevant based on their topic, funder, research approach, funding type, and the stage of pregnancy they address. We looked at funding awarded with a start date between 2013 and 2017, giving us a sample of five years of UK public and charitable research funding. Overall we identified 580 awards, spanning a wide range of fields, disciplines and funders.

Figure 1. Overview of study approach.



Source: RAND Europe.

Task B aimed to contextualise the amount of funding allocated to pregnancy research, both against the costs and burden of pregnancy as a health condition, and against the amount invested in other areas of research compared to their costs.

Task C was a prioritisation exercise spanning the whole of pregnancy research, and was intended to provide a picture of the key topics of importance to different stakeholders, including researchers, healthcare professionals, charities, funders and members of the public. We sourced a longlist of possible topics drawing on a review of literature, crowdsourcing ideas from experts, and through a workshop with members of the public. This was then condensed into a set of 78 topics that respondents were asked to prioritise in an online survey. They were asked to do this in two ways – by providing a rating (lower priority, medium priority, high priority, very high priority) for each topic, and then subsequently by selecting their 'top 5' most important topics from the full list of 78. These topics were grouped into 13 broad categories for the purposes of analysis. The broad category areas and the topics (in brief) are provided for reference in Table 1.

To test, contextualise and explore the data and emerging findings, the outcomes across all tasks of the study were discussed in two workshops – one with experts spanning research, healthcare and policy, and another with members of the public.

More detail about the methodology and the data generated can be found in the accompanying 'data and methods' report. Throughout the report, unless otherwise stated, all of the funding information quoted is based on primary data-collection conducted by the study team.

1.3. Key caveats and limitations

A number of caveats and limitations to our analysis are set out in more detail in the accompanying data and methods report. Important issues to highlight include:

- **Availability and completeness of funding data:** There are limitations both in the availability of funding data and in the completeness of funding data provided. Some funders were unable to provide us with data within the time frame of the study. Some funding records were incomplete – for example, in where no abstract was available, our classification of the project was based on the title alone. Also, funding data was not available for industry research, so this analysis covers public- and charitably-funded research only.
- **Pregnancy is not a disease we want to eradicate, so comparison to costs of other conditions is challenging:** We have developed comparators to allow us to set the level of pregnancy research funding in context. However, when we compare level of spend in the NHS on pregnancy to other conditions we need to keep in mind the difference in context. In an ideal situation, research-based evidence would lead to a reduction in the incidence and burden of conditions such as cancer. Ultimately, in the case of a cure, NHS costs could in theory be reduced to zero. In an ideal scenario, we will still need to use NHS resource to support healthy pregnancies. Therefore, much of NHS spend is not invested in addressing costs that research may reduce. Use of DALYs (Disability Adjusted Life Years) is also challenging in this context, since the measures provided may not capture long-term implications of poor pregnancy outcomes. Stillbirths are also not effectively captured in DALY measurements.

Table 1. Survey categories and topics

Category name	Topic name
Conception and family planning	Awareness/use of pre-conception care
	Effects of contraception on fertility, cancer, miscarriage
	Health before pregnancy
Assisted reproduction and fertility	How does ovarian hyperstimulation syndrome occur?
	Making ART [Assisted Reproductive Technologies] safer/more effective
	Long-term effects of ART
	Risks of older women having babies
	Fertility and endometriosis
Managing other health conditions throughout pregnancy	Medications safe to take during pregnancy
	Pregnancy and long-term conditions
	Care for pregnant women with epilepsy
	Care for women with diabetes during pregnancy
	Care for obese women during pregnancy
	Reducing obesity in pregnancy
	Risks to babies of obesity in pregnancy
	Options for women diagnosed with cancer in pregnancy
	Assessing risks in pregnant women with rare disease
Perinatal mental health	Preventing & managing mental health problems
	Identifying women at risk of mental health problems
	Birth experiences and postnatal mental health
	Effectiveness of alternatives to medication for mental health treatment
	Risks and benefits of drugs for mental health
	Impact of poor mental health
Pregnancy complications	Detecting & caring for ectopic pregnancy
	Nausea and vomiting in pregnancy
	Thromboembolism and pulmonary embolism in pregnancy
	Gestational diabetes in pregnancy
	Preventing and caring for pre-eclampsia
	Preventing and managing small-for-gestational-age fetuses
	Improving long-term child outcomes
Screening during pregnancy	Antenatal screening for low-risk women
	Identifying pregnancies for additional monitoring
	Screening for prenatal alcohol exposure
	Screening and managing placenta praevia
	Chickenpox in pregnancy
Health-related behaviours during pregnancy	Improving diet and nutrition of women
	Nutrition during pregnancy and effect on the baby
	Changes to diet and activity during pregnancy
	Reducing alcohol, drug use, and smoking
	Supporting women to be healthier
	Reducing domestic violence during pregnancy
	Effectiveness of midwife support to help women be healthier

- **The prioritisation survey trades off specificity with length and comprehension:** Pregnancy is an extremely broad area and there is a very large number of potential topics that could have been included in the online survey. However, we also needed to ensure that the survey was not too long and that the content was comprehensible to a large range of audiences, including members of the public. Therefore, the final selection of topics balances these competing needs, resulting in a set of 78 reasonably broad but clear and well-specified topics.
- **The survey is focused only on topics, not other characteristics of funding:** The prioritisation survey only captures information on the priority level placed on research topics or questions. It does not seek to determine what type of research should be conducted to address these questions (for example discovery research or clinical research, or which disciplines should contribute) – this is most appropriate to be determined by researchers working in the relevant fields. Similarly, the survey does not seek to identify what types or level of funding might be needed in each area to address the research question, though in our analysis we do start to explore this based on the evidence available. It is also worth noting that the evidence needs that are related to each topic have not been assessed and validated – and hence it may be that evidence is already available in some areas.
- **Survey respondents may differ in background knowledge and in their interpretation of the survey:** A wide range of individuals – with different backgrounds, knowledge and experience – have contributed to the prioritisation survey. This is a strength of the approach in many regards. However, it is also important to note that the level of understanding of some of the more niche conditions or of the specific challenges and issues in some areas may vary between individuals, and this may have influenced their response. Additionally, people may have responded to or interpreted the survey in different ways. For example, some may have focused on and prioritised the most important issues regardless of current investment, whilst others may have looked to highlight topics that need more resources.
- **The sample of members of the public in the survey is relatively small:** We received a high rate of response to the online survey, with a total of 592 respondents, including 250 members of the public. However, this still represents an extremely small proportion of the UK public and as such may not be representative of the views of the public as a whole.

2 Findings

2.1. £51m per year is invested in pregnancy research in the UK

A total of £255 million was spent on pregnancy research from 2013–2017 in the UK, giving an annual average spend during that period of £51m. This represents approximately 2.4 per cent of all direct, non-industry health-research funding over that period. The exact funding values varied by year, as illustrated in Figure 2.⁴

The National Institute for Health Research (NIHR) and the research councils within UK Research and Innovation (UKRI) are the largest funders of pregnancy research, as shown in Figure 3. Together, NIHR, the Medical

