

# Preeclampsia prevention by timed birth at term

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| <b>Submission date</b><br>01/11/2022   | <b>Recruitment status</b><br>No longer recruiting     | <input checked="" type="checkbox"/> Prospectively registered<br><input checked="" type="checkbox"/> Protocol<br><input type="checkbox"/> Statistical analysis plan<br><input checked="" type="checkbox"/> Results<br><input type="checkbox"/> Individual participant data |
| <b>Registration date</b><br>02/11/2022 | <b>Overall study status</b><br>Completed              |   |
| <b>Last Edited</b><br>18/12/2025       | <b>Condition category</b><br>Pregnancy and Childbirth |   |

## Plain English summary of protocol

### Background and study aims?

Preeclampsia (PE) is a medical condition that can develop during pregnancy after 20 weeks of gestation. It is determined by high blood pressure and the presence of protein in the urine or the finding of maternal organ dysfunction. PE is one of the leading causes of maternal and perinatal death and disabilities. There is evidence to suggest some benefits to labour induction at or beyond term in women with PE, including a 67% reduction in perinatal death, an 8% reduction in the rate of caesarean section and a 12% decrease in neonatal intensive care unit admission. However, further evidence is required to establish whether early delivery in women could prevent PE in both the mother and their children. Therefore, the aim of this study is to establish whether screening for PE risk at 35-36 weeks' gestation and planning early-term birth for women at increased risk for PE, can reduce the incidence and severity of the disease as well as adverse pregnancy outcomes.

### Who can participate?

Women aged over 18 years with a single pregnancy

### What does the study involve?

Participants will be randomly allocated to either the intervention group or the control group. In the intervention group, planned early-term birth will be at 37, 38, 39, 40, or 41 weeks, depending on the women's PE risk, and following induction or by caesarean, as appropriate. Initiation of birth will be by labour induction (by local protocol) or elective caesarean (if indicated or desired by the woman) within the first 2 days of the gestational week, according to local protocol. In the control group birth will await the onset of spontaneous labour or the development of a clinical need for delivery.

### What are the possible benefits and risks of participating?

Participants may benefit from a reduced chance of developing preeclampsia, which could have a positive impact on the health of both the mothers and the children. There is a risk of pain from the blood collection at two of the clinical visits. There are potential risks from elective caesarean and childbirth.

### Where is the study run from?

King's College Hospital, London and Medway Maritime Hospital (UK)

When is the study starting and how long is expected to run for?  
October 2022 to November 2024

Who is funding the study?  
The Fetal Medicine Foundation (UK)

Who is the main contact?  
Prof. Kypros Nicolaides, [Kypros@fetalmedicine.com](mailto:Kypros@fetalmedicine.com)

## Contact information

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## Additional identifiers

### Clinical Trials Information System (CTIS)

Nil known

### Integrated Research Application System (IRAS)

315444

### ClinicalTrials.gov (NCT)

Nil known

### Central Portfolio Management System (CPMS)

54393

## Study information

### Scientific Title

Preeclampsia prevention by timed birth at term: a randomised trial

### Acronym

INDUCTION

### Study objectives

To determine the effect of screening and timing of delivery on the incidence of delivery with preeclampsia (PE).

### Ethics approval required

Old ethics approval format

### Ethics approval(s)

Approval pending, London-Surrey Borders Research Ethics Committee (The Old Chapel, Royal Standard Place, NG1 6FS, UK; +44 (0)207 1048 088; surrey.rec@hra.nhs.uk)

### Study design

Interventional randomized controlled trial

### Primary study design

Interventional

### Study type(s)

Prevention

### Health condition(s) or problem(s) studied

Pre-eclampsia

## Interventions

Randomisation will be provided by a computer-generated programme hosted by King's Clinical Trials Unit, in random permuted blocks, using a minimisation algorithm to ensure balance in the treatment allocation stratified for participating site.

**Intervention group 1:** Screening for PE at 35-36 weeks' gestation (by a combination of maternal factors, MAP, PIgf and sFlt-1) and planned early-term delivery if the risk for PE is increased, at a risk of at least 1 in 50.

