



# Prevention of Cerebral Palsy in Pre-Term Labour (PReCePT)



# Clinical Background

- The prevalence of preterm birth is increasing
- While the survival of infants born preterm has improved, the prevalence of cerebral palsy has risen
- The incidence of cerebral palsy decreases significantly with increasing gestational age

**22–27 weeks 14.6%**

**28–31 weeks 6.2%,**

**32–36 weeks 0.7%**

**Full-term - 0.1%**





# Aims

---

- To improve compliance with NICE Guidance NG25 and increase the proportion of eligible women offered Magnesium Sulphate (MgSO<sub>4</sub>) in England
- Long Term: Reduction in the incidence of cerebral palsy in babies born preterm.



# Clinical Background

## Magnesium sulphate for women at risk of preterm birth for neuroprotection of the fetus (Review)

Doyle LW, Crowther CA, Middleton P, Marret S, Rouse D



THE COCHRANE  
COLLABORATION®

This is a reprint of a Cochrane review, prepared and maintained by The Cochrane Collaboration and published in *The Cochrane Library* 2010, Issue 1

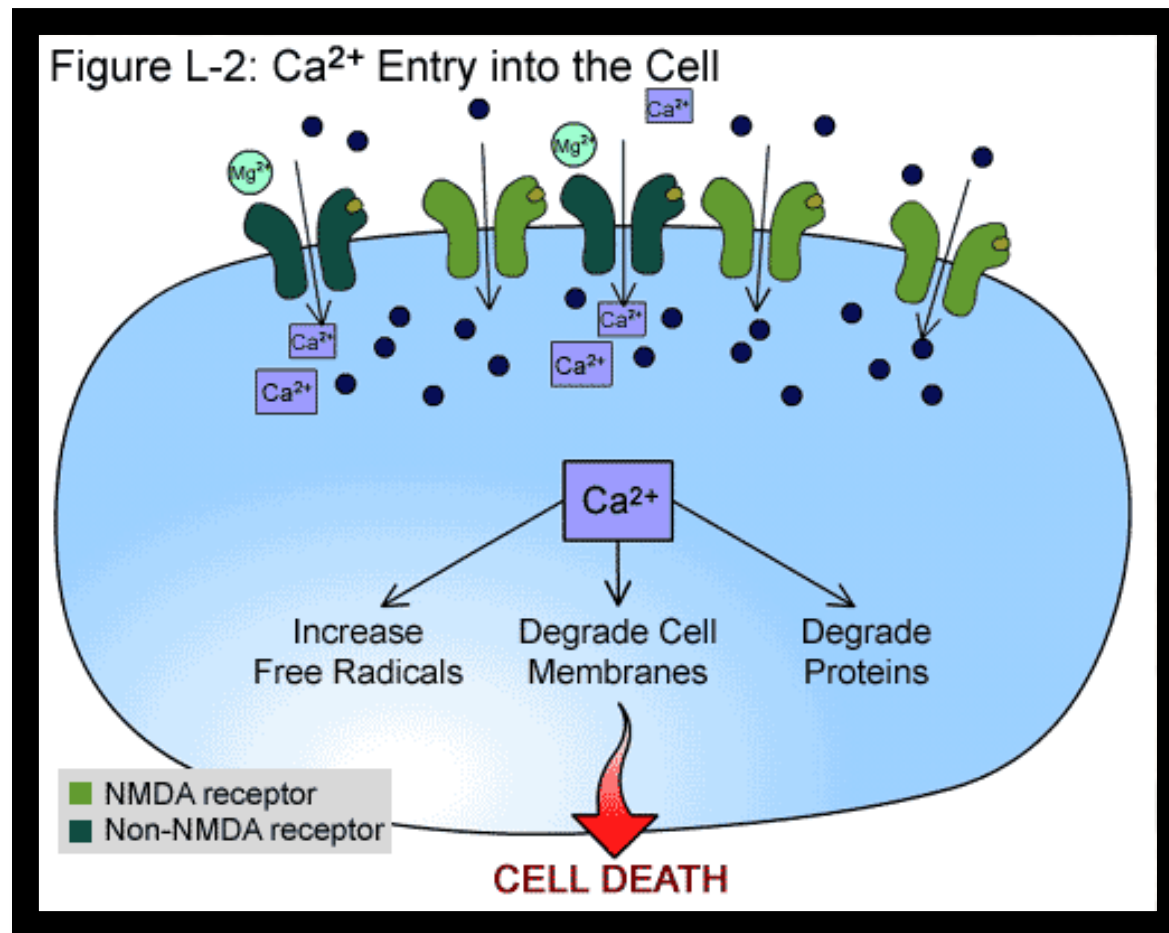
<http://www.thecochranelibrary.com>

Antenatal magnesium sulphate therapy given to women at risk of preterm birth substantially reduced the risk of cerebral palsy in their child (relative risk (RR) 0.68; 95% Confidence interval (CI) 0.54 to 0.87; five trials; 6145 infants).