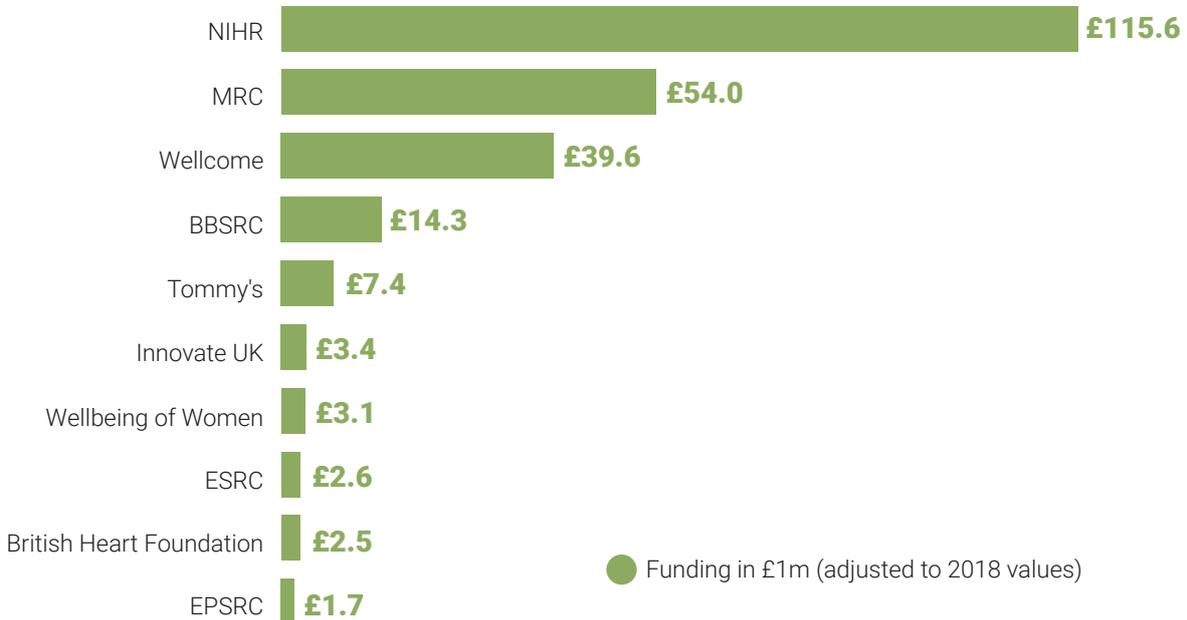
Research Council (MRC) and Wellcome provide around 80 per cent of pregnancy research funding in the UK. However, a wide range of charities also support pregnancy-related research and although their overall contribution relative to the large funders is small, they do make significant contributions in some areas. Smaller charitable and other funders (excluding NIHR, MRC and Wellcome) make important contributions in a number of specific areas, supporting 43 per cent of stillbirth research, 26 per cent of research on obesity in pregnancy, 53 per cent of research on diabetes in pregnancy, and all research on lupus in pregnancy – despite providing only 9 per cent of funding overall.

Figure 2. Total funding by year (adjusted to 2018 values).



Source: RAND Europe analysis.

⁴ There are no obvious year-on-year differences that account for the annual variation. However, it is worth noting that three large awards (£5m+) were made by Wellcome in 2014, which may account for some of the disparity.

Figure 3. Top 10 funders by funding amount (adjusted to 2018 values), 2013–2017.

Source: RAND Europe analysis.

Limited data are available on pregnancy research in industry. Our analysis has only identified 53 industry-supported projects funded over the five-year period, compared to 408 projects in cancer research, for example. This is supported by previous analysis suggesting that the level of investment in research related to pregnancy in industry is low (Chappell and David 2016).

2.2. For every £1 spent on pregnancy care in the NHS, around 1p is spent on research

By comparison, pregnancy-related care costs the NHS £5.8bn per year. This means pregnancy research funding is less than 1 per cent of NHS spending on pregnancy. Research investment in pregnancy-related topics is about 2 per cent of the pregnancy-related litigation claims received in 2018/19.

Comparing this to other conditions, we find the investment is much lower than for conditions such as heart disease (7p for every £1 spent) and cancer (12p for every £1), as shown in Figure 4.

However, when we look at research spend by comparison to the health burden, the picture is more comparable. If we quantify the burden of different diseases using Disability Adjusted Life Years (DALYs) – which measure years of healthy life lost – we find that £143 is invested in pregnancy research per DALY. This is similar to other conditions, as shown in Figure 5.

This difference is perhaps in part due to the differences in the nature of pregnancy as a health condition relative to the comparators used. Many pregnancies are healthy and so while they might cost the NHS money, they do not necessarily lead to loss of health or wellbeing. This would not be true for the other conditions used as comparators.

Figure 4. Research funding for every £1m spent in the NHS for different health conditions.



Source: RAND Europe analysis, building on work of Luengo-Fernandez et al. (2015).

Figure 5. Research funding per DALY for different health conditions (in £).



Source: RAND Europe analysis, building on work of Luengo-Fernandez et al. (2015).

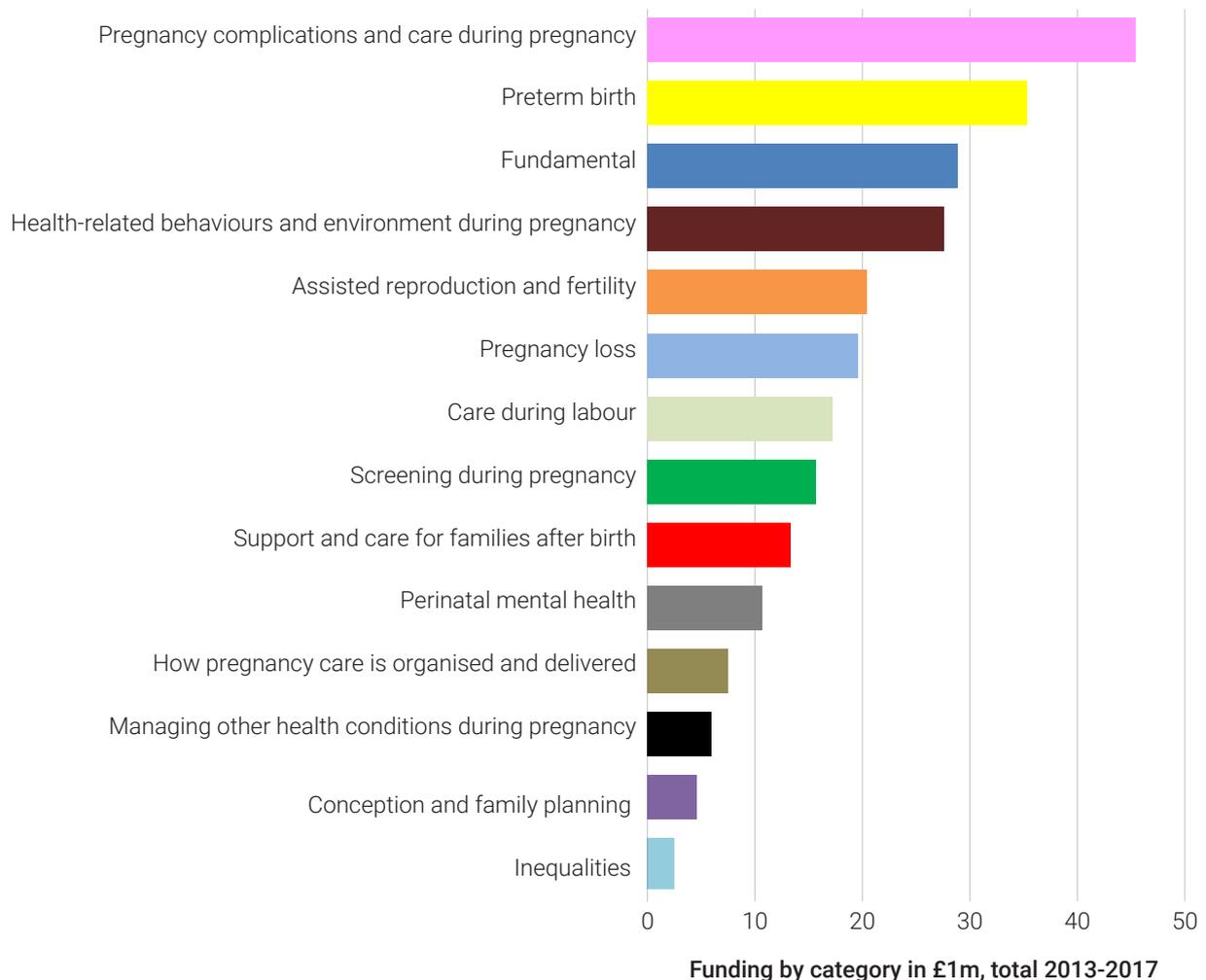
We also note that litigation claims related to pregnancy are around fifty times the current pregnancy research spend, estimated at £2.5bn in 2018–19 (NHS Resolution 2019).

