British Association of Perinatal Medicine

Antenatal Optimisation

for Preterm Infants less than 34 weeks

A Quality Improvement Toolkit

October 2020

in collaboration with

NNAP
National Neonatal
Audit Programme

Contents

Abbreviations

AHSN	Academic Health Sciences Network
ANS	antenatal steroids
CL	cervical length
CP	cerebral palsy
CS	caesarean section
EFW	estimated fetal weight
GBS	Group B Streptococcus
GIRFT	Getting It Right First Time
IGFB1	Insulin-like Growth Factor-Binding Protein 1
IUT	in utero transfer
IVH	intraventricular haemorrhage
LMS	local maternity system
LNU/SCU	Local Neonatal Unit/Special Care Unit
MatNeoSIP	Maternity and Neonatal Safety Improvement Programme
MCQIC-SPSP	Maternity & Children's QI Collaborative-Scottish Patient Safety Programme
MDT	multidisciplinary team
Mg	magnesium
NEC	necrotising enterocolitis
NICE	National Institute for Health and Care Excellence
NLR	negative likelihood ratio
NMPA	National Maternity and Perinatal Audit
NICU	Neonatal Intensive Care Unit
NNAP	National Neonatal Audit Programme
NSQI	Neonatal Services Quality Indicators
ODN	Operational Delivery Network
PAMG	Placental alpha microglobulin-1
PlGF	Placental Growth Factor
PLR	positive likelihood ratio
PTB	preterm birth
PTL	preterm labour
PVL	periventricular leucomalacia
qfFN	quantitative fetal fibronectin
QI	quality improvement
RCOG	Royal College of Obstetricians and Gynaecologists
SBLCBv2	Saving Babies Lives Care Bundle version 2
sIVH/PVH	severe (Grade 3 or 4) intraventricular haemorrhage/periventricular haemorrhage
SCN	Strategic Clinical Network
SOP	standard operating procedure
SPC	statistical process control
UKPCN	UK Preterm Birth Clinical Network
WHO	World Health Organisation

Overview

The focus of this toolkit is to support implementation of the key elements of Antenatal Optimisation (AO):
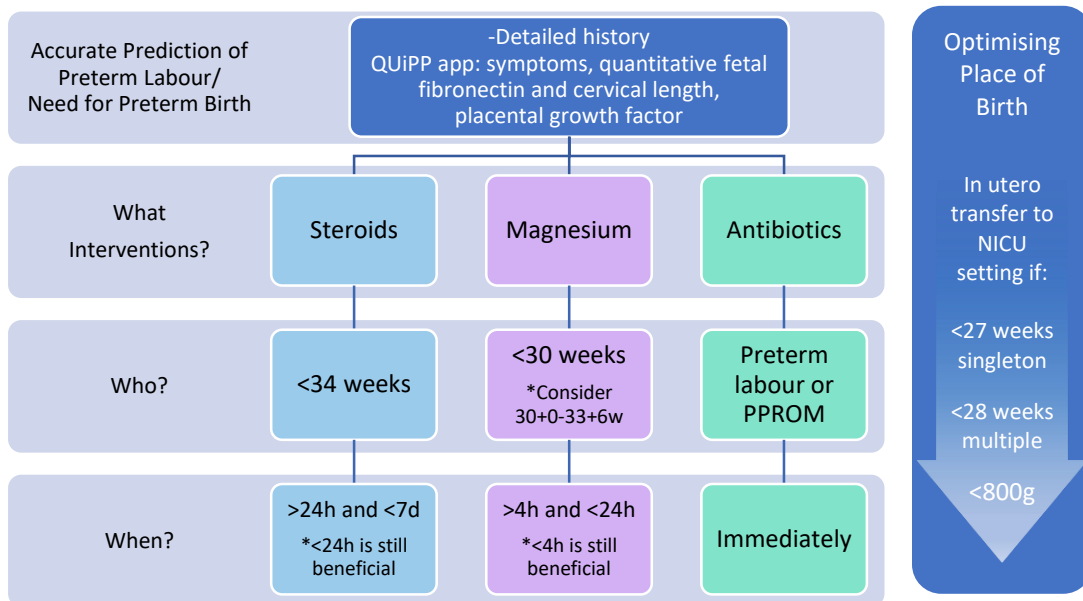
This toolkit is aimed at you if leading quality improvement around AO or you are in an improvement team:

- If you have the resources to undertake a full change management QI project but have little knowledge or experience you may want to read this toolkit in its entirety
- If you have some QI experience but know a limited amount about AO, you may wish to focus on the evidence and learning from high performers and parent stories
- If you know a lot about AO and the key elements required for improvement but lack QI knowledge you may choose to focus on understanding the QI journey and QI resources
- If you are tasked with collecting/understanding/interpreting data and do not know where to start, look out for the data tools
- If you are tasked with leading the project and you want to start building your project team, take a look at the section about who you need to get involved and how to optimise the context.

If your QI project team is a mix of all of the above, there should be something in this toolkit for everyone to get your project started.

This toolkit will provide your team with the following resources:

- The rationale for Antenatal Optimisation QI when you and your team, or those supporting the project at executive level, require to know the evidence for change
- Easy to use QI tools to understand where you are now and what you need to commence your project without any prior QI experience
- Guidance about how to build your team and secure buy-in for your project
- Examples of QI that have been shown to be successful in improving AO for very preterm babies, including improvement stories from high performing units
- Tools to help you measure and understand the impact of your changes
- Examples of how to embed change and sustain momentum including parent experience stories

Introduction

The British Association of Perinatal Medicine (BAPM) aims to improve standards of perinatal care by supporting all those involved in providing this care to optimise their skills and knowledge. A key value of the BAPM is 'working collaboratively' to provide the safest and most effective service for babies and families by delivering high quality perinatal care and provide support for perinatal professionals.

The National Neonatal Audit Programme (NNAP)[1] is commissioned by the Healthcare Quality Improvement Partnership (HQIP), delivered by the Royal College of Paediatrics and Child Health (RCPCH) and funded by NHS England along with the Scottish and Welsh Governments. The NNAP assesses whether babies admitted to neonatal units in the United Kingdom receive consistent high quality care. It sets evidence-based standards on key clinical outcomes and in turn identifies areas for quality improvement (QI) concerning the delivery and outcomes of neonatal care.

With these shared goals in mind, the BAPM, the NNAP and other key stakeholder organisations in perinatal care are collaborating in a three-year national quality improvement initiative which will target key NNAP measures. This initiative will align with and support other neonatal national quality workstreams such as the Maternity and Neonatal Safety Improvement Programme (MatNeoSIP)[2] in England, and the Maternity and Children Quality Improvement Collaborative-Scottish Patient Safety Programme (MCQIC-SPSP)[3] in Scotland. The work is aligned with the Saving Babies' Lives Care Bundle (SBLCBv2)[4]. Each improvement drive includes a QI toolkit mapped to the [BAPM Neonatal Services Quality Indicators](#) (NSQI)[5] and has been developed by clinicians who have demonstrated excellence in the area of focus, led by the multidisciplinary BAPM Quality Steering Group ([Appendix 1](#)). Improvement at local and national level as a result of improvement work undertaken will be measured by the NNAP and other stakeholder organisations.

Each toolkit will:
   a. Provide the evidence base for effective interventions
   b. Facilitate units in interrogating their data and processes in order to undertake selected quality improvement activities suited to the local context
   c. Assist units in interpreting and monitoring the results of their QI activities
   d. Provide and signpost resources to facilitate QI in the area of focus.