# MgSO<sub>4</sub>: Mechanism of Action

Rapidly crosses the placenta and enters the fetal brain within minutes





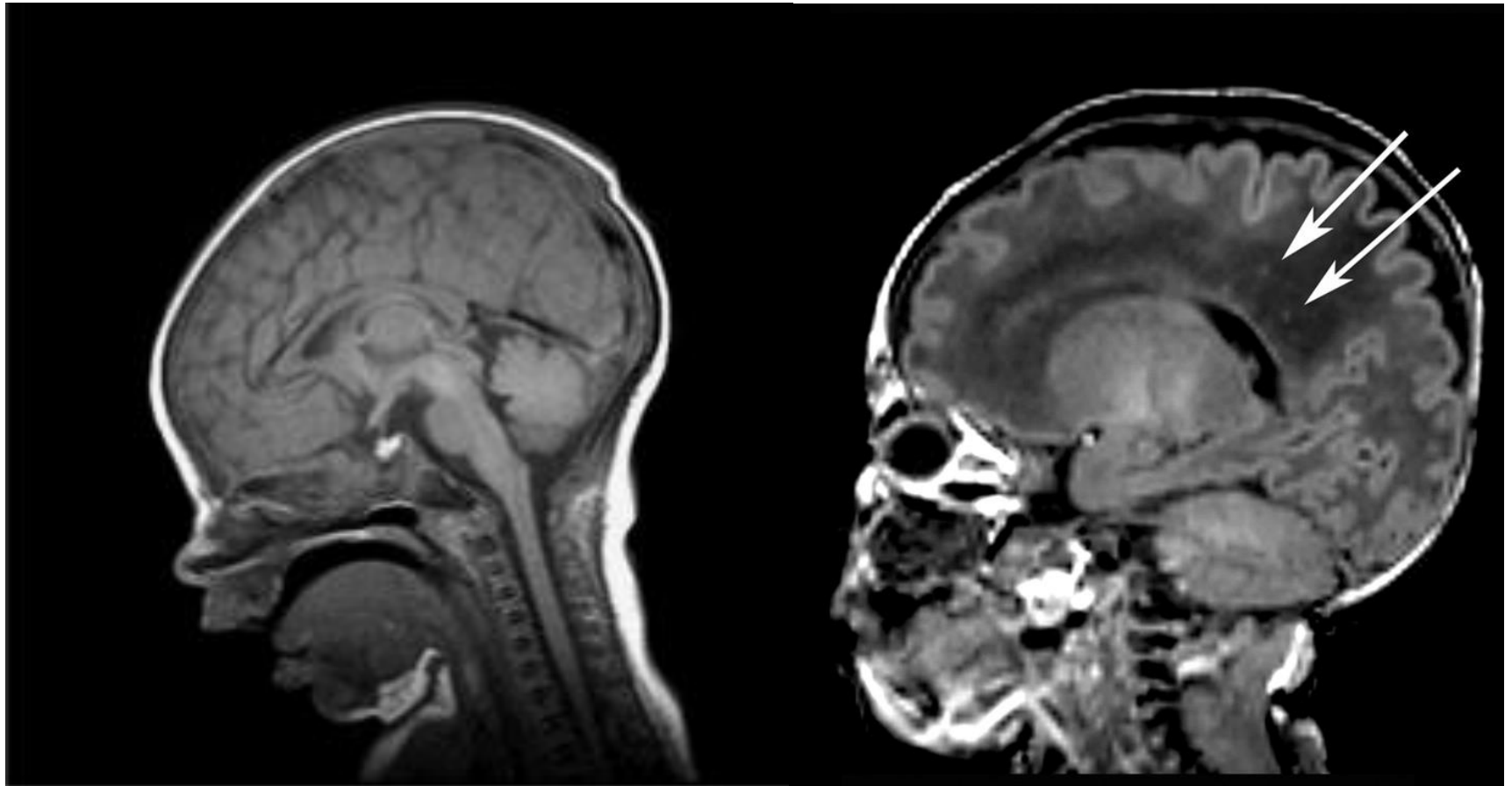
# The Problem

- Fewer than half of eligible women in planned/unplanned preterm labour are receiving magnesium sulphate (MgSO<sub>4</sub>) when clinically indicated.
- Challenge presented to West of England Academic Health Science Network by University Hospitals Bristol NHS Trust in 2014.
- Reviewed clinical evidence for MgSO<sub>4</sub>
- Steering Group of experts formed
- QI project designed across 5 Trusts in W-England
- PReCePT journey began
  - (BMJ Open Quality; Burhouse et al., 2017)





# Preterm Brain Injury





# Preterm Birth and Cerebral Palsy

- Preterm birth is the major risk factor for CP
- 10% of very low birth weight babies develop CP







# Cerebral Palsy (CP)

- A condition marked by impaired muscle coordination/movement (spastic paralysis) and/or other disabilities, typically caused by damage to the brain before or at birth
- Average lifetime Health Care costs per individual: ~£800,000
- The cost to the individual and their family is unquantifiable
- Until recently no intervention available to prevent CP in preterm babies





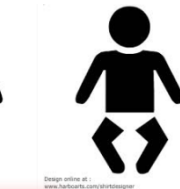
# Cerebral Palsy



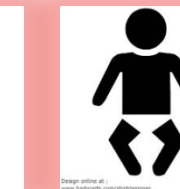
Unable to walk



Unable to talk



Epilepsy



Experience pain



Intellectual  
impairment



# Academic Health Science Networks

---

- AHSNs are a diverse network of partners (providers of NHS care working with universities, industry, NHS commissioners and a wide range of other organisations)
- The West of England Academic Health Science Network is one of 15 such networks across England and led the initial PReCePT project
- Working to put innovation at the heart of healthcare, to improve patient outcomes.