2.3. Pregnancy research covers diverse topics and disciplines

Current pregnancy research in the UK spans a diverse range of topics and disciplines. Funding is provided across all of the elements of pregnancy research captured in the survey to differing extents – as illustrated in Figure 6 – and there are also a wide range of

disciplines contributing to knowledge regarding pregnancy, as shown in Figure 7. There is significant overlap between both topics and disciplines, with most individual awards spanning multiple topic areas, and also multiple research types and disciplines. This reflects the interconnectedness of the many different issues highlighted. For example, the prevalence of perinatal mental health conditions has been found to be correlated with both experience of domestic violence (Howard et al. 2013) and obesity (Molyneaux et al. 2014).

This diversity in pregnancy research is supported by stakeholders. In our prioritisation

Figure 6. Total funding (2013–2017) by category.⁵

Source: RAND Europe analysis.

survey, more than 70 per cent of respondents considered all topics at least a 'medium priority' and for 65 of the 78 topics, more than half of respondents rated them as a 'high' or 'very high priority'. Additionally, only one topic was not selected by at least one respondent as one of their 'top 5' priority topics. This illustrates that although we can identify a number of topics that were most commonly selected as a high priority across all survey respondents, some individuals

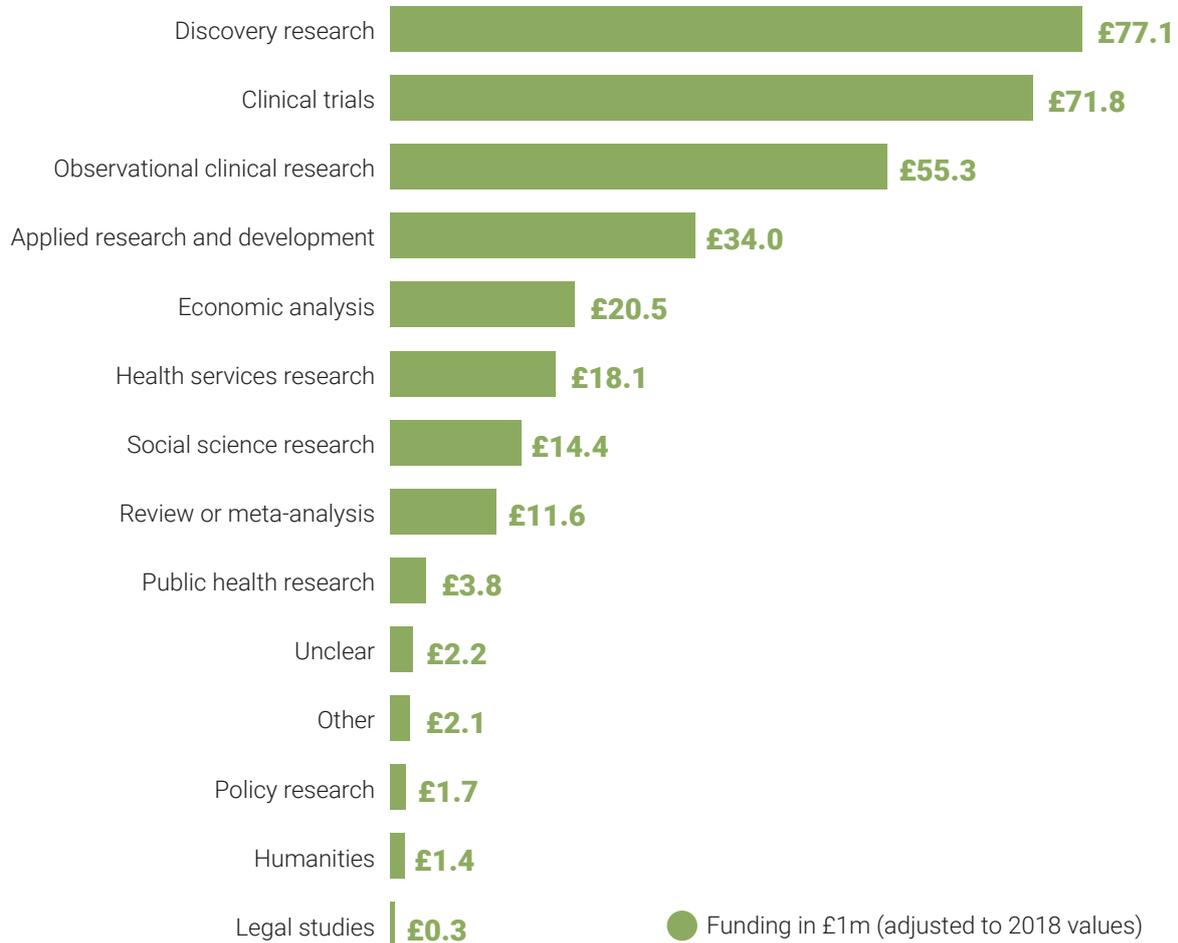
have a strong interest in all of these topics, and broadly, most respondents see the value in addressing the majority of these topics.

2.4. Mental health research is the top priority for all stakeholders and is likely underfunded

A clear priority emerging from our prioritisation exercise is mental health research.

⁵ Colours are assigned to different categories here and used throughout the remainder of the report. 'Fundamental' refers to underpinning research not focused on any one specific area or outcome.

Figure 7. Total amount of funding (2013–2017) by research type.



Researchers, healthcare professionals and the public all agreed that perinatal mental health is a top priority, selecting 'How can we prevent and manage mental health problems during and after pregnancy?' most frequently as one of the top 5 priority topics (Table 2). Despite the importance placed on perinatal mental health by all stakeholders, this area currently receives 4 per cent of all UK pregnancy research funding.

Previous work has also shown that the costs of perinatal mental health problems can be significant. Lifetime costs to society and public services in the UK are estimated to exceed £6

bn for each year's cohort of pregnancies, with 72 per cent of these costs relating to adverse impacts on the child rather than the mother (Bauer et al. 2014). By comparison, annual spend on research related to perinatal mental health is an average of £3.8m.

Mental health problems are also one of the most common complications of pregnancy – for depression alone, 12.7 per cent of women will experience perinatal depression (Gaynes et al. 2005), and across all mental health conditions this may be as high as 20 per cent (Bauer et al. 2014; Gaynes et al. 2005).

Table 2. Topics most frequently selected as a 'top 5' priority by all stakeholders, and by stakeholder groups.⁶