The toolkit has been designed using well-established QI methodology and under the Royal College of Paediatrics and Child Health 'Quality Improvement in Child Health' Strategic Framework[6]. The toolkit will introduce some essential QI tools and methods that are quick to learn and easy to apply. In addition the BAPM website also offers a range of free QI resources, links to easy-to-use templates and e-learning, QI tutorials and a forum for shared learning (www.bapm.org/quality). The toolkit does not intend to replicate any existing local or national QI activity undertaken in the area of focus but to complement these endeavours with a practical step-by-step guide.

The Perinatal Optimisation Care Pathway
Perinatal optimisation refers to the process of reliably delivering evidence-based interventions in the antenatal, intrapartum and neonatal period to improve preterm outcomes. Examples of current perinatal optimisation initiatives, which aim to result in the consistent application of a bundle of interventions, are those of the West of England AHSN PERIPrem bundle[7] and the SPSP-MCQIC Preterm Wellbeing Package[8].

The BAPM 'Perinatal Optimisation Care Pathway' refers to these various interventions as they occur over time and apply to both the mother and her preterm baby and aligns with key elements of the above initiatives. The pathway is supported by four BAPM toolkits (Antenatal Optimisation, Optimal Cord Management, Normothermia and Maternal Breast Milk). These toolkits are a focus of the implementation programme led by MatNeoSIP which supports key recommendations from the Neonatal Critical Care Transformation Review[9] and the Saving Babies Lives Care Bundle v2[4]. Additional perinatal optimisation interventions such as respiratory management are recognised, but are not yet included in this pathway.

The Perinatal Optimisation Care Pathway
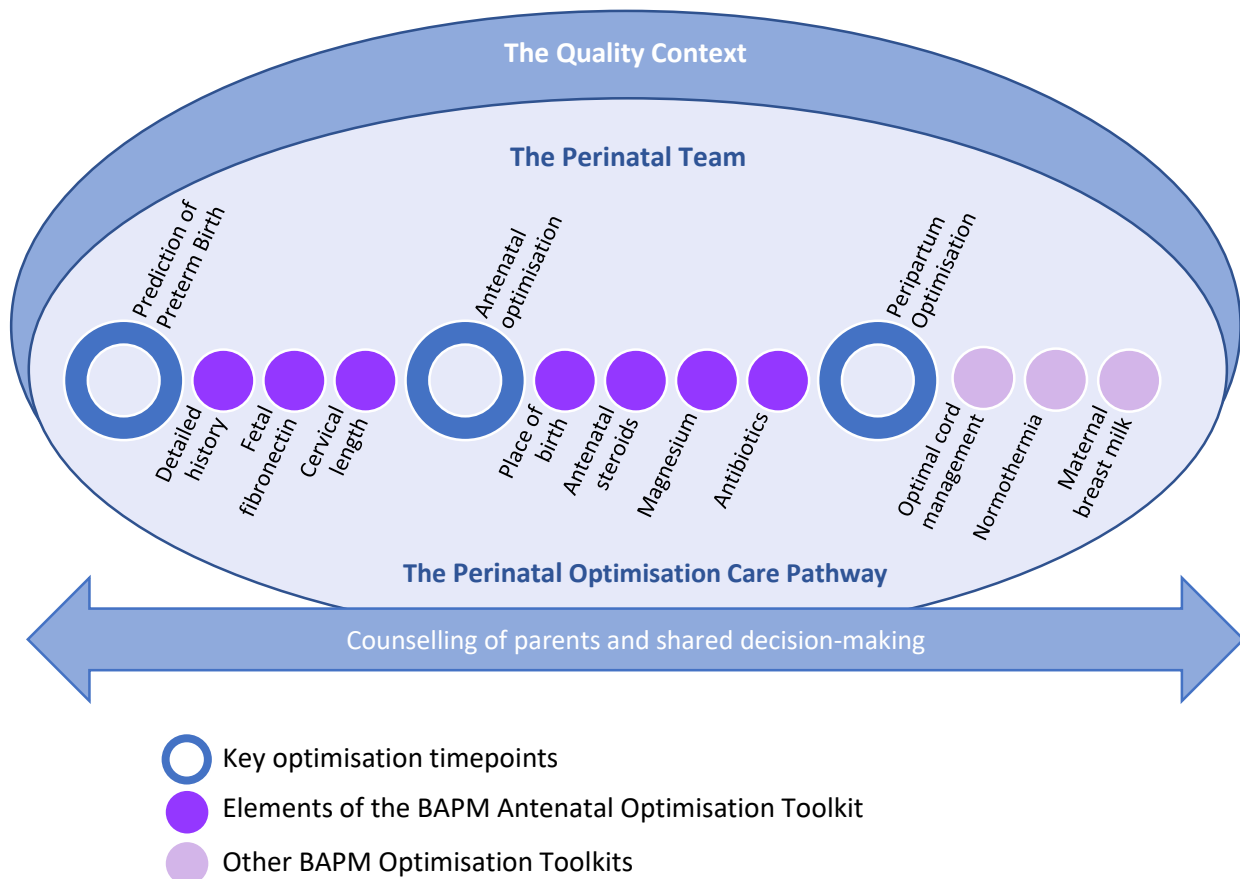
This Perinatal Optimisation Care Pathway sits within the remit of the local and network 'Perinatal Team' whose strong teamworking culture, high quality communication habits and pursuit of common goals result in the reliable delivery of these protective interventions. Such implementation success can only occur within a favourable 'Quality Context' where the structure and processes support an optimal environment for delivering quality improvement. Such key contextual features are described in the BAPM Neonatal Service Quality Indicators[5] (Appendix 2). Throughout the pathway high quality communication about risks and benefits of interventions should take place with parents. In the context of extreme preterm gestations, the principles of the BAPM Extreme Preterm Framework should be adhered to, including a joint discussion between the parents and both a senior obstetrician and neonatologist, which includes a risk-based assessment of prognosis[10]. For communication guidance, see the appendices 'Helping parents to understand extreme preterm birth' and 'Communication Guidance for professionals consulting with families at risk of extreme preterm delivery'.

Antenatal Optimisation: Toolkit Aims

- All women who are at risk of preterm birth (including both those in threatened preterm labour and those requiring intervention because of maternal or fetal indications), are **identified appropriately and in a timely manner** using evidence-based methods.
- All women giving birth before 34 weeks of gestation, should receive a full course of **antenatal steroids** no longer than 7 days prior to birth, and ideally completed 24-48 hours before birth
- All women giving birth before 30 weeks of gestation, should receive a loading dose and ideally a minimum of 4 hour infusion of **antenatal magnesium sulphate** within the 24 hours prior to birth.
- All women in established preterm labour (<37 weeks) should receive **intrapartum antibiotic prophylaxis** to prevent early onset neonatal Group B Streptococcal (GBS) infection irrespective of whether they have ruptured amniotic membranes.
- Singleton infants less than 27 weeks of gestation, multiples less than 28 weeks of gestation and any gestation with an estimated fetal weight of less than 800g should be **born in a maternity service on the same site as a neonatal intensive care unit (NICU).**

Notes:

Aims are different to standards. This toolkit does not seek to delineate standards. The aims of this toolkit are to improve the antenatal environment for all preterm infants whilst reducing unnecessary and potentially harmful treatments in those women who do not go on to give birth prematurely. It is fully acknowledged that while units and networks will strive to achieve full compliance across all measures without unnecessary intervention, due to the complex presentation of preterm labour this may not be achievable in all circumstances.

Where there is evidence of maternal or fetal compromise necessitating urgent intervention, achievement of the above objectives should never delay birth.