# Cost of Magnesium Sulphate

- From £1 per treatment
- MgSO<sub>4</sub> ampoule = £1
- 5 x N/Saline Ampoules = £0
- Plus the cost of consumables



# The Pathway

- Guideline
- Proforma for women's notes
- Parent information leaflet co-created with Bliss & local parents





# Drivers for success

---

- Strong clinical representation from pilot sites
- Strong lay representation
- Fast paced; progress made rapidly
- Strong 'buy in' at Trust Executive level





# PReCePT DRIVER DIAGRAM

## Primary Drivers:

System components which will contribute to moving the aim

## Secondary Drivers:

Elements of the associated primary driver.

They can be used to create projects or change packages that will affect the primary driver

## Aims / Primary

**Outcome:**  
To increase the numbers of eligible women offered Magnesium Sulphate to prevent cerebral palsy in preterm babies from 43% to 86% (to match antenatal steroid uptake) between 2018 and 2020.

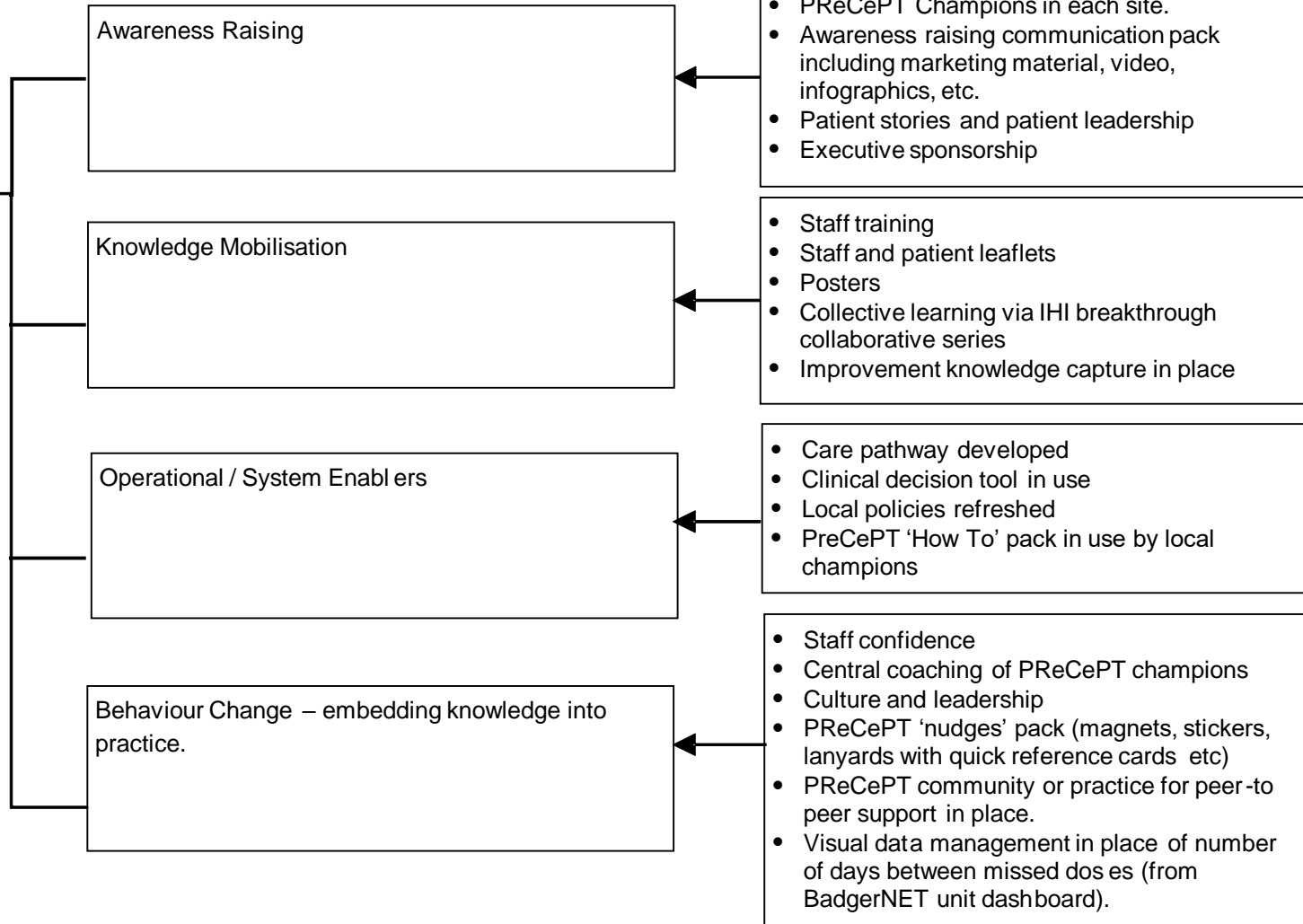
## Measures:

**Aim Measure:**

**Primary Driver - Outcome Measure (s):**

**MgSO4 Uptake**

**Secondary Drivers - Process measure(s):**





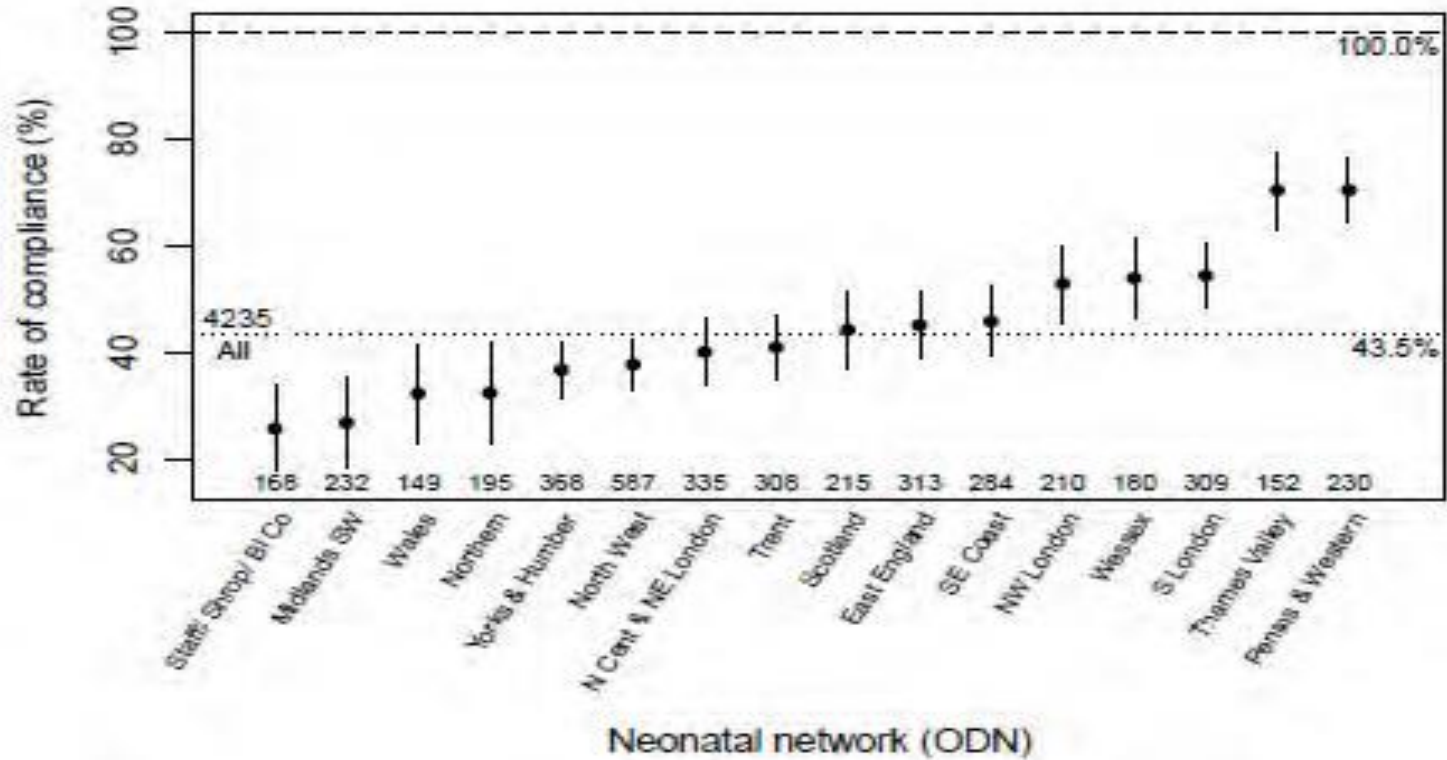


# Clinical Guideline - Key Points

- Offer MgSO<sub>4</sub> to all women less than 30 weeks gestation who are in established preterm labour or having a planned preterm birth within 24 hours
- Consider for women 30<sup>+0</sup> - 33<sup>+6</sup> weeks gestation who are in established preterm labour or having a planned preterm birth within 24 hours
- Administer a 4g Intravenous bolus of MgSO<sub>4</sub> followed by infusion 1g per hour until birth or for 24 hours whichever is sooner
- Administer to women prior to transfer to other centres; discontinue infusion during transfer
- Contraindications: patient choice to decline, Myasthenia Gravis and emergency/urgent delivery
- Ideally the earlier before birth the better, (within 24 hours), but even when given immediately (0-4 hours) before birth it will have benefit.



# The national picture





# Clinical Evidence

NICE 2015 (NG25)

BMJ Open Quality (2017)

Preterm labour and birth (NG25)

## 1.10 Magnesium sulfate for neuroprotection

- 1.10.1 Offer intravenous magnesium sulfate for neuroprotection of the baby to women between 24<sup>10</sup> and 29<sup>16</sup> weeks of pregnancy who are:
- in established preterm labour or
  - having a planned preterm birth within 24 hours.
- 1.10.2 Consider intravenous magnesium sulfate for neuroprotection of the baby for women between 30<sup>10</sup> and 33<sup>16</sup> weeks of pregnancy who are:
- in established preterm labour or
  - having a planned preterm birth within 24 hours.
- 1.10.3 Give a 4 g intravenous bolus of magnesium sulfate over 15 minutes, followed by an intravenous infusion of 1 g per hour until the birth or for 24 hours (whichever is sooner).
- 1.10.4 For women on magnesium sulfate, monitor for clinical signs of magnesium toxicity at least every 4 hours by recording pulse, blood pressure, respiratory rate and deep tendon (for example, patellar) reflexes.
- 1.10.5 If a woman has or develops oliguria or other signs of renal failure:
- monitor more frequently for magnesium toxicity
  - think about reducing the dose of magnesium sulfate.