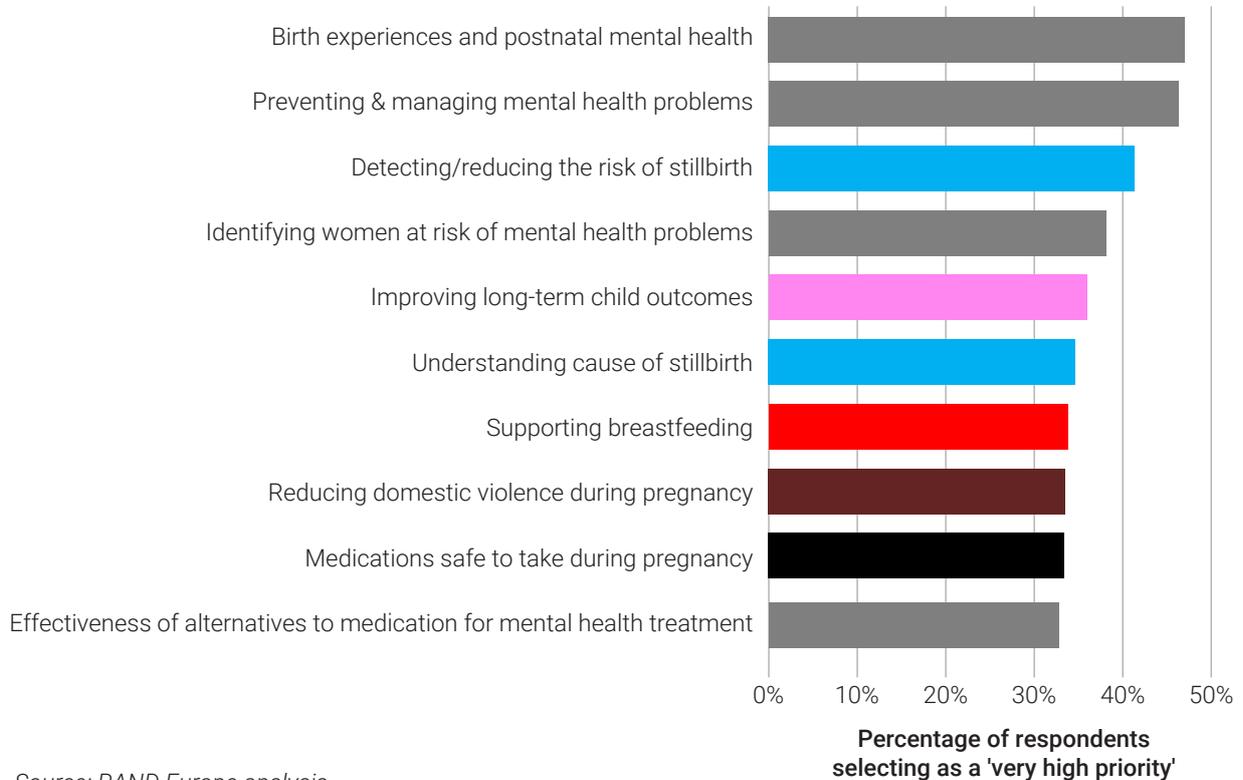
Rank	All stakeholders (n=592)	Healthcare professionals (n=212)	Members of the public (n=250)	Researchers (n=158)
1	Preventing & managing mental health problems	Preventing & managing mental health problems	Preventing & managing mental health problems	Preventing & managing mental health problems
2	Birth experiences and postnatal mental health	Detecting/reducing the risk of stillbirth	Birth experiences and postnatal mental health	Preventing/ managing small-for-gestational-age fetuses
3	Medications safe to take during pregnancy	Inequalities in pregnancy outcomes by level of deprivation	Medications safe to take during pregnancy	Ethnic inequalities in pregnancy outcomes
4	Detecting/ reducing the risk of stillbirth	Birth experiences and postnatal mental health	Supporting breastfeeding	Reducing/ preventing preterm birth
5	Supporting breastfeeding	Reducing/ preventing preterm birth	Nausea and vomiting in pregnancy	Detecting/reducing the risk of stillbirth

Some of these issues relate to poor provision of services, with current care delivery not meeting evidence-based practice standards. For example, guidelines published in 2015 estimate that 85 per cent of localities do not have specialist perinatal mental health services providing care to the level recommended in practice guidelines (National Collaborating Centre for Mental Health (UK) 2014). This implies a potential need for implementation research, as well as investment in the delivery of care. However, there are also a range of gaps in the research evidence identified in the guidance, most recently updated in 2018, notably:

- **Preventing postpartum psychosis:** 'What methods can improve the identification of women at high risk of postpartum psychosis and reduce this risk?'
- **The safety of drugs for bipolar disorder in pregnancy and the postnatal period:** 'How safe are drugs used to treat bipolar disorder in pregnancy and the postnatal period?'
- **Psychological interventions focused on the mother–baby relationship:** 'Are interventions designed to improve the quality of the mother–baby relationship in the first year after childbirth effective in women with a diagnosed mental health problem?'
- **Structured clinical management for moderate to severe personality disorders in pregnancy and the postnatal period:** 'Is structured clinical management for moderate to severe personality disorders

⁶ Colour shading denotes the broad category into which the topics fall (see Figure 1). Grey=perinatal mental health; Blue=pregnancy loss; Pink=pregnancy complications and care during pregnancy; Black=managing other health conditions throughout pregnancy; turquoise=inequalities; Red=support and care for families after birth; Yellow=preterm birth. Source: RAND Europe analysis.

Figure 8. Top 10 priority topics by the percentage of all respondents rating the topic as a 'very high' priority.⁷



Source: RAND Europe analysis.

in pregnancy and the postnatal period effective at improving outcomes for women and their babies?'

- **Psychological interventions for moderate to severe anxiety disorders in pregnancy:** 'Are psychological interventions effective for treating moderate to severe anxiety disorders (including obsessivecompulsive disorder, panic disorder, posttraumatic stress disorder and social anxiety disorder) in pregnancy?' (National Collaborating Centre for Mental Health (UK) 2014).

One potential issue in increasing investment in perinatal mental health identified by

stakeholders is the need to build capacity. Of the funding awards currently identified, around 42 per cent of awards were fellowships or studentships, and of a total of 25 identified awards focusing primarily on perinatal mental health, eight PhD or pre-PhD-level awards focused on perinatal mental health over the 5-year period. However, there are likely to be many further PhD students trained through other sources of PhD funding (e.g. within other larger awards, or through doctoral award centres). Nonetheless, given the current levels of investment in the field relative to other disciplines, there may be a need for investment in capacity-building to facilitate effective

7

Colour shading denotes the broad category into which the topics fall (see Figure 1). Grey=perinatal mental health; Blue=pregnancy loss; Pink=pregnancy complications and care during pregnancy; Red=support and care for families after birth; Dark red=health-related behaviours and environment during pregnancy; Black=managing other health conditions throughout pregnancy.

delivery of a wider portfolio of research on perinatal mental health in the UK. This would likely need to cover not just PhD awards, but also more advanced fellowships to support career development.

2.5. Stillbirth is also a priority for stakeholders

Looking at the priorities based on the proportion of respondents rating topics as 'very high priority' (Figure 8), we observe that although perinatal mental health remains very important, stillbirth also emerges as one of the main priorities for further research.

Our understanding of **stillbirth** is still limited. Depending on the classification system used, somewhere between 10 and 50 per cent of stillbirths are unexplained (Flenady et al. 2009; Lamont et al. 2015). The costs and consequences of stillbirth are also still not well understood, though even just taking the costs to the NHS of investigation immediately following stillbirth, the cost is in the range of £1,242–£1,804 per case (Mistry et al. 2013), and care costs for stillbirths are 10–70 per cent greater than those for a livebirth (Heazell et al. 2016). However, the personal and societal implications of stillbirth are also significant and not well quantified (Heazell et al. 2016).