The optimal timing of antenatal steroids should be achieved by more accurate prediction of preterm birth rather than a routine strategy of repeat dosing which does not improve mortality but may impact fetal growth.

Birth during transport is extremely rare. In the vast majority of cases, timely transfer is appropriate and achievable, and the benefits outweigh the risks. Every decision about appropriateness of transfer should be made by a consultant obstetrician and be based on an assessment of the risk and benefit, distance to travel and risk of birth during the journey.

The delineation of strategies to prevent preterm birth is outwith the scope of this toolkit and are covered by NICE[11] and the UK Preterm Clinical Network[12].

Parents should be actively involved in planning the birth of their preterm baby along with neonatal, obstetric and midwifery teams. At gestations <27w, parents should be involved in risk-based shared decision-making with the most senior clinicians available in accordance with the BAPM Extreme Preterm Framework[10]. This working group recognises that not all families and clinicians will opt for an active treatment pathway for infants at very high risk of a poor outcome. Staff should be aware of local bereavement care arrangements and palliative care pathways and be able to signpost to local and national bereavement organisations. Clinical teams requiring support in these challenging cases should consult their local tertiary referral units for advice and guidance.

Rationale

Prematurity is the most significant cause of mortality in children under five and is associated with significant morbidity in surviving infants. Many well-established evidence-based antenatal interventions reduce the

risk of neonatal death and associated preterm morbidities. UK audit data show there is variable uptake in these interventions with wide variability between units and networks[13]. Optimal delivery of these interventions is dependent on the accurate prediction of preterm birth and the BAPM strongly recommends adoption of the QUiPP app using the QUiPP App Toolkit[14] to improve prediction and timing of interventions. This toolkit seeks to provide users with a framework to understand the local context for QI, understanding enablers and barriers to implementation so that key interventions can be more reliably delivered.

A summary of the evidence and key drivers for antenatal optimisation is provided in Appendix 3.

How to use this toolkit

This improvement activity referred to in this toolkit is not intended to be read as a guideline which mandates a standard improvement journey for all units. Instead it is a practical resource from which units who wish to improve compliance rates of antenatal optimisation measures can select the most suitable interventions for their particular context. For example, there are units which achieve high NNAP compliance with 'antenatal steroid administration' but this may be at the expense of optimal timing, occurring more than a week before birth with many more women treated than who go on to have a preterm birth. Another unit may have a lower compliance rate but the timing of administration is optimal. The improvement solution for each unit may be different. Similarly, optimal place of birth may be variably dictated by accuracy in predicting preterm birth or by referral, capacity or transfer issues. Individual units are encouraged to interrogate their processes in order to understand where and how optimisation measures are applied in their local setting and select interventions which are best suited to their context.

Antenatal Optimisation: Rationale and Key Elements
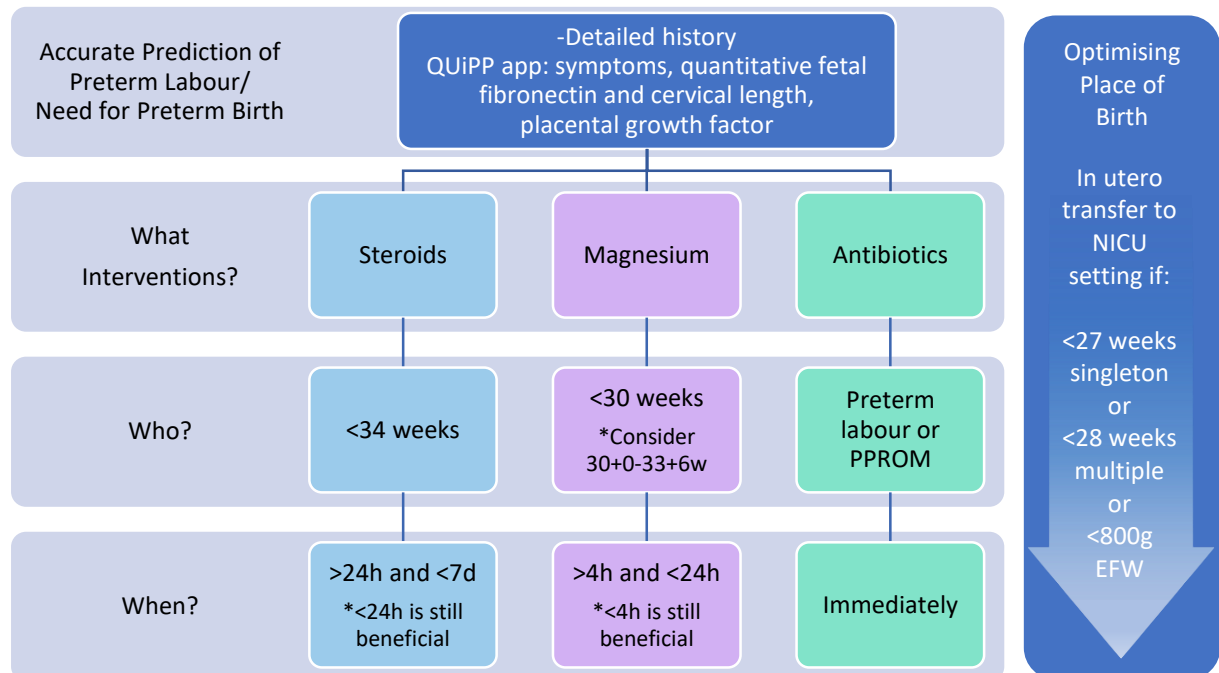
Antenatal Optimisation to Improve Preterm Outcomes- the rationale

See Appendix 3 for full evidence summary

- Reduce death by 30%
- Reduce NEC by 50%
- Reduce sIVH by 45%

1 more baby surviving for every 8-10 women treated <26w [15]

Steroids

Magnesium

•Reduces cerebral palsy by 30%

1 fewer baby with CP for every 37 women treated <30w [16]

1 fewer baby with infection for 9 GBS+ women treated in PTL [17]

Antibiotics

Place of birth

1 more baby surviving for every 20 women transferred [18]

•The risk of death from GBS in preterm infants is 25% and 10 times that of term infants

- If not born in a tertiary unit:
- 2-3x higher risk sIVH/PVH
- 1.3x higher risk of death

The Antenatal Optimisation Care Bundle- the key elements

See Appendix 3 for full evidence summary

Accurate Prediction of Preterm Labour/ Need for Preterm Birth	-Detailed history QUiPP app: symptoms, quantitative fetal fibronectin and cervical length, placental growth factor			Optimising Place of Birth
What Interventions?	Steroids	Magnesium	Antibiotics	In utero transfer to NICU setting if:
Who?	<34 weeks	<30 weeks *Consider 30+0-33+6w	Preterm labour or PPROM	<27 weeks singleton or <28 weeks multiple or <800g EFW
When?	>24h and <7d *<24h is still beneficial	>4h and <24h *<4h is still beneficial	Immediately	

- If these maternal interventions are not achieved before birth, the opportunity for benefit is lost •