BMJ Open Quality

## Preventing cerebral palsy in preterm labour: a multiorganisational quality improvement approach to the adoption and spread of magnesium sulphate for neuroprotection

Anna Burhouse,<sup>1</sup> Charlotte Lea,<sup>2</sup> Stephen Ray,<sup>1</sup> Hannah Bailey,<sup>3</sup> Ruth Davies,<sup>4</sup> Hannah Harding,<sup>2</sup> Rachel Howard,<sup>5</sup> Sharon Jordan,<sup>6</sup> Noshin Menzies,<sup>1</sup> Sarah White,<sup>1</sup> Kathryn Phillips,<sup>1</sup> Karent Luyt<sup>7</sup>

To cite: Burhouse A, Lea C, Ray S, et al. Preventing cerebral palsy in preterm labour: a multiorganisational quality improvement approach to the adoption and spread of magnesium sulphate for neuroprotection. *BMJ Open Quality* 2017;6:e000189. doi:10.1136/bmpq-2017-000189

Received 16 August 2017  
Accepted 16 August 2017



<sup>1</sup>Quality Improvement, West of England Academic Health Science Network, Bristol, UK  
<sup>2</sup>Maternity, United Bristol Hospital NHS Foundation Trust, Bristol, UK  
<sup>3</sup>Maternity, Royal United Hospital Bath NHS Trust, Bath, UK  
<sup>4</sup>Maternity, Great Western Hospitals NHS Foundation Trust, Swindon, UK  
<sup>5</sup>Maternity, Gloucestershire Hospitals NHS Foundation Trust, Cheltenham, UK  
<sup>6</sup>Maternity, North Bristol NHS Foundation Trust, Bristol, UK  
<sup>7</sup>School of Clinical Science, University of Bristol, Bristol, UK

Correspondence to  
Anna Burhouse;  
anna.burhouse@gmail.com

**ABSTRACT**  
Magnesium sulphate has been demonstrated to be an effective neuroprotectant for babies delivered prematurely (under 37 weeks' gestational age). Antenatal administration reduces infant mortality and cerebral palsy (CP); however, uptake in the UK has been significantly lower than other countries. A quality improvement (QI) project (Preventing Cerebral Palsy in Pre-Term Labour (PreCePT)) was carried out in the West of England, UK, to raise awareness of evidence and to improve the uptake of magnesium sulphate as neuroprotectant in preterm deliveries. Five National Health Service (NHS) Trusts and the West of England Academic Health Science Network participated in the QI project. The project was underpinned by a multifaceted QI approach that included: patient and clinical coproduction of resources; recruitment of clinical champions to support the local microsystems and create a stimulating/supporting environment for change; Plan, Do, Study, Act cycles; training for over 600 NHS staff and awareness raising and strategic influencing of key leaders. A baseline audit and regular measurement of the number of eligible women receiving magnesium sulphate was undertaken at each hospital site, and the overall programme was evaluated using data from an international benchmarking organisation for neonatal care outcomes—the Vermont Oxford Network. During the project 664 staff received magnesium sulphate training. The use of magnesium sulphate increased across the West of England from an average baseline of 21% over the 2 years preceding the project to 88% by the conclusion of the project. The project was also able to influence the development of a national data collection process for benchmarking the use of magnesium sulphate for neuroprotection in preterm deliveries in the UK. PreCePT appears to have had a favourable effect on the uptake of magnesium sulphate across the West of England. The project has also provided learning about how to stimulate adoption and spread of evidence using a QI approach across a network.

### PROBLEM

Cerebral palsy (CP) is a significant consequence of preterm birth.<sup>1</sup> Within the West of

England, approximately 500 infants are born weighing less than 1500 g each year.<sup>2</sup> These babies are eligible for antenatal magnesium sulphate, which has been proven to reduce the rate of CP.<sup>1</sup> Before the inception of this project, only between 8% and 66% of eligible infants were receiving this treatment across the five sites,<sup>3</sup> potentially resulting in disability that could have been prevented. Significant variation in operational practice was identified both within and between the sites, and we discovered that even where a policy existed that highlighted the need to give antenatal magnesium sulphate, it was not consistently being administered, and a large number of staff and parents were unaware of the need to offer this treatment, often confusing it with the treatment for pre-eclampsia.

The West of England Academic Health Science Network is a membership organisation made up of NHS health and social care providers, clinical commissioning groups, universities and the South West Ambulance Service. It acts to coordinate projects across the member organisations to improve quality and patient safety and speed up the adoption of evidence into practice.

'PreCePT' was co-designed with a range of partners in response to a call asking for local examples of best practice that could be shared with our member organisations and which would benefit from a QI approach to implementation and spread.

Dr Karen Luyt, MBChB, PhD, FRCPC (Consultant in Neonatal Medicine and Consultant Senior Lecturer Neonatal Neuroscience, University of Bristol), submitted a proposal to share the progress that had been made in University Hospitals Bristol NHS Foundation Trust in the use of magnesium



# Clinical Evidence

## Assessing the neuroprotective benefits for babies of antenatal magnesium sulphate: An individual participant data meta-analysis