In a recent priority-setting process, the following priorities for research into stillbirth were identified⁸:

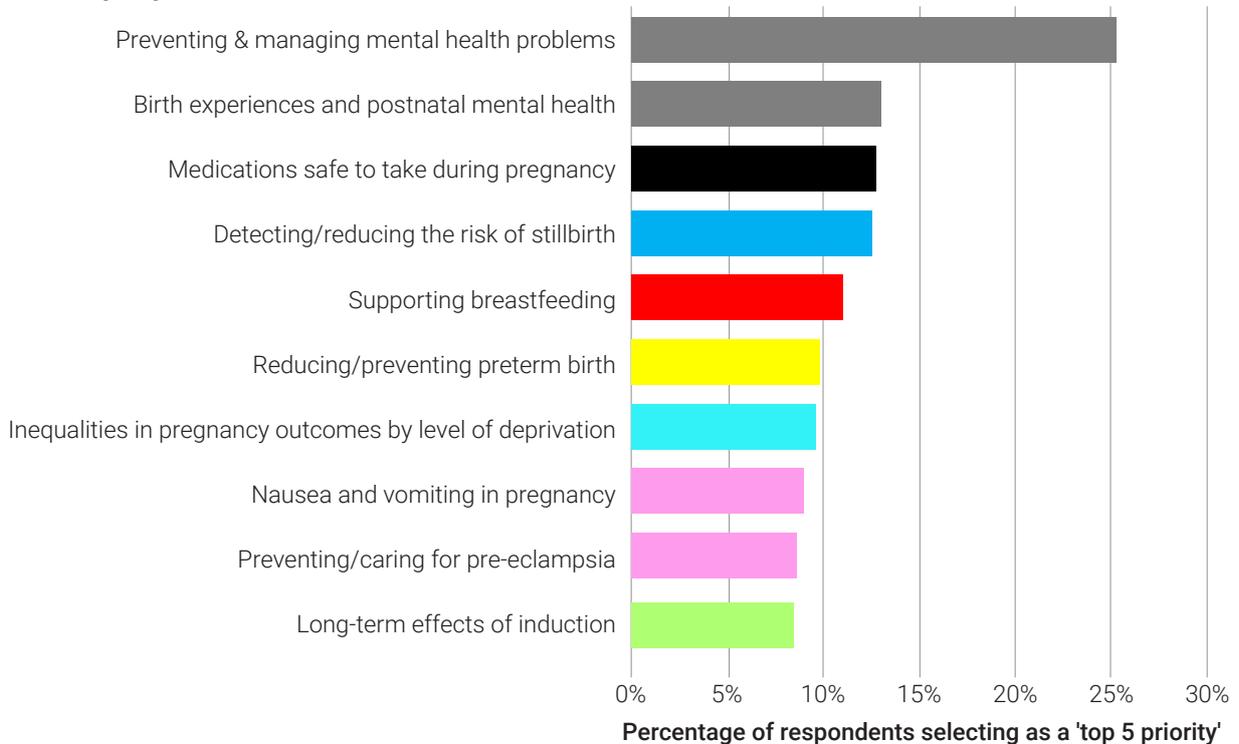
- How can the structure and function of the placenta be assessed during pregnancy to detect potential problems and reduce the risk of stillbirth?
- Does ultrasound assessment of fetal growth in the third trimester reduce stillbirth?
- Do modifiable 'lifestyle' factors (e.g. diet, vitamin deficiency, obesity, sleep position,

sleep apnoea, lifting and bending) cause or contribute to stillbirth?

- Which investigations identify a fetus at risk of stillbirth after a mother believes she has experienced reduced foetal movements?
- Can the wider use of existing tests and monitoring procedures, especially in later pregnancy, and the development and implementation of novel tests (biomarkers) in the mother or in early pregnancy, help prevent stillbirth?
- What causes stillbirth in normally grown babies?
- What is the most appropriate bereavement and postnatal care for both parents following a stillbirth?
- Which antenatal care interventions are associated with a reduction in the number of stillbirths?
- Would empowering women to know about relevant evidence-based signs and symptoms and raise them with healthcare professionals reduce stillbirth?
- How can staff support women and their partners in subsequent pregnancies, using a holistic approach to reduce anxiety, stress and any associated rise in visits to healthcare settings?
- Why is the incidence of stillbirth in the UK higher than in other similar high-income countries, and what lessons can we learn from them?

Currently, the funding to conduct stillbirth research is limited. Over the five-year period 2013–2017, a total of £5.8m was invested in stillbirth research in the UK, around 2 per cent of all UK pregnancy research funding. Of that funding, 43 per cent came from two charitable funders: Tommy's and Sands. Funding from the

Figure 9. Top 10 priority topics by the percentage of all respondents including the topic as one of their 'top 5' priorities.⁹



Source: RAND Europe analysis.

largest pregnancy research funders (Wellcome, NIHR and UKRI) amounted to £2.7m.

2.6. Other priority topics are varied, spanning preterm birth, inequalities, postnatal support and safety of medications during pregnancy

Alongside perinatal mental health and stillbirth, other priority topics identified in the survey include preterm birth, inequalities in pregnancy outcomes, postnatal support (including breastfeeding), medication safety during pregnancy, pre-eclampsia, and the long-term effects of induction (Figure 9). These topics are

amongst the top 10 most frequently selected as one of a respondent's 'top 5' priorities. All but one of the topics is also rated as 'very high' priority by more than a third of respondents. We also find that there is wider evidence to suggest that the costs and consequences associated with these priority topics are significant.

Preterm birth is the leading cause of perinatal deaths. It is directly linked to 27 per cent of early neonatal deaths globally, and implicated in increasing the risk of babies dying from other causes – overall, half of neonatal deaths worldwide are linked to prematurity (Simmons et al. 2010; Lawn et al. 2005), rising to 70 per cent in higher income countries (Flood and

9 Colour shading denotes the broad category into which the topics fall (see Figure 1). Grey=perinatal mental health; Black=managing other health conditions throughout pregnancy; Blue=pregnancy loss; Red=support and care for families after birth; Yellow=preterm birth; Turquoise=inequalities; Pink=pregnancy complications and care during pregnancy; Light green=care during labour.

Malone 2012). Preterm birth is also linked to a range of increased risks for mortality and morbidity throughout early childhood and into later life (Simmons et al. 2010). The costs of preterm birth to the public sector in the UK are high – estimated at £2.9 bn over the long term for each annual cohort. There is also evidence of an inverse relationship between gestational age at birth and costs to the public sector of providing care (Mangham et al. 2009).

Inequalities in outcomes are identified across a range of pregnancy-related conditions. ONS statistics show that in the UK Pakistani, Black Caribbean and Black African babies have almost twice the national average rates of infant mortality, and that this is linked to an increased likelihood of living in a deprived area and having parents in a less advantaged socioeconomic position (Office for National Statistics 2015). Evidence also suggests that severe maternal health problems are more common for women in lower socioeconomic groups and for non-white women (Lindquist et al. 2013). Recent work shows that in the UK, black women are five times more likely and Asian women twice as likely as white women to die during pregnancy (Knight et al. 2018).

An increased understanding of which **medications are safe to take during pregnancy** is also highly prioritised by respondents, and this responds to a clear challenge in evidence-based perinatal prescribing. Because so few drugs are developed and tested for use during pregnancy (Chappell and David 2016) many drugs have to be used ‘off-label’ to treat pregnant women (Herring et al. 2010), and in many cases the implications may be unknown, or medications are known to be unsafe may be prescribed (Hardy et al. 2006). Another risk is that women do not receive treatment for conditions (such as UTIs) due to uncertainty or concerns around the safety of medications (Twigg et al. 2016). In part, this is exacerbated by unclear guidance and packaging information that refers the