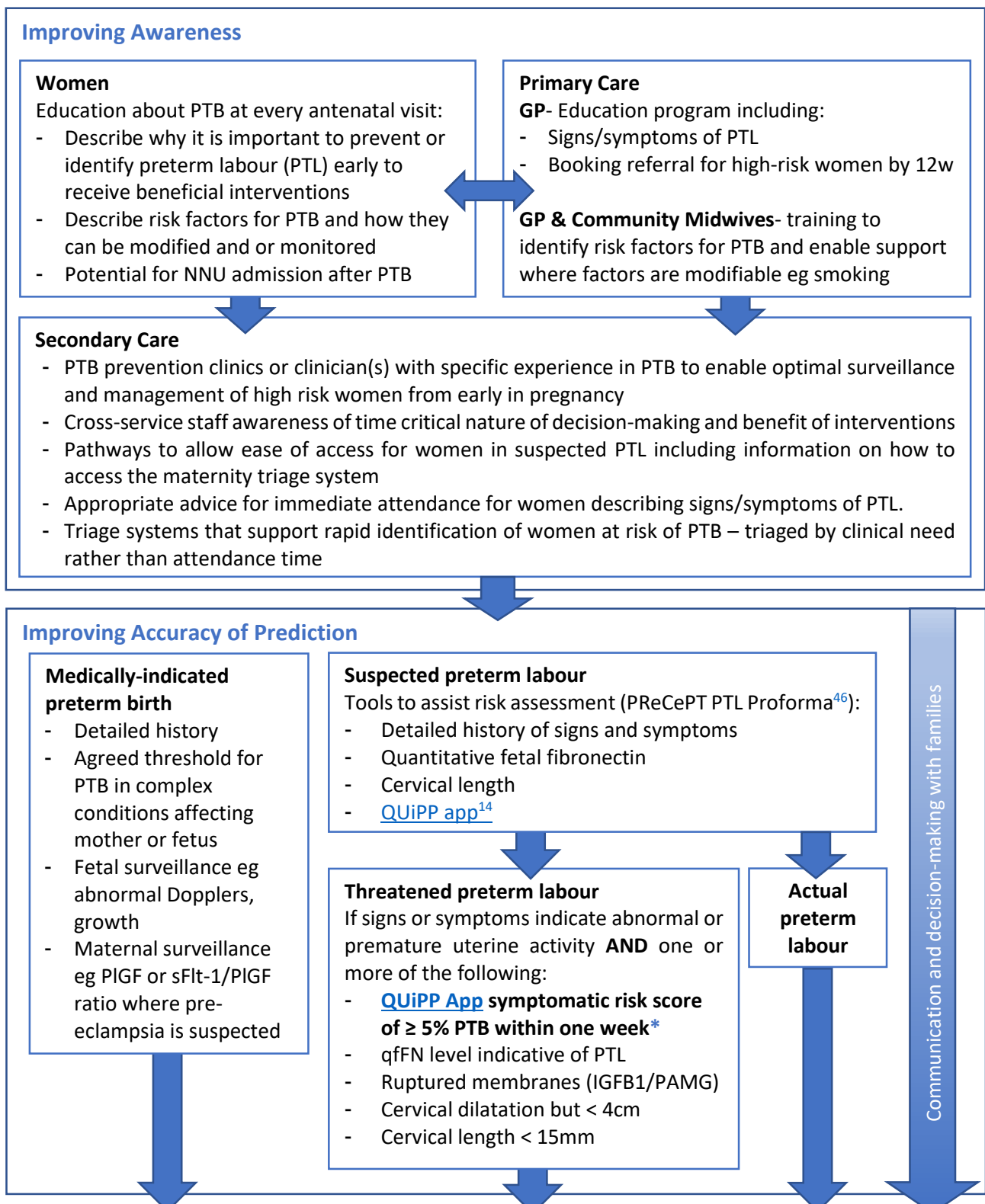# Antenatal Optimisation: Implementation evidence and resources

Table of evidence

The following table provides evidence of that which has been shown to be successful in practice in implementing the various elements of the Antenatal Optimisation pathway and lists other resources to support implementation.

Implementation strategy	Reference
Prediction of preterm birth	
Triage system for rapid assessment of women presenting in preterm labour	19
Use of clinical decision-making technology to improve accuracy	20
Guidelines for steroids, magnesium and antibiotics:	
Evidence-based	21-27
Readable, accessible and supported with training and implementation tools	21 23-29
High reliability of delivery: consistent adoption without discordant senior opinion	24-31
National or regional processes that incentivise, educate, train and support	1 23 25 27 32 33
Local, regional or national processes that support:	
Timely and efficient delivery (including standardisation, checklists, feedback, reminders, decision aids, process redundancy and default actions)	24-28
Cross disciplinary engagement and joint working	23-29 31 32 34
Clinical leadership	25 27 29
Data collection, audit and feedback	22-27 29 32 35
Training to promote benefits of interventions	24-29 31
Training in QI methodology	21 23 25 34
Change behaviour and improvements in organisational culture	21 23 25 27 28 34
Partnering with parents for improvement	26 29
Network level arrangements for:	
In utero transfer of women at risk of preterm birth	27 31 32 36
Neonatal unit capacity	27 32 36
Labour ward capacity	27 36
Centralisation of perinatal retrieval	37 38
Simplifying referral processes	27
Network level responsibility for:	
Standardising care throughout region	22 27 34 37 39-41
Reducing variation	22 27 34 39-41
Sharing performance data including exception reporting	22 27 30 34 35 39 40
Opportunities for shared learning	22 27 30 34 39 40
Organisations and resources supporting or incentivising quality improvement in Antenatal Optimisation	
Maternity and Neonatal Safety Improvement Programme, NHS England	2
Preterm Perinatal Wellbeing Package, MCQIC-SPSP	8
NNAP Online	1
Saving Babies' Lives Version 2, NHS England	4
NICE Adoption Support resource for Placental Growth Factor	42
Maternity Incentive Scheme, Clinical Negligence Scheme for Trusts, NHS Resolution	33
PReCePT	43
PERIPrem care bundle, West of England Academic Health Sciences Network	7
European Standards of Care for Newborn Health	44
Bliss Baby Charter	45

Achieving Antenatal Optimisation- Best Practice Flowchart

The following schema has been developed by the members of the Antenatal Optimisation toolkit group (Appendix 1), using evidence-based interventions and examples of best practice from high-performing units and networks, including the Guy's and St Thomas' Threatened Preterm Labour Guideline. It illustrates a system that is best designed to achieve a high rate of antenatal optimisation with a low rate of adverse consequences. Units and networks who wish to improve rates of antenatal optimisation should review the various timepoints in this pathway and identify elements of best practice which could be adopted locally.

Improving Awareness

Women
Education about PTB at every antenatal visit:
- Describe why it is important to prevent or identify preterm labour (PTL) early to receive beneficial interventions
- Describe risk factors for PTB and how they can be modified and or monitored
- Potential for NNU admission after PTB

Primary Care
GP- Education program including:
- Signs/symptoms of PTL
- Booking referral for high-risk women by 12w

GP & Community Midwives- training to identify risk factors for PTB and enable support where factors are modifiable eg smoking

Secondary Care
- PTB prevention clinics or clinician(s) with specific experience in PTB to enable optimal surveillance and management of high risk women from early in pregnancy
- Cross-service staff awareness of time critical nature of decision-making and benefit of interventions
- Pathways to allow ease of access for women in suspected PTL including information on how to access the maternity triage system
- Appropriate advice for immediate attendance for women describing signs/symptoms of PTL.
- Triage systems that support rapid identification of women at risk of PTB – triaged by clinical need rather than attendance time

Improving Accuracy of Prediction

Medically-indicated preterm birth
- Detailed history
- Agreed threshold for PTB in complex conditions affecting mother or fetus
- Fetal surveillance eg abnormal Dopplers, growth
- Maternal surveillance eg PlGF or sFlt-1/PlGF ratio where pre-eclampsia is suspected

Suspected preterm labour
Tools to assist risk assessment (PReCePT PTL Proforma[46]):
- Detailed history of signs and symptoms
- Quantitative fetal fibronectin
- Cervical length
- QUiPP app[14]

Threatened preterm labour
If signs or symptoms indicate abnormal or premature uterine activity **AND** one or more of the following:
- **QUiPP App** symptomatic risk score of ≥ 5% PTB within one week*
- qfFN level indicative of PTL
- Ruptured membranes (IGFB1/PAMG)
- Cervical dilatation but < 4cm
- Cervical length < 15mm

Actual preterm labour

Communication and decision-making with families

Improving Delivery of Antenatal Optimisation Interventions (S.T.A.M.P.E.D.)**

S. **Steroids**: if <34w. Give so that course is completed around 24h before birth and not more than 7 days before birth. Benefit remains if given <24h, if birth is imminent.