Screening for PE will be undertaken by the 'competing-risks model' FMF algorithm that combines maternal demographics and medical history, MAP and maternal serum sFlt-1 and PIgf, to provide a personalised risk of PE. MAP will be measured by validated automated devices and a standardised protocol. Serum sFlt-1 and PIgf concentrations will be measured by an automated device (BRAHMS KRYPTOR compact PLUS, Thermo Fisher Scientific, Hennigsdorf, Germany). Women will have a planned initiation of early-term delivery, according to their risk of PE, as follows:

In the intervention arm, planned early-term birth will be at 37, 38, 39, 40, or 41 weeks, depending on the women's PE risk, and following induction or by caesarean, as appropriate. Initiation of birth will be by labour induction (by local protocol) or elective caesarean (if indicated or desired by the woman) within the first 2 days of the gestational week, according to local protocol.

### Control group 2: Usual care

Birth will await the onset of spontaneous labour or development of a clinical need for delivery, as per relevant NICE or RCOG clinical guidance on the timing of birth in general (ng207) or specific to maternal or fetal conditions (e.g., NG133 for pregnancy hypertension)

### Trial timeline:

11-13 weeks – normal routine care and study information provided

20-22 weeks – normal routine care and study information provided

35-36+6 weeks – normal routine care and study information provided (randomisation if participants are eligible and consented to participant)

## Intervention Type

Procedure/Surgery

## Primary outcome(s)

Delivery with PE as defined by the International Society for the Study of Hypertension in Pregnancy (ISSHP) 2021.14. The definition of PE is chronic hypertension or new onset hypertension (systolic blood pressure (BP) should be  $\geq 140$  mm Hg and/or diastolic  $\geq 90$  mm Hg, on at least two occasions four hours apart BP  $> 140/90$  mm Hg)  $\geq 20$  weeks of gestation together with any of the following:

1. Proteinuria, defined as  $\geq 300$  mg in 24 hours or urinary creatinine ratio  $\geq 30$  mg/mmol (0.3 mg/mg) or two readings of at least ++ on dipstick analysis of midstream or catheter urine specimens if no 24-hour collection is available; or
2. Maternal organ dysfunction, defined as any one of the following:
  - 2.1. Acute kidney injury with creatinine  $> 90$   $\mu$ mol/l or
  - 2.2. Liver involvement with elevated transaminases (alanine or aspartate aminotransferase [ALT or AST]  $> 40$  IU/L or twice the normal concentration) or

- 2.3. Haematological complications (thrombocytopenia with platelet count  $<150 \times 10^9/L$ ), disseminated intravascular coagulation or haemolysis, or
- 2.4. Neurological complications, such as eclampsia, altered mental status, blindness, stroke, clonus, severe headaches, or persistent visual scotomata, or
3. Uteroplacental dysfunction, defined as estimated fetal weight (EFW)  $<3$ rd percentile or EFW at the 3rd to 10th percentile in the presence of either of the following: uterine artery pulsatility index (UtA-PI)  $>95$ th percentile, umbilical artery PI (UA-PI)  $>95$ th percentile, or middle cerebral artery PI (MCA PI)  $<5$ th percentile

All outcome measures will be recorded during the routine care appointment and during childbirth. When the participants do not give birth at the chosen hospital, then the outcome is taken from their medical record.

#### **Key secondary outcome(s)**

All outcome measures will be recorded during the routine care appointment and during childbirth. When the participants do not give birth at the chosen hospital, then the outcome is taken from their medical record.