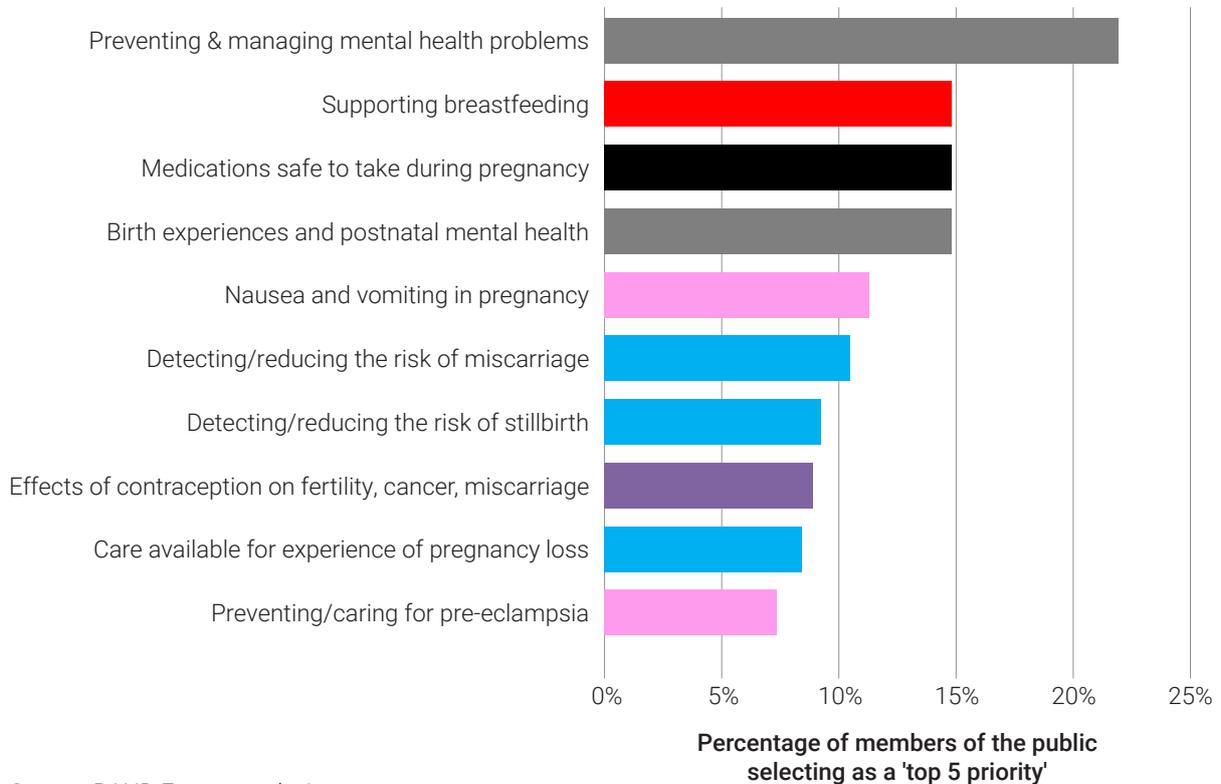
user to the GP – who may also be unsure about the safety of specific medications that will likely not have been tested in pregnancy (Twigg et al. 2016). Similar challenges occur for breastfeeding women in the postnatal period, and during conception.

Pre-eclampsia is a complication that affects 2–8 per cent of pregnancies. The consequences of pre-eclampsia can be significant. The condition is responsible for approximately 15 per cent of all direct maternal deaths in the UK. Pre-eclampsia also increases the risk of perinatal mortality by a factor of five (English, Kenny, and McCarthy 2015).

Increasing rates of **breastfeeding** in the UK could result in significant cost savings due to the long-term implications across the population in terms of common childhood infections and maternal risk of breast cancer (Pokhrel et al. 2015). For example, supporting women who are exclusively breastfeeding at 1 week to continue to do so until 4 months could save the NHS £11m per year through reduced incidence of some common childhood infections (Pokhrel et al. 2015). In the UK, though 81 per cent of mothers start to breastfeed, by six weeks only 55 per cent are still breastfeeding, falling further to 34 per cent at six months (Rayfield et al. 2015).

Nausea and vomiting is a common complication of pregnancy that is experienced by up to 85 per cent of women during pregnancy (Niebyl 2010). Although common, it can be debilitating – about 35 per cent of women who experience nausea and vomiting show clinically significant symptoms that can impact on family relationships and lead to work absence (Attard et al. 2002; Mazzotta et al. 2000). For up to 3 per cent of women the more severe condition hyperemesis gravidarum ensues, resulting in severe vomiting and often causing dehydration, nutritional deficiencies, weight loss and commonly hospitalisation (ACOG 2018). Despite this being a common condition, the

Figure 10. Top 10 priority topics for members of the public, based on the proportion of members of the public selecting the topics as one of their 'top 5' priorities.¹⁰



Source: RAND Europe analysis.

quality of evidence regarding the effectiveness of treatments for nausea and vomiting in pregnancy is low (McParlin et al. 2016).

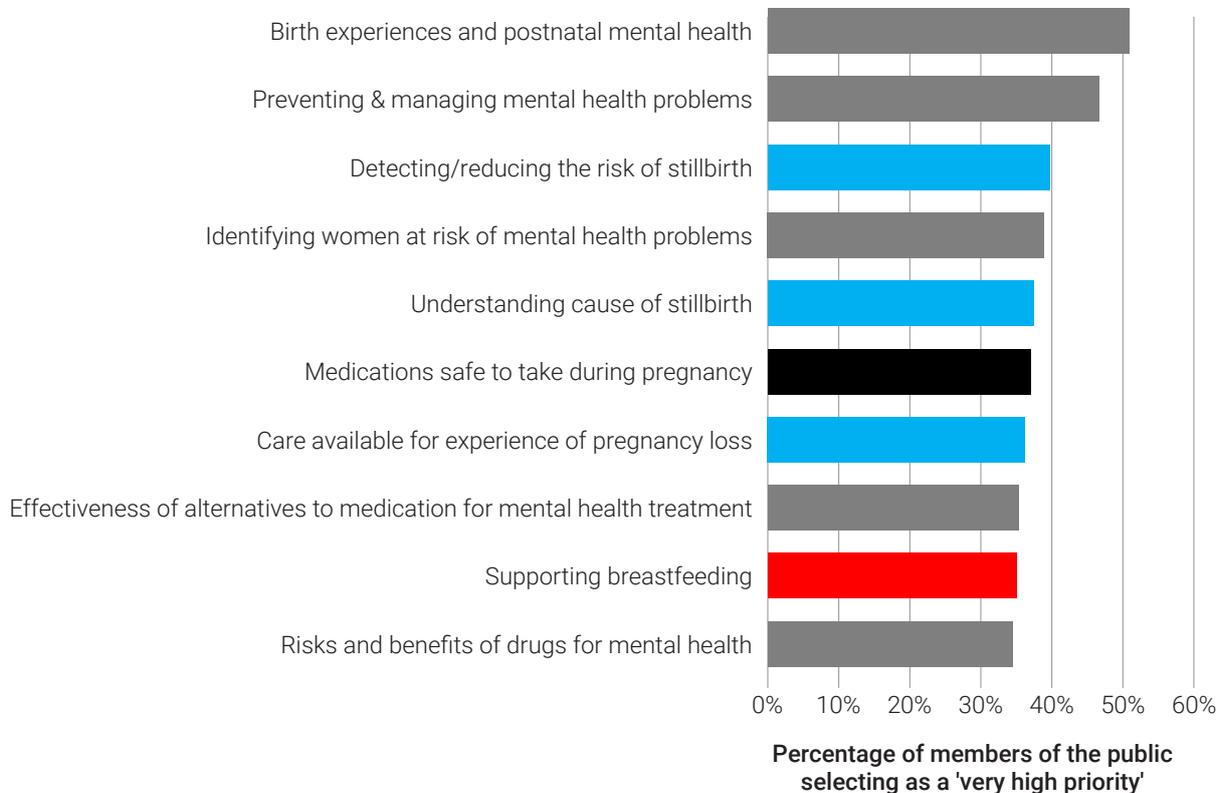
In the UK, around 20 per cent of all deliveries are **induced** (NHS Digital 2019). This can be for a range of reasons, from post-term pregnancy to maternal age. However, there is limited evidence regarding the **longer term consequences** of induction as an intervention, with some initial emerging evidence suggesting there may be negative long-term outcomes from a range of birth interventions, including induction (Peters et al. 2018).

2.7. The public values research that addresses issues faced by many women during and after pregnancy, and places particular emphasis on mental health and pregnancy loss

Although we find some broad consensus across groups, there are some differences in priorities identified between the different stakeholder groups completing the prioritisation survey. The Top 10 priorities for members of the public, shown in Figure 10, are primarily issues that are commonly experienced by many women during

10 Colour shading denotes the broad category into which the topics fall (see Figure 1). Grey=perinatal mental health; Red=support and care for families after birth; Black=managing other health conditions throughout pregnancy; Pink=pregnancy complications and care during pregnancy; Blue=pregnancy loss; Purple=conception and family planning.