T. **Transfer:** evaluate need for transfer (<27w singletons, <28w multiples, <800g). Start process now.

A. **Antibiotics**: if labour is established, start GBS prophylaxis with optimal timing at least 4h before birth. If premature rupture of membranes, follow local guidance.

M. **Magnesium**: if <30w and consider up to 34w. Give a loading dose of intravenous magnesium sulphate then a maintenance infusion. Pause for transfer if necessary and restart after. Optimal timing to start at least 4h before and continuing up until birth but benefit may remain if given <4h, if birth imminent.

P. **Parents**: establish parental understanding and discuss risks and benefits of PTB and potential interventions. This should include the neonatal team, describe likely neonatal journey and offer tour.

E. **Evaluate for Tocolysis**: consider only if it allows in utero transfer.

D. **Delivery Plan**: to include early discussion with neonatal team, intrapartum monitoring, mode of birth, optimal cord management and whether active or palliative management for baby at birth.

Best Practice in Delivery of Antenatal Optimisation Interventions

General

It is recommended that each unit should establish:

- Obstetric, Neonatal and Midwifery leads for Antenatal Optimisation
- A 'Perinatal Team' culture with shared goals and responsibilities
- A maternity triage system such as the Birmingham Symptom-specific Obstetric Triage System[47] to expedite assessment of women presenting acutely with symptoms of PTL
- A preterm birth guideline to support the delivery of the key elements of Antenatal Optimisation
- A rolling training package including simulation to ensure staff awareness of both the benefits and the need for timeliness in delivering the elements of Antenatal Optimisation. Situational awareness training using the Situational Awareness Programme for Everyone (SAFE) Toolkit[48] may be valuable
- Auditable standards and a system of exception reporting where interventions are not achieved

Parents

- Information for parents about the risks of PTB, NNU admission and the benefit of interventions. PReCePT, Bliss and the BAPM Extreme Preterm Framework: Helping parents to understand extreme preterm birth have useful resources[10 45 46]
- Where a woman is expected to give birth before 27w, parental discussions should be led by senior members of the paediatric and neonatal teams and should be based on the BAPM Extreme Preterm Framework for Practice: Communication Guidance for professionals consulting with families at risk of extreme preterm delivery[10]
- Parent-held passports may aid information-sharing about interventions between different units

Pharmacological interventions

To ensure prompt administration of medication, consider the value of prescription templates, pre-made administration packs, stickers and checklists. Where available, practice should align with PReCePT[46]

In utero transfer

To ensure efficient and effective referral and transfer processes, networks should work to establish:

- A network-wide combined maternity and in utero transfer policy including reciprocal transfer
- A central referral hub with defined turnaround time (auditable) for requests
- Decisions about appropriateness of transfer being made by senior clinicians and supported by risk assessment tools using details of maternal and fetal wellbeing and progression of labour
- Remote support for clinicians in LNU/SCUs by those in NICU settings
- NICU and associated Maternity Unit policy of 'auto-acceptance' of in utero transfers
- Guidance about staff resource and experience required to accompany in utero transfer
- Guidance for Ambulance Service Partners about time critical nature of transfer

*in some situations, such as remote distance from a NICU at extreme preterm gestation, a lower QUiPP threshold may be appropriate in prompting transfer. These decisions should be clinician-led.
**adapted from 'STEAMED,' (QUiPP Toolkit) to prioritise parental discussion, with endorsement from QUiPP Toolkit Team. STEAMED also appropriate to use.

Overview of the Improvement Journey

A project is the way in which you accomplish change and the specific objectives of your improvement journey. The following table shows the steps that are commonly taken on this journey. Each step is discussed further in subsequent sections.

| Phase 1 | Phase 2 | Phase 3 | Phase 4 | Phase 5 |

	Approach	**Methods and Tools**	**Outcome**
1. **Define the problem**	Identify the problem and how large it is	Forcefield analysis Fishbone diagram Case review Process mapping Pareto chart Learn from experts Driver diagram	Define the problem, diagnose why the problem occurs and what improvement would look like
2. **Develop a shared purpose**	Form a team of enthusiasts	Engaging a team Engaging stakeholders Optimise context	Establish a shared objective and a culture for change
3. **Plan and implement changes**	Formulate, prioritise and test solutions	Project Charter QI Methodology	Complete a formalised plan of proposed improvements
4. **Test and measure improvement**	Test, review and re-test improvements	PDSA Measurement Run chart Statistical Process Control Chart Days between Chart	Determine whether improvement has resulted in change
5. **Implement, embed and sustain**	Implement widely and ensure sustainability	Education Communication Motivation Governance	Shared learning and embedding changes into practice

Phase One: Define the Problem

Where are we now?

It is important to understand your local data, and to benchmark where possible in the context of regional, national and international standards (NSQI 11,12) observing any changes over recent years. To achieve this your team should understand how to look at your local data, what questions to ask and where to access benchmarking data such as Badgernet National reports and comparison charts, the network data dashboards, NNAP Online and Nightingale, Vermont Oxford Network as examples. Finally, being able to convey these data to the wider team clearly and concisely will facilitate a stronger commitment to the implementation of quality improvement interventions.

1. Prediction of preterm birth

Aim: All women who are at risk of preterm birth (including both those in threatened preterm labour and those requiring to be delivered because of maternal or fetal indications), are identified appropriately and in a timely manner using evidence-based methods.

Ask:

a. What proportion of women with risk factors for preterm birth are appropriate risk-stratified and referred to a preterm birth clinic during their pregnancy?

b. What proportion of women presenting to assessment units and labour wards in threatened preterm labour who are risk-stratified using an appropriate risk-assessment tool (e.g. QUIPP app: fetal fibronectin +/- cervical length assessment)?

c. What proportion of women experience in utero transfer for possible preterm labour but do not go on to deliver?

2. Antenatal steroids

Aim: All women giving birth before 34 weeks of gestation, should receive a full course of antenatal steroids no longer than 7 days prior to birth, and ideally completed 24-48 hours before birth

Ask:

a. What proportion of women in your unit /network achieved this?

b. What proportion of women in your unit/network giving birth before 34w received no antenatal steroids at all?

c. What proportion of women in your unit/network giving birth before 34w received an incomplete course of steroids?

d. What proportion of women in your unit/network giving birth before 34w had more than one complete course of steroids prior to birth?

e. What proportion of women in your unit/network received a full course of steroids greater than 7 days before birth?

f. What proportion of women receiving steroids did not give birth before 37w?

3. Magnesium Sulphate

Aim: All women giving birth before 30 weeks of gestation, should receive a loading dose and ideally a minimum of a 4 hour infusion of **antenatal magnesium sulphate** within the 24 hours prior to birth

Ask:

a. What proportion of women in your unit/network achieved this?

b. What proportion of women received only a full or partial loading dose without infusion?

c. What proportion of women received repeated dosing?