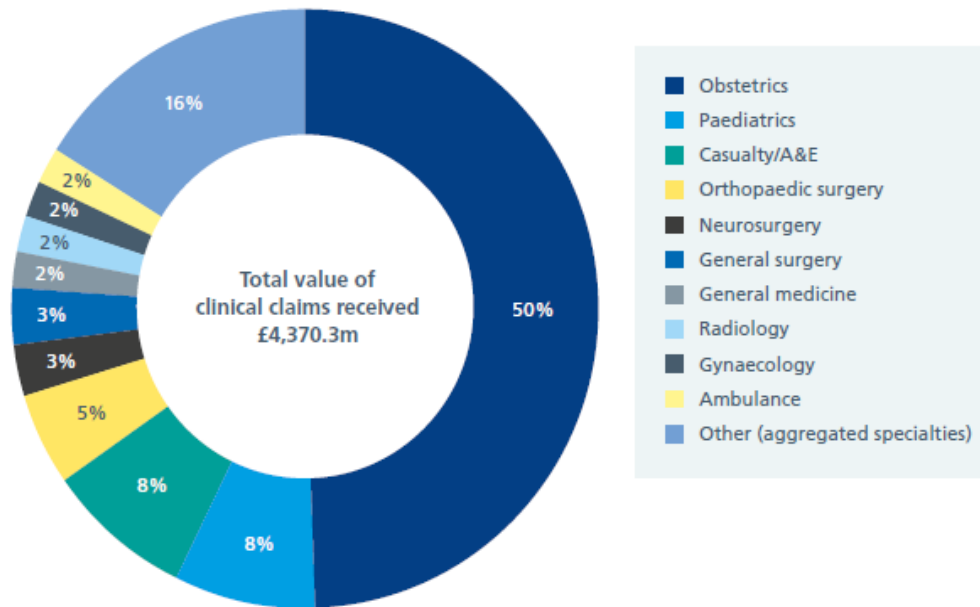
Caroline A. Crowther<sup>1,2\*</sup>, Philippa F. Middleton<sup>2,3</sup>, Meryn Voysey<sup>4</sup>, Lisa Askie<sup>5</sup>, Lelia Duley<sup>6</sup>, Peter G. Pryde<sup>7</sup>, Stéphane Marret<sup>8,9</sup>, Lex W. Doyle<sup>10,11,12</sup>, for the AMICABLE Group<sup>11</sup>

- Antenatal magnesium sulphate for fetal neuroprotection can be recommended to be given close to planned or expected preterm birth using the smallest effective dose of 4g with or without a 1g/hour maintenance dose
- Antenatal magnesium sulphate is an inexpensive effective treatment that can reduce the burden of death and cerebral palsy in babies born very preterm
- Widespread adoption of recommendation to use antenatal magnesium sulphate prior to preterm birth could lead to significant global health benefits



# NHS Litigation Cost for CP: £1.9 billion in 2016

Figure 10: Value of clinical negligence claims received in 2016/17 by speciality across all clinical negligence schemes<sup>5</sup>



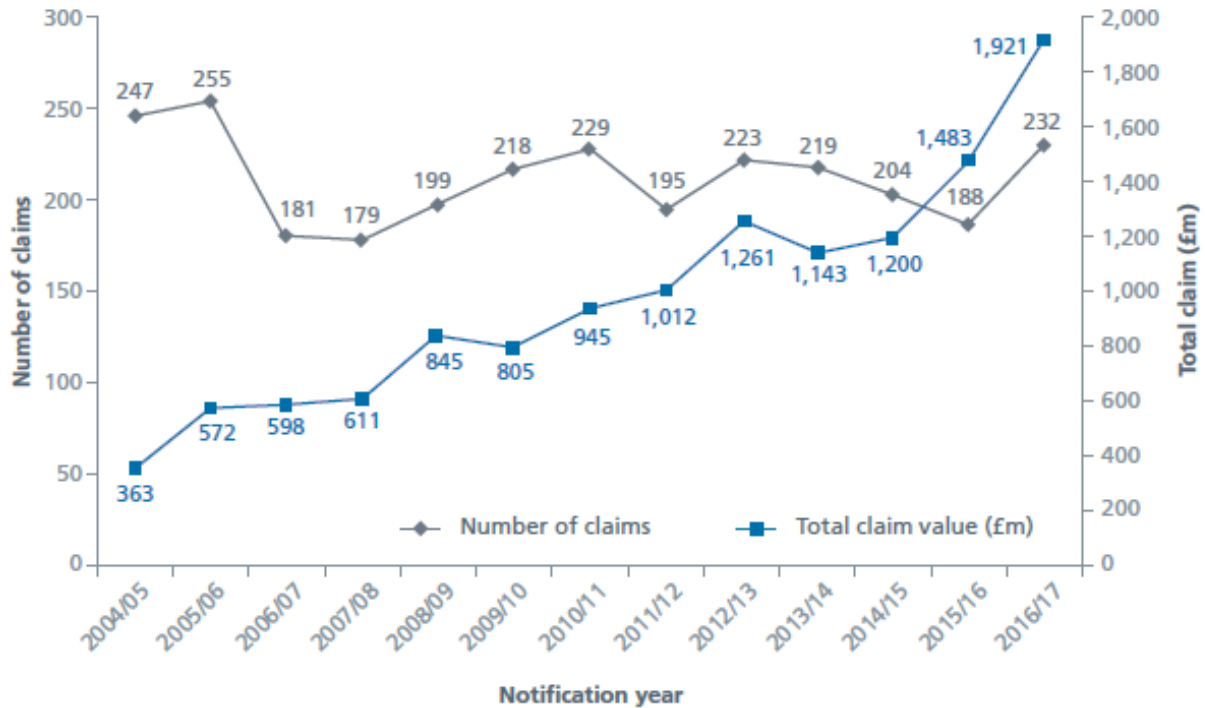
As in previous years, the greatest value of claims received across all our clinical negligence schemes relate to the obstetrics speciality.