Figure 11. Top 10 priority topics for members of the public, based on the proportion of respondents who rated the topic as a 'very high' priority.¹¹



Source: RAND Europe analysis.

pregnancy – such as breastfeeding, nausea and vomiting, and taking medications – alongside mental health issues and pregnancy loss. As stated by one of the participants at a workshop: 'All the topics, either we've experienced them or we know someone who has, so they all feel really important and relevant.' However, this is based on the selection of 'top 5' priorities, so may in part reflect familiarity and salience of particular issues.

This is borne out when looking at data on which topics are selected most frequently as 'very high priority' by members of the public as shown in Figure 11. Here we see stillbirth

and mental health emerging strongly as priority issues, and less emphasis on issues such as nausea and vomiting in pregnancy, though breastfeeding and medications remain important issues for this group.

As shown in Figure 12, there are differences in the relative importance of some of these topics across different stakeholder groups. For example, researchers and healthcare professionals both place a high level of importance on mental health and stillbirth. However, researchers and healthcare professionals place a lower level of priority on breastfeeding support and nausea and

11 Colour shading denotes the broad category into which the topics fall (see Figure 1). Grey=perinatal mental health; Blue=pregnancy loss; Black=managing other health conditions throughout pregnancy; Red=support and care for families after birth.

Figure 12. Topics most frequently selected as a 'top 5' priority for all respondents, and breakdown of the percentage of respondents selecting that topic from different stakeholder groups.¹²

Topic	All respondents (n=592)	Healthcare professionals (n=212)	Public and patients (n=250)	Researchers (n=158)
Preventing & managing mental health problems	25.30%	25.90%	22.00%	25.30%
Birth experiences and postnatal mental health	13.00%	12.70%	14.80%	10.80%
Medications safe to take during pregnancy	12.70%	7.50%	14.80%	11.40%
Detecting/reducing the risk of stillbirth	12.50%	15.10%	9.20%	14.60%
Supporting breastfeeding	11.00%	6.60%	14.80%	7.60%
Reducing/preventing preterm birth	9.80%	12.30%	6.80%	16.50%
Inequalities in pregnancy outcomes by level of deprivation	9.60%	14.20%	5.60%	11.40%
Nausea and vomiting in pregnancy	9.00%	4.70%	11.20%	8.90%
Preventing/caring for pre-eclampsia	8.60%	8.00%	7.20%	13.30%
Long-term effects of induction	8.40%	10.80%	7.20%	10.10%
Preventing/managing small-for-gestational-age fetuses	8.30%	11.80%	2.00%	17.70%
Ethnic inequalities in pregnancy outcomes	7.90%	10.40%	1.60%	17.10%
Continuity of Midwife care	7.90%	10.80%	5.20%	9.50%
Effectiveness of current postnatal care	7.60%	8.50%	6.40%	11.40%
Support women to make informed decisions	7.60%	7.50%	7.20%	7.00%

Source: RAND Europe analysis.

vomiting in pregnancy, and researchers are less likely to select medications safe to take during pregnancy as one of their top priorities. However, healthcare professionals and researchers more frequently prioritise preterm birth, inequalities, and small-for-gestational-age fetuses as one of their top priorities. This may reflect a higher level of familiarity with conditions such as preterm birth, which may not be part of a majority of pregnancies but can have significant implications when they do occur. Similarly, inequalities may be less apparent to individual experiences of pregnancy, but rather emerge as significant at the population level. In general, priorities are relatively similar between researchers and healthcare professionals, but these are slightly different to the views of members of the public.

This may in part be because a number of researchers are also healthcare professionals, so there is some overlap between these groups.

2.8. The level of funding currently provided differs across the topics identified as priorities

Based on our analysis, it is likely that more investment is needed in perinatal mental health, as already highlighted. Comparing UK funding and priority level across categories, we can also identify other areas that may merit further investment. Interpreting and comparing the different levels of investment across categories is not necessarily straightforward. For example,

pregnancy complications seem to receive a relatively high level of investment compared to other categories (as shown in Figure 13). However, there are many different potential complications of pregnancy, so it may be that within this there are areas of underinvestment. It may also be that conducting research in some areas is more expensive than in others, due to the types of study needed. Some of the other challenges in interpreting and acting on discrepancies in funding and priority level are set out in section 2.9 below. Despite these limitations, it is apparent that some areas of research should be considered for future investment given their priority level and current research spend. One of these is pregnancy loss, which despite being a high priority – with stillbirth in particular highlighted as a key issue requiring further research – accounts for only 3.8 per cent of research spend. Similarly, postnatal care only receives 1.4 per cent of total funding, despite concerns around breastfeeding support and wider aspects of postnatal care, including mental health. This area may merit further investment. Managing other conditions during pregnancy also appears to receive a relatively low level of investment. Inequalities in pregnancy – currently comprising less than 1 per cent of the pregnancy research portfolio in the UK – may also merit further investment.

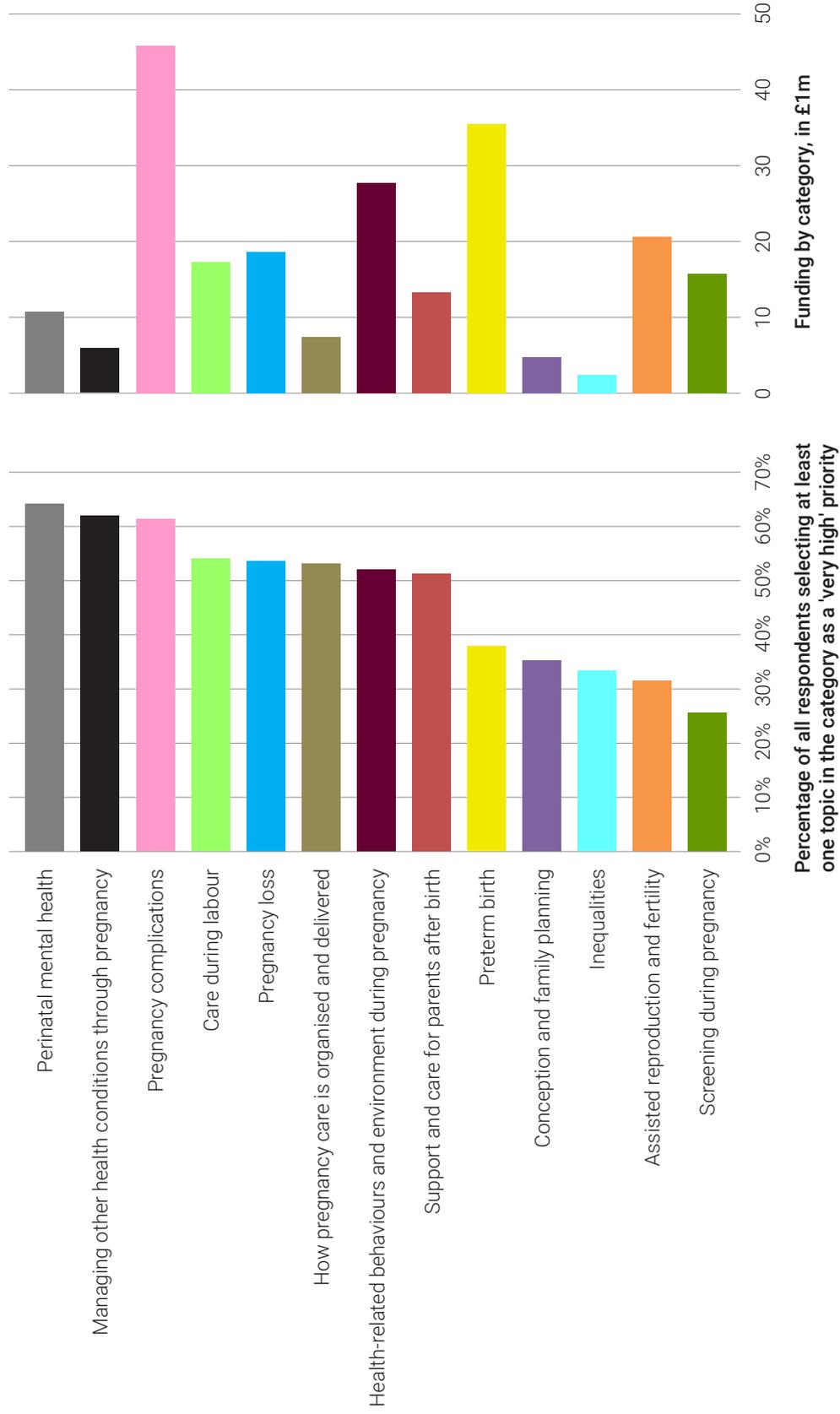
Finally, though it is not highlighted independently within the research prioritisation process, the basic physiology and mechanisms of conception, gestation and birth are key underpinning factors, without which many other questions cannot be answered, and which in many regards are still poorly understood. Research into basic questions around pregnancy is therefore important