4. Antibiotics

Aim: All women in established preterm labour should receive intrapartum antibiotic prophylaxis to prevent early onset neonatal Group B Streptococcal (GBS) infection irrespective of whether they have ruptured amniotic membranes.

Ask:
a. What proportion of women in your unit/network received appropriate intrapartum prophylaxis against GBS?
b. What is the prevalence of preterm early onset GBS infection in your unit/network?

5. Place of birth
Aim: Singleton infants less than 27 weeks of gestation, multiples less than 28 weeks of gestation and infants where the estimated fetal weight is less than 800g, should be born in a maternity service on the same site as a neonatal intensive care unit (NICU).
Ask:
a. What proportion of babies born in your unit/network achieved this?
b. What proportion of babies born in your unit/network required transfer after birth for gestation-appropriate neonatal care?
c. How many requests for in utero transfer were declined?
    a. How often was this on account of lack of neonatal care provision?
    b. How often was this on account of lack of other capacity eg maternity, transport?
d. How many women were transferred in anticipation of preterm birth but did not deliver within 1w?

6. Using NNAP Online it may also be useful to ask?
a. Are your data both accurate and complete?
b. How have your data changed over time?
c. How does this compare with the UK average?
d. How does this compare with other units in your network?
e. How does this compare with other units of similar size and acuity?

How did we get here?

There are many tools to help your team understand why eligible women may not receive antenatal optimisation measures (NSQI 13). You do not need to use all of these tools but should explore which of these exercises works best for your team. Remember that this is a process which should involve frontline staff as they are best able to describe the barriers and enablers in the system. Include teams outside of maternity teams including for example pharmacists and sonographers.

Resources:
BAPM QI Made Easy: 'Investigating your Current Practice'
NHS Improvement: Project Management

1. *Forcefield analysis-* this tool balances the positive and negative drivers influencing delivery of antenatal optimisation interventions and scores assigned to describe the strength of each force. Study, plan and act to strengthen the weaker positive forces and diminish the resisting forces (Figure 2). A template can be found on the BAPM Quality Webpages.

2. *Pareto Chart-* in categorising the underlying problem, a Pareto chart gives a visual depiction of the frequency of problems in graphical form, allowing you to target the areas that offer the greatest potential for improvement (Figure 3).
    Resource: NHS Improvement Pareto Chart Tool

3. *Fishbone diagram-* cause and affect analysis tool. This is a useful tool for categorising factors which influence the ability to deliver optimisation measures (Figures 4a and b). A template can be found on the BAPM Quality Webpages.

4. ***Case review*** – take the last 10-20 cases where an antenatal optimisation measure was not achieved and using a structured review tool (Appendix 4) to identify any common themes. Consider reviewing 10 cases where all elements of the bundle were achieved and identify strengths.

5. ***Process mapping***- walk through the journey that a woman takes from the start of preterm labour through to birth and think about the factors within the process and the environment that may contribute (see Figure 1 for ideas). PERIPrem also has a useful process map detailing potential barriers and can be found here.

Figure 2. An example of a forcefield analysis for Place of Birth
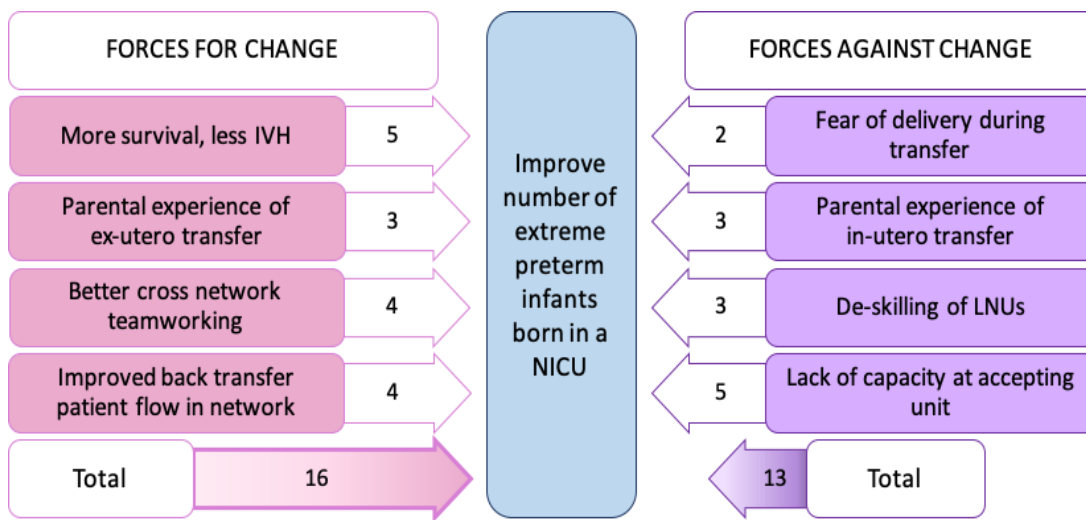
Figure 3. An example of a Pareto chart for Place of Birth
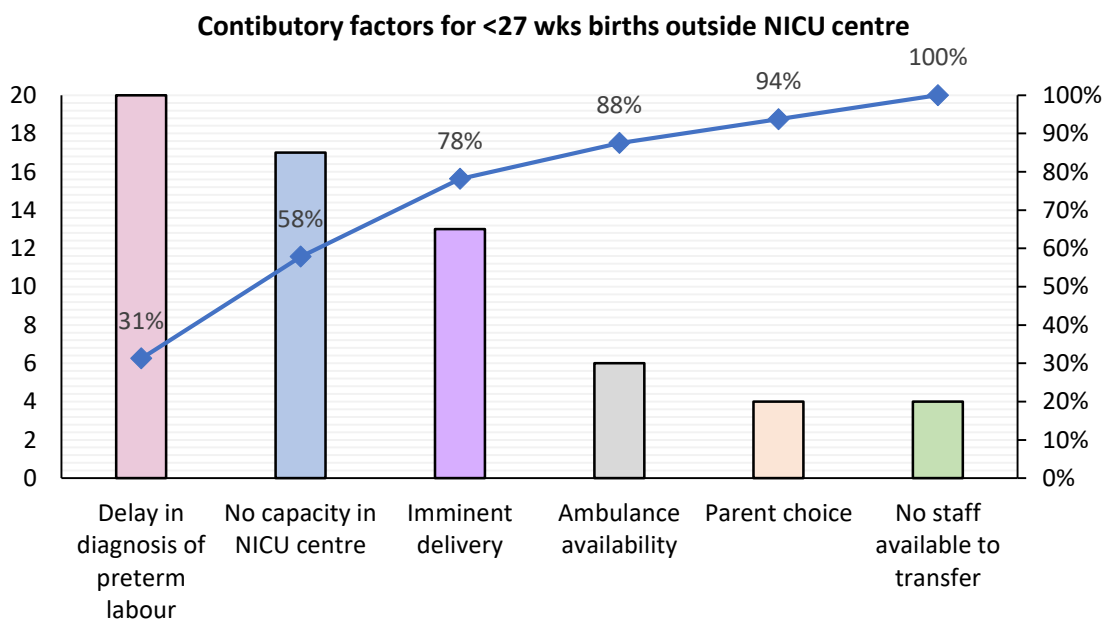
The chart above shows that around 80% of causes can be explained by three factors: a delay in diagnosis at the LNU, a lack of cot capacity at the NICU centre and women presenting too late in established labour. This problem will therefore require local, network and community solutions to solve.