1. Emergency caesarean section, defined as any caesarean section after spontaneous onset or induction of labour. A caesarean section without prior labour will be considered as elective
2. Neonatal care unit stay for  $\geq 48$  consecutive hours up to primary hospital discharge home or 28 days of life, whichever is earlier

#### **Other secondary outcomes:**

1. GH, defined as systolic BP  $\geq 140$  mm Hg and/or diastolic  $\geq 90$  mm Hg, on at least two occasions 4 hours apart, and developing at  $\geq 20$  weeks' gestation in previously normotensive women (i.e., BP  $<140/90$  mm Hg)

2. Components of the 2021 ISSHP definition of PE (as above)

2.1. PE as defined by ACOG 201915:

2.2. GH (as above) or severe hypertension (as below), and either

2.3. Proteinuria (as above) or

2.4. In absence of proteinuria, one/more of:

2.4.1. Pulmonary edema

2.4.2. Platelet count  $<100 \times 10^9/\text{litre}$

2.4.3. Serum creatinine  $>97 \mu\text{mol/L}$  or a doubling in its value

2.4.4. Abnormal liver enzymes (ALT or AST  $>67 \text{ IU/litre}$ )

3. 'Severe features' of PE (one or more), and its components, according to ACOG 201915 and without alternative diagnoses:

3.1. Severe hypertension (as defined below)

3.2. Platelet count  $<100 \times 10^9/\text{L}$

3.3. ALT or AST raised to twice normal ( $>67 \text{ IU/L}$ ) and persistent severe right upper quadrant abdominal or epigastric pain unresponsive to medication and not otherwise accounted for by alternative diagnoses

3.4. Serum creatinine  $>97 \mu\text{mol/L}$  or a doubling of value in the absence of other renal disease

3.5. Pulmonary edema

3.6. New-onset headache unresponsive to medication

3.7. Visual disturbances

4. Preeclampsia Integrated Estimate of Risk Score (PIERS) combined adverse maternal outcome, and its components, derived from Delphi consensus (with the exception of the Glasgow coma score  $<13$ ):

4.1. Maternal death

4.2. Central nervous system complications (one or more of):

4.2.1. Stroke (acute neurological event with deficits lasting > 24 hr, not due to a post-ictal state)

4.2.2. Eclampsia (generalized convulsion in the absence of a history of epilepsy)

4.2.3. Blindness (either retinal or cortical, defined as loss of visual acuity in the presence of intact pupillary response to light)

4.3. Cardiorespiratory complications (one or more of):

4.3.1. Uncontrolled hypertension (requiring administration of 3 or more different parenteral [intravenous or intramuscular] antihypertensive agents within a 12-hour period)

4.3.2. Inotropic support (use of vasopressors to keep systolic BP >90 mmHg or a MAP >70 mmHg)

4.3.3. Pulmonary oedema (diagnosed clinically with one/more of oxygen saturation < 95%, diuretic treatment or x-ray confirmation)

4.3.4. Respiratory failure (intubation, ventilation by endotracheal tube or non-invasively, or need for > 50% oxygen for > 1 hr which is not due to caesarean delivery)

4.3.5. Myocardial ischemia or myocardial infarction (by characteristic ECG changes and markers of myocardial necrosis)

4.3.6. SpO<sub>2</sub> <90%

4.4. Haematological complications (one or more of):

4.4.1. Platelet count <50 x 10e9/L

4.4.2. Transfusion (of any blood product)

4.5. Hepatic complications (one or more of):

4.5.1. Dysfunction (INR>1.2 in the absence of DIC or treatment with warfarin, OR, in the presence of DIC or treatment with warfarin: either mixed hyperbilirubinemia >17 µM or hypoglycemia <2.5 mM) in the absence of insulin)

4.5.2. Hepatic haematoma or rupture (presence of a blood collection under the hepatic capsule as confirmed by imaging or at laparotomy)

4.6. Acute kidney injury:

4.6.1. Acute serum creatinine >200 µM with pre-existing renal disease

4.6.2. Acute serum creatinine >150uM with no pre-existing renal disease

4.6.3. Dialysis

4.7. Placental abruption (clinically or on placental examination)

4.8. Other (as detailed, with appropriate information from hospital records)

5. Core maternal outcome set for PE17 (one or more of) and its components:

5.1. Maternal mortality

5.2. Central nervous system complications: eclampsia, stroke, blindness that is retinal or cortical (as defined for PIERS)