## NHS Resolution

Annual report and accounts 2016/17

# And increasing.....

**Figure 19: A comparison of the number and total value of claims for maternity cerebral palsy/brain damage claims over time across all clinical negligence schemes**





# The PReCePT Journey

---

Quality Improvement - refers to the systematic use of methods and tools to try to continuously improve the quality of care and outcomes for patients”

Ross & Naylor October 2017

Making the case for quality improvement lessons for NHS Boards & leaders

PReCePT Project :

Demonstrated implementation was achievable in 5 units in the West of England

PReCePT Study:

Evaluation of enhanced QI support in a recruited sample of units across the UK

PReCePT Programme:

Adoption & spread of best practice across England to all units



# PReCePT Programme Methodology

---

## **Tranche 1: (starting from June 2018)**

- 7 AHSNs; Approximately 78 maternity units
- Baseline ranging from 0% - 88% uptake with number of eligible births varying from 1 - 89 per unit

## **Tranche 2: (starting from September 2018)**

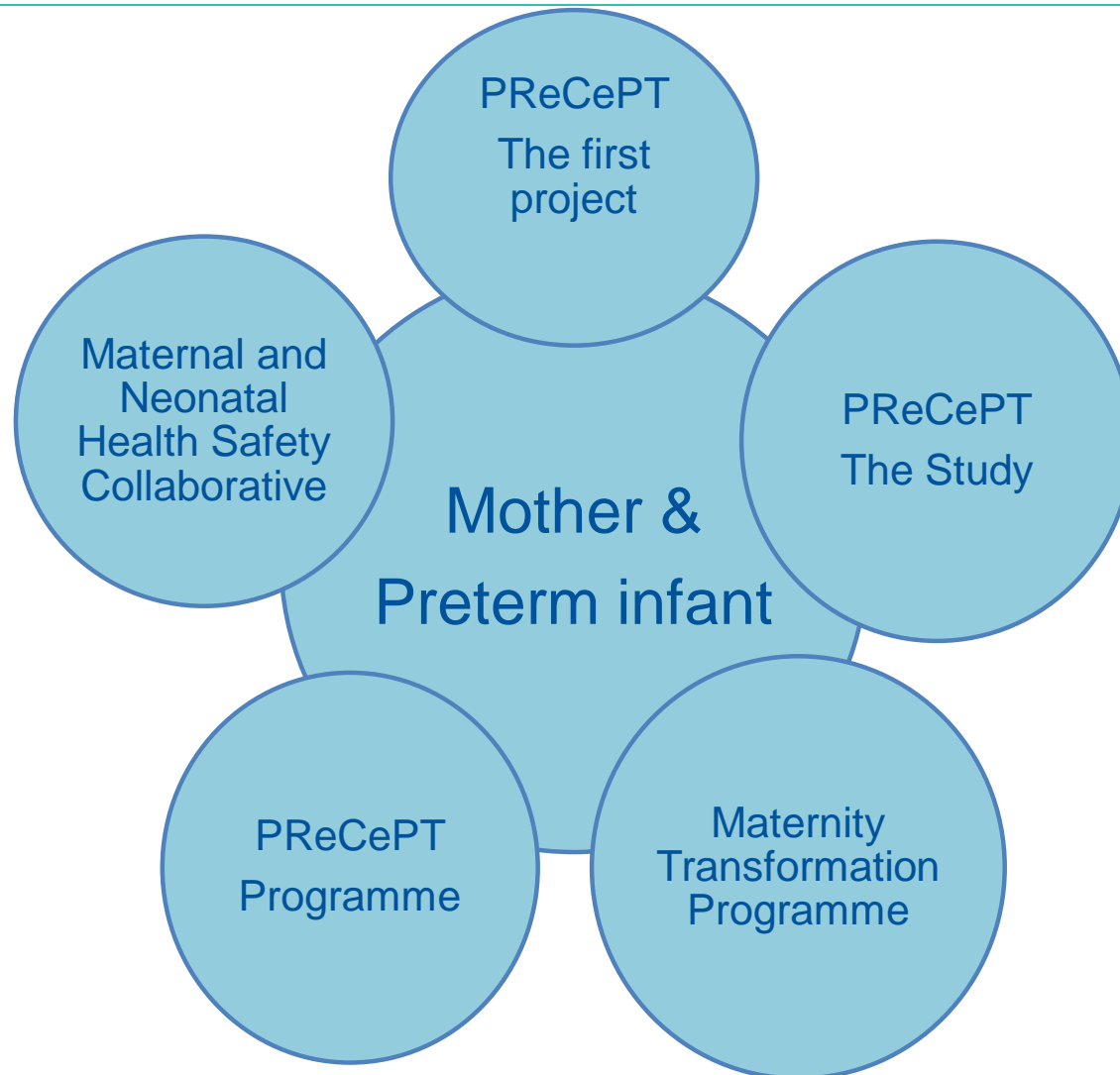
- 7 AHSNs; Approximately 72 maternity units
- Baseline ranging from 0% – 100% with number of eligible births varying between 1 – 92 per unit

**Aim: To increase the number of eligible mothers offered MgSO<sub>4</sub> from unit baseline (43% across England) to 85% with a stretch target of 95%**





# Improving outcomes for maternal and neonatal health





# Life QI

---

A quality improvement platform for health and social care, used globally and developed with NHS

- All project documents in one place – create driver diagrams, conduct PDSA cycles & view run charts
- Facilitates collaboration & discussion
- Can be used for QI at any scale
- Provides reporting & analytics
- Secure space for QI data



# PReCePT Programme Timeline

---

- April 2018: NHSE funding to adopt and spread PReCePT to all maternity units in England using the AHSN network as the supporting vehicle
- June 2018: Baseline data available from Patient Safety Measurement Unit (from BadgerNet)
- June 2018: First tranche of 7 AHSN's work with their local units to implement PReCePT
- September 2018: Second tranche of 7 AHSNs Go Live
- April 2020: Achieve target of 85% eligible mothers receive MgSO<sub>4</sub> and a stretch target of 95% in high achieving units.