Figure 4a. An example of a fishbone diagram for Antenatal Steroids and Magnesium
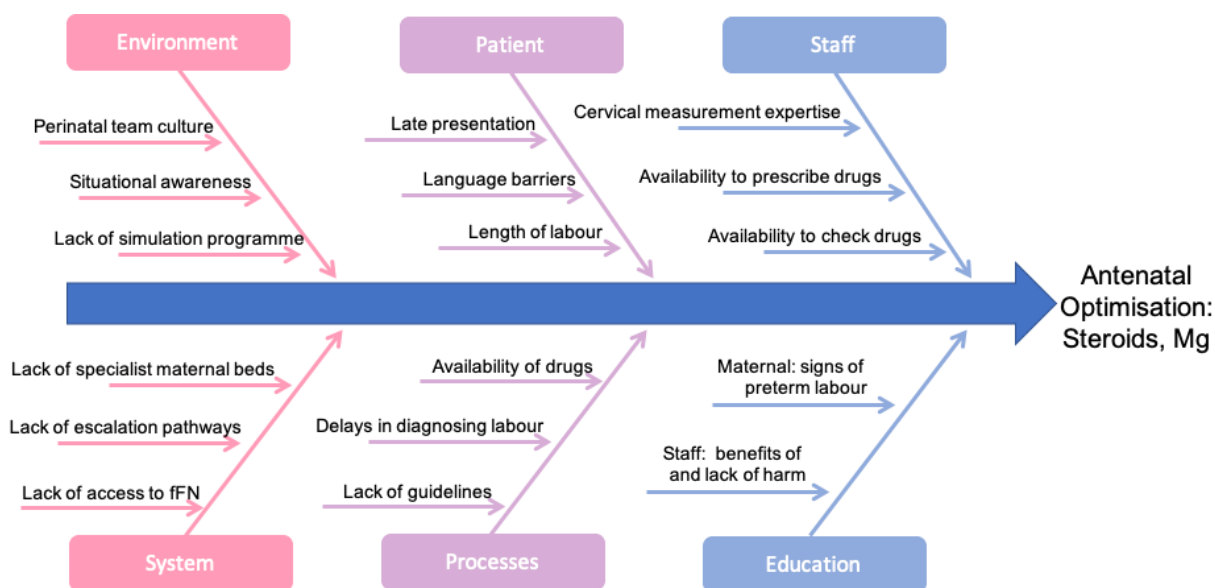
Figure 4b. An example of a fishbone diagram for Place of Birth
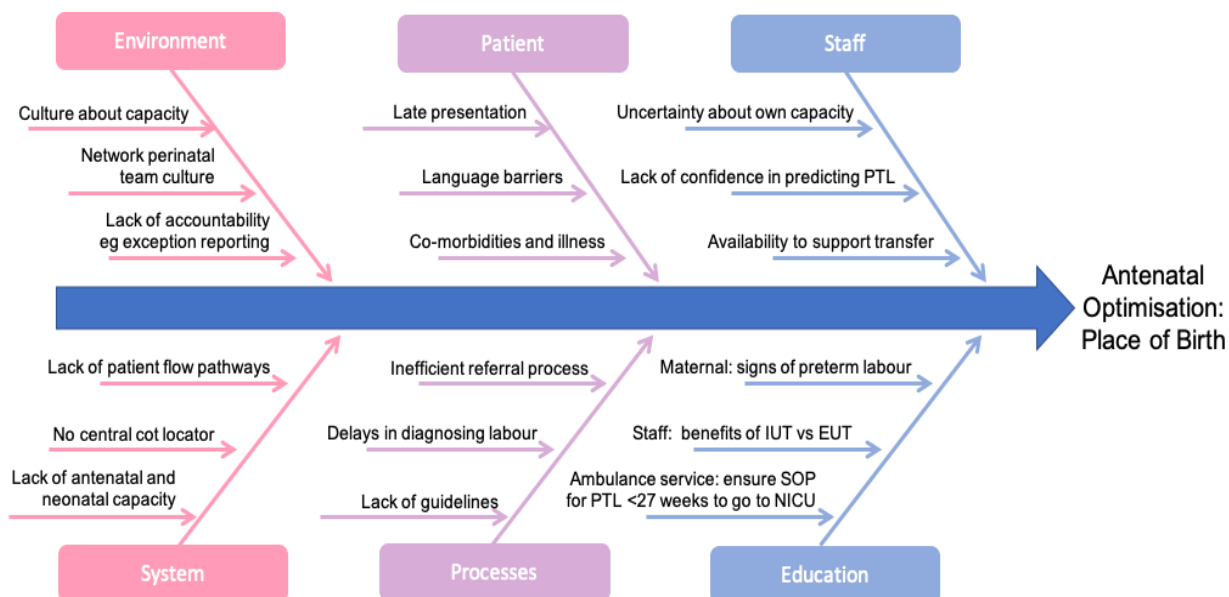
The Improvement Plan

Using one or more of these tools will identify potential areas for improvement and ideas for change. These ideas can be pulled together into a driver to allow you to apply a clear and organised structure to your
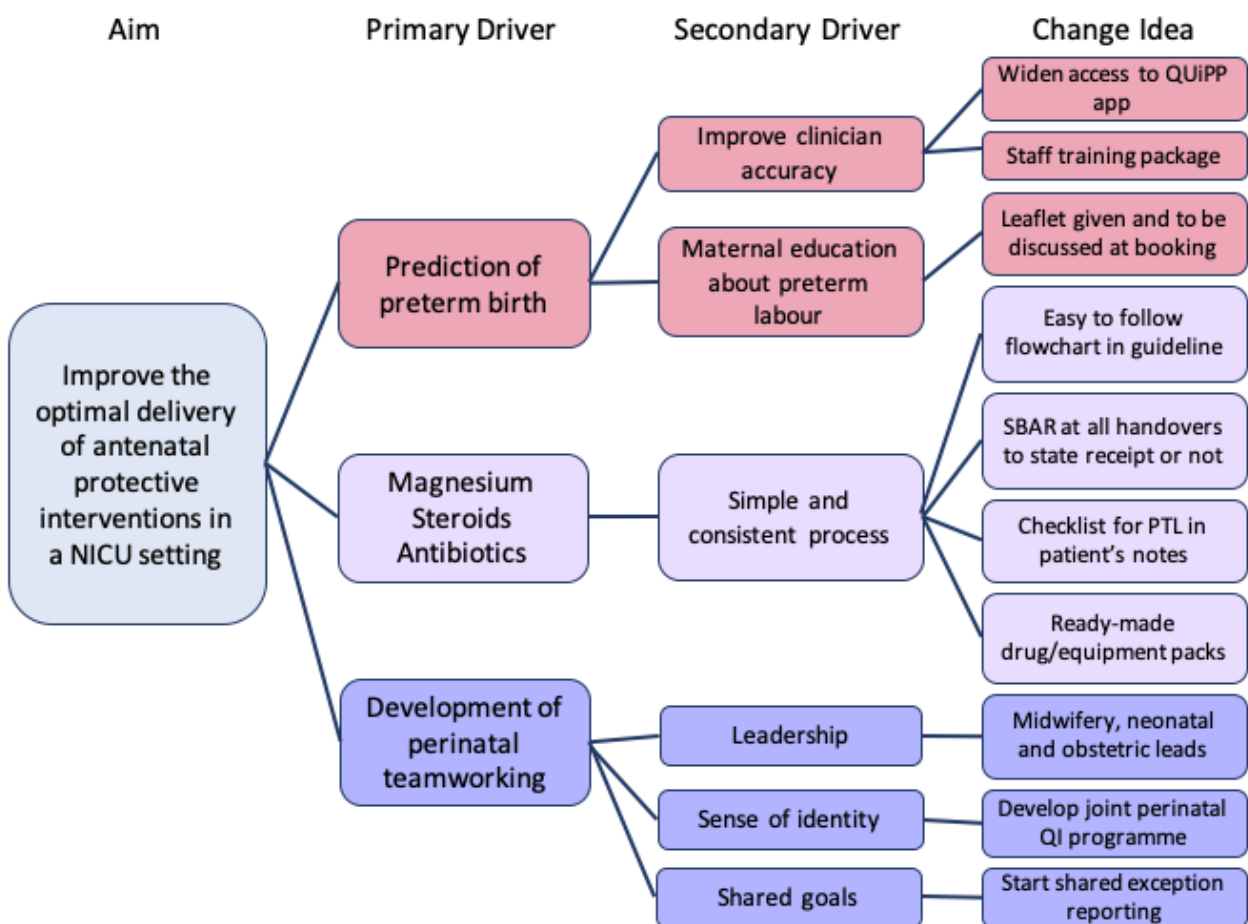
project (Figure 5). An example of a comprehensive driver diagram for the optimisation and stabilisation of the very preterm infant has been developed by NHS Improvement and can be found in resources below.