5.3. Cardiorespiratory complications: pulmonary edema, respiratory failure (as defined for PIERS)

5.4. Platelet count <100 x 10e9/L

5.5. Hepatic complications: AST or ALT raised to twice normal, or haematoma (as for PIERS)

5.6. Acute kidney injury (as for PIERS)

5.7. Placental abruption

5.8. Postpartum haemorrhage (defined as blood loss ≥1 L within the first 24 hours after birth)

5.9. Maternal admission to intensive care or high dependency unit

6. Severe hypertension (defined as systolic BP ≥160 mm Hg and/or diastolic BP ≥110 mm Hg, on at least one occasion)

7. Caesarean section (any)

8. Labour onset, classified as spontaneous, induced, or no labour. (Spontaneous rupture of membranes without labour will be considered as spontaneous labour onset)

9. Maternal admission to intensive care or high dependency unit

10. Total number of nights in hospital

11. Gestational age at delivery

12. Stillbirth

13. Birthweight <3rd, <5th and <10th percentile for gestational age, calculated using the Fetal Medicine Foundation birthweight chart

14. Neonatal death (after birth or within the first 28 days of life)
15. Admission to neonatal care unit (for any duration)
16. Neonatal morbidity:
  - 16.1. Intraventricular haemorrhage grade II or above, defined as bleeding into the ventricles
  - 16.2. Neonatal sepsis (defined as confirmed bacteraemia in cultures)
  - 16.3. Encephalopathy grade (mild, moderate, severe) requiring head cooling
  - 16.4. Neonatal seizures
  - 16.5. Anaemia defined as low haemoglobin and/or haematocrit requiring blood transfusion
  - 16.6. Respiratory distress syndrome, defined as the need for ventilation with or without surfactant
  - 16.7. Necrotising enterocolitis requiring surgical intervention
  - 16.8. Composite of any of the above
17. Neonatal therapy:
  - 17.1. Neonatal intensive care unit admission
  - 17.2. Ventilation, defined as the need for positive pressure (continuous positive airway pressure) or nasal continuous positive airway pressure (NCPAP) or intubation
  - 17.3. Composite of any of the above

**Completion date**

21/11/2024

## Eligibility

**Key inclusion criteria**

1. Singleton pregnancy
2. Live fetus at 35+0-36+6 weeks' gestation
3. Able to provide informed and documented consent

**Participant type(s)**

Patient

**Healthy volunteers allowed**

No

**Age group**

Mixed

**Lower age limit**

16 years

**Upper age limit**

55 years

**Sex**

Female

**Total final enrolment**

8000

**Key exclusion criteria**

1. Age <16 years
2. Women with established PE
3. Known major fetal abnormality
4. Participating in another intervention study that influences the outcomes of this study

**Date of first enrolment**

30/04/2023

**Date of final enrolment**

21/11/2024

## Locations

**Countries of recruitment**

United Kingdom

England

**Study participating centre**

**King's College Hospital**

16-20 Windsor WalK

London

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**Study participating centre**

**Medway Maritime Hospital Laboratory**

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## Sponsor information

**Organisation**

King's College Hospital NHS Foundation Trust

**ROR**

<https://ror.org/01n0k5m85>

# Funder(s)

## Funder type

Charity

## Funder Name

Fetal Medicine Foundation

## Alternative Name(s)

FMF

## Funding Body Type

Private sector organisation

## Funding Body Subtype

Trusts, charities, foundations (both public and private)

## Location

United Kingdom

# Results and Publications

## Individual participant data (IPD) sharing plan

### IPD sharing plan summary

Data sharing statement to be made available at a later date

## Study outputs

| Output type                      | Details | Date created | Date added | Peer reviewed? | Patient-facing? |
|----------------------------------|---------|--------------|------------|----------------|-----------------|
| <a href="#">Results article</a>  |         | 04/12/2025   | 18/12/2025 | Yes            | No              |
| <a href="#">Protocol article</a> |         | 10/04/2025   | 14/04/2025 | Yes            | No              |