# Regional Neonatal Lead

---

- Provide clinical leadership to regional Maternity and Neonatal units to deliver PReCePT (Approximately 1 PA per week, fixed term 1 year)
- Support AHSNs within the region to ensure successful delivery of the project
- Communicate with AHSN leads and other partners to maximise engagement
- Work collaboratively with other regional leads to ensure effective implementation of the project locally and nationally
- Report on implementation progress & monitor uptake of MgSO<sub>4</sub> in maternity/neonatal units in the region
- Monitor and report on cerebral palsy rates on BadgerNet via the two years outcomes data
- Liaise with NHSi & AHSN Patient Safety Collaborative colleagues working on the clinical driver “Improve the optimisation and stabilisation of the very preterm infant” within the Maternal and Neonatal Health Safety Collaborative



# Role of the Obstetrician

---

- MgSO<sub>4</sub> administration is an obstetric intervention and a core component of the diagnosis and management of preterm labour
- Each unit should engage the support of an Obstetrician to work collaboratively with Neonatologists and Midwives to ensure the intervention is incorporated into unit guidelines and becomes standard practice
- To work collaboratively with their regional lead in order to ensure effective implementation of the project locally and nationally



# Midwives, Neonatologists & Obstetricians

---

- **Work collaboratively** to ensure guidelines are consistent and reinforce the guidance in practice
- Liaise with transferring units to ensure MgSO<sub>4</sub> loading dose is given ***before transfer, if possible***
- Enter data in **BadgerNet** database when baby admitted to Neonatal Unit.
- Monitor MgSO<sub>4</sub> uptake rate for your unit monthly in **BadgerNet**



# Midwife Lead Role

---

- Act locally to successfully embed use of magnesium sulphate (MgSO<sub>4</sub>) pathway to become a sustainable part of on-going practice
- Develop working plan in partnership with AHSN PReCePT lead
- Develop local implementation plan e.g. clinical pathway, training package, Identification of staff groups and deliver training
- Create a communication and engagement plan
- Provide regular short reports to AHSN PReCePT lead
- Use LIFEQI i.e. PDSA on embedding MgSO<sub>4</sub>, time between missed doses, etc.
- Work collaboratively with Regional Clinical Lead to interrogate BadgerNet locally to review data completeness & support understanding of missed doses and other relevant issues



# Our challenge XX AHSN

(insert unit/AHSN name)

---

- Insert your local data here for Unit/AHSN if you wish






# Parent leaflets & posters



**Having a baby before 30 weeks: magnesium sulphate as protection against cerebral palsy**



Prevention of Cerebral Palsy in PreTerm Labour



## PreCePT

**Preterm births are increasing**  
More premature babies than ever before are surviving, but the number with cerebral palsy continues to increase

Cerebral palsy affects around 1 in every 400 babies\*  
nationally this was approximately 1,937 babies in 2016

Just under half are born prematurely.

1 in 3 unable to walk	1 in 4 unable to talk	1 in 4 has epilepsy	3 in 4 experience pain	1 in 2 has intellectual impairment
-----------------------	-----------------------	---------------------	------------------------	------------------------------------

**[MgSO<sub>4</sub>]**

### Magnesium Sulphate

Proven to be effective at reducing risk of developing cerebral palsy in babies born before 30 weeks

By around 50%

Offers neuroprotection reducing the risk of harm to a baby's brain

From £1.00 per treatment

Incidence of cerebral palsy

- 22-27 wks 14.6%
- 20-21 wks 6.2%
- 22-36 wks 0.7%
- full term 0.1%

From £1.00 per treatment

On average only 43% of eligible mothers received MgSO<sub>4</sub> in 2016

If we treated all mothers of at-risk babies, we could prevent 223 babies per year from developing cerebral palsy in England

\*There is a lot of variation regionally, nationally and internationally (driven by definitional issues, particularly at the less complex end of the condition, and genuine differences in underlying epidemiology).

Declaration: The Precept programme is funded by The Health Foundation in collaboration with the West of England AHSN, United Hospitals Bristol NHS Foundation Trust and NHR CLARHC West.



# What does this mean for PReCePT?

## If we get this right we can achieve:

- Improved quality and better woman centred care
- Improved neuroprotection for babies born at less than 30 weeks
- Become innovators & leaders in the national adoption and spread of the project

## AND MOST IMPORTANTLY

- Fewer babies with cerebral palsy
- Improved quality of life of preterm babies and their families





# Our mission

---

- To give every eligible mother in preterm labour the choice
- To enable every baby to reach their full potential



# Cormac's Story

First baby to benefit from MgSO<sub>4</sub> neuroprotection in Bristol



On Neonatal Intensive Care  
Born at 27 weeks gestation

Celebrating 1<sup>st</sup> Birthday



Age XX



Active & healthy 5 year old

Parental consent given to share their story and photographs



---

Look out for monthly  
**PReCePT** performance monitoring  
dashboards





---

Any Questions?