– both to address the challenges outlined, and to understand and expand our knowledge on a process that is central to human existence. This type of research currently receives around 11 per cent of pregnancy-related funding – approximately £5.8m per year, on average.

2.9. Funding decisions also need to take into account a range of wider considerations

Although the prioritisation survey provides a useful starting point, there is a range of other factors that need to be considered in deciding where to target future pregnancy research funding. An important consideration will be research capacity. In many of these areas, where current levels of research are low, an initial priority may be to train researchers to work in the field, through PhD schemes or by providing opportunities for researchers with relevant experience in parallel fields to apply their expertise in the context of pregnancy. Reflecting on the nature of the research-need in different areas will also be important. There may be a need for a diverse range of approaches, and some types of research are more expensive than others, meaning differential levels of investment might be needed across different priority areas – depending on the state of development of research in that area, the nature of the problem, and the types of research needed. For example, clinical trials are a lot more expensive to support than, for example, social sciences studies. There may also be a need to consider relative priorities within different areas – we have drawn out some of the potential research topics to be addressed within stillbirth and perinatal mental health above, for example. To inform this analysis, the detailed survey

Figure 13. Proportion of respondents selecting at least one topic in each category as a 'very high priority', compared to total funding (2013–2017).¹³



Source: RAND Europe analysis.

data can also shed light on the relative priority placed across topics by stakeholders.

Other sources of evidence might also be valuable in trading off and prioritising the relative value of investing in different research areas. One of these might be economic analyses, revealing the potential returns on investment – both in terms of potential cost savings to the NHS or to society, but also in terms of the potential for improvements in health and quality of life. However, such analyses are not available for all potential research areas. A key feature of any return on investment assessment is also the likely timeline to payoff – investments that can achieve returns quickly are a better bet. However, though aiming to deliver better outcomes in pregnancy quickly is certainly desirable, that should not be to the exclusion of longer term investments in key underlying issues in pregnancy that may not be so quickly and readily addressed.

Another consideration is the relative need for investment in research and investment in care delivery. In some areas, notably mental health, it may be that existing practice falls well-short of existing evidence-based guidance. In these cases, though there may be scope for additional research, it may also be that there is a significant need for effective implementation of the knowledge we already have. This also suggests that there may be a need for more implementation research to understand how to better improve practice standards.

A final consideration is the role of the UK in the wider international pregnancy research landscape. It may be that in some areas, it is preferable to draw upon research conducted in other countries and apply those findings in a UK context. This will require some reflection on which research can be translated across health-system contexts, and where there is a greater need to conduct research in the UK because of the importance of country-specific factors. This might be more important, for example, in terms of implementation research, and perhaps less important for discovery research.

Underpinning all of these potential considerations is a need for wider strategic coordination and decision-making across the pregnancy research funding landscape. Decisions need to be taken on where the UK should build on its existing strengths, which new areas are worth the effort to build capacity and expertise in order to deliver high quality research, and where we should rely on research done in other countries and consider how best to interpret and implement that evidence in a UK context. As noted above, no single funder dominates pregnancy research, so this will require coordination across both large scale and niche funders to help ensure strategies are complementary and support effective collective development of the field as a whole.

3 Reflections

For every £1 spent on pregnancy care in the NHS, less than 1p is spent on pregnancy research in the UK. This is significantly less than spending on other conditions – indeed, less is spent annually on pregnancy research than the NHS litigation claims related to pregnancy. Whilst a proportion of the NHS spend will be on healthy pregnancies, it is also worth reflecting that negative outcomes in pregnancy can lead to conditions – and accompanying NHS costs – into childhood and indeed through the life course, a financial burden that will not be captured within the NHS pregnancy care costs. Beyond NHS costs, poor pregnancy outcomes can have significant impacts on women and families. This low level of research investment is compounded by extremely limited investment in pregnancy research in the private sector, with only 53 identified projects funded over five years, compared to 408 projects in cancer research. There is a case for further investment in pregnancy research. The prioritisation survey offers some guidance on where to target that investment.

A priority across stakeholder groups is investment in mental health research – which is currently poorly funded in relation to physical health in terms of both healthcare provision and research. Perinatal mental health is one of the most common complications of pregnancy, affecting up to 20 per cent of women, yet currently receives 4 per cent of research

investment in pregnancy. Priorities identified in this area include both preventative measures, and work to establish the effectiveness of different interventions.

Stillbirth is another clear priority for investment based on the prioritisation exercise, with detecting and reducing stillbirth rated as a ‘very high’ priority by more than 40 per cent of respondents. By contrast, stillbirth research receives just over £1m in funding per year (on average) – around 2 per cent of all pregnancy research funding – with 43 per cent of that coming from two charitable funders.

Other potential priority areas include preterm birth, inequalities, postnatal support (including breastfeeding), medication safety during pregnancy, pre-eclampsia, and the long-term effects of induction. Across these topics we see clear evidence of the costs and consequences of poor outcomes in pregnancy.

However, the identification of key areas for investment should also take into account wider considerations beyond the scope of the survey. One of these is the potential for return on investment. For example, if effective antenatal interventions could reduce risk levels across a range of these conditions – and others – they could potentially be cost-effective both in terms of research investment and healthcare delivery. Another important factor is consideration of research capacity. With low current investment in the UK in many of these areas, time and

effort might be required to build up the capacity to deliver high quality research to address some of these challenges.

The survey did not specify the types of research that should be funded to address these specific challenges, but the scope of the priorities identified suggests that research using a broad range of approaches will be needed. For example, up to half of stillbirths are due to unknown causes, suggesting a need for discovery research to explore the underlying mechanisms of pregnancy in order to identify how they might go wrong. Another example is perinatal mental health, for which there may be limitations in the quality and consistency of implementation, suggesting a need for implementation research to explore issues such as why some health visitors ask about postnatal mental health and others do not.

Determining where and how pregnancy research funding should be invested will need to draw on not just the evidence provided here about the topics that matter to stakeholders, but also the costs and consequences of different pregnancy issues, the feasibility

of conducting research to address these problems, the wider international pregnancy research landscape, and the capacity and strengths of the UK research system (and how they can be built and expanded).

Pregnancy is a fundamental part of the human condition and pregnancy care is a part of all of our lives. Improving the experience of care before, during and after birth, making birth safer and more equitable, and improving outcomes can deliver benefits that stretch beyond pregnancy itself. Additionally, a small reduction in NHS litigation claims in relation to pregnancy may be sufficient in itself to financially compensate for a significant increase in investment in pregnancy research. This suggests there is also a sound economic case for investment in pregnancy research. The evidence provided here highlights the need for action and is intended to act as a starting point to promote discussion and help funders coordinate increased, targeted investment in pregnancy research in the UK.

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