In developing your local driver diagram, both the BAPM and the NNAP strongly recommend that as part of a change programme to improve antenatal optimisation, this is developed with multidisciplinary input and uses evidence-based strategies to develop an effective implementation strategy.

Resources
NHS Improvement: Project Management
BAPM Quality Resource Templates
NHS Improvement Driver Diagram

Figure 5. An example of a driver diagram to improve delivery of the Antenatal Optimisation bundle

Learning from high performers

It can be helpful to speak to other units about how they have tackled low rates of compliance (NSQI 18). High performing units and those who have made significant improvements over time can be identified from NNAP Online. A number have shared their learning below.

Place of Birth: Lawrence Impey, Consultant Obstetrician Oxford University Hospitals NHS Foundation Trust

*The biggest barrier we found was **ignorance of the benefits** of being delivered in a NICU setting, and policy. **Fear of birth during transfe**r is also huge but most of the woman where arrival was 'too late for transfer' could quite easily have been transferred. **The 'NICU full' issue** is a major and unnecessary barrier to in utero transfer. Now the request for transfer comes through ONLY to the consultant obs on call, and there is a **default policy of acceptance**. The NICU, despite initial major reservations, remain happy about this.*

Steroids: Shona Cowan and Nirmala Mary, Consultant Obstetricians, NHS Lothian

*We have 90% compliance for steroids given within a week of birth. We use qualitative fetal fibronectin only, but have **educated consultants and trainees** to avoid giving steroids 'just in case' but only when women develop signs of labour. For iatrogenic preterm birth we now are more careful to time steroids precisely 24 hours before CS.*

Place of Birth: Manju Chandiramani and Tim Watts, NHSE London IUT Guidance Implementation, Guy's and St Thomas' NHS Foundation Trust

Exception reporting of failed in utero transfers showed 55% were preventable. Barriers included:
- ***Too difficult***: *neonatal and maternity capacity; referral can take hours, most women with threatened labour don't deliver but can block cots*
- ***Not prioritised***: *not what the obstetrician is trained to do, failures viewed as systemic, poor outcomes are not visible to those jointly responsible*

*We **changed the conversation**:*
- ***Predictive testing*** *to focus IUT for high risk delivery*
- ***Standardised referral pathway***
- ***Standardised acceptance process***: *1h from referral*
- ***Documentation*** *for investigation of failed transfer*

SE London LMS Preterm Midwife Champions

1. Your passion is infectious *– bring energy, role model for change*
2. Do the leg work early *– build knowledge, understand the problem, pre-empt the questions*
3. You can't do it alone *– bring your colleagues with you and make them your champions*
4. Engage on all angles *– engage senior support to add weight and help unblock any difficulties so everyone can support your mission*
5. Empower women *– they are your greatest asset in changing people's behaviours*
6. Persistence *– change is hard but with time you will see the difference you're making*
7. Learn and share together *- draw on the support of fellow PReCePT/Preterm midwife champions*

Magnesium: Sam O'Hare, Consultant Neonatologist; Annette Ballard, Lead MW PReCePT, Cambridge
- ***Keep it simple:*** *It was important to leave the dosing protocol exactly the same*
- ***Make it easy:*** *A new 'preterm box' was introduced during PReCePT which contained all of the medications, monographs, syringes and giving sets required for an anticipated preterm delivery*
- ***Engage the entire MDT:*** *People are more likely to remember to do something if they believe that it is important. Educational sessions for the midwives, obstetricians and neonatologists ensured a whole perinatal team approach. Information and updates were included in the NICU Newsletter, a talk was given at the East Anglian Obstetric Anaesthesia Group conference and an article authored by the PReCePT lead midwife at the Rosie hospital was published in 'The Practising Midwife' journal. All helped to raise the profile of the project and encourage ongoing engagement from the whole team.*
- ***Create a sense of expectation and duty of care:*** *the compelling evidence of the benefits of $MgSO_4$ for neurodevelopment outcomes was widely shared, creating a sense of expectation that women must have access.*

Learning from parents

Parent feedback and experience can be extremely useful in understanding their role in successful implementation of your change strategy (NSQI 9). Parent education, attitudes and beliefs can be important in both preventing and facilitating change. Parents also help you to understand the impact of your change idea and can be impactful voices in helping staff understand the need for change (NSQI 10). We are grateful to the Parent Advisory Group of the North West Neonatal ODN for sharing their experiences with some of the antenatal optimisation measures.

"I was in hospital for 3d from 24+6, had a positive fetal fibronectin test, regular tightenings throughout, increased pain but I wasn't scanned because it was weekend…..When I went down to scan first thing on the Monday morning I only had 0.5 mm of cervix length left and he was delivered not long after at 25+2w. We received the results of X's MRI scan last week and it showed periventricular leukomalacia which was difficult for us. I know that if he would've received the steroids/magnesium then his brain/lungs would have been protected- evidence to support this is overwhelming although I know that every baby is different"

"My waters broke at 24w and we came straight to hospital. The doctors gave me steroids to help protect the baby's lungs but by the next day my infection markers and symptoms were a lot worse, and the consultants were exploring delivery options. Over the next few hours I started to improve. The consultants agreed that due to the risk of sepsis, I should stay in hospital until the birth but two days later a new consultant discharged me. At 25w I presented again with signs of sepsis. I was given magnesium but my baby was delivered about an hour later"

"I was on hospital bedrest in a hospital with a level 2 unit from 20w. I reached 23+6 and it looked like my baby may need to be delivered, so I was transferred to a hospital with a level 3 unit. Unfortunately the nearest available unit was over an hour's drive away – frustrating as there were three other, closer level 3 units but none of them had available beds or cots"

"My experience was that I was not told I was in pre-term labour until a very late stage…..I was conscious that staff felt I was time wasting when I attended hospital the first time. I think women do need to be taken more seriously if they are showing signs of early labour. The signs can be subtle but early recognition can help to alleviate maternal anxiety about going into early labour and improve outcomes for the baby"

"My first baby was born at 29w... I was only given steroids when I was 8cm dilated which was approximately an hour before she was born. I did attend the hospital with some lower abdominal discomfort 12 hours prior to this and so I feel this was a missed opportunity for steroids to have been given. I attended the maternity day unit 5 days previously for a bloody show. I was given anti-D for being rhesus negative but steroids were not offered. I feel steroids could have at least been discussed but no mention of steroids or signs of pre-term labour were explained. The diagnosis of pre-term labour was made late and I do feel that more needs to be done in the recognition of pre-term labour"

"I was proactive in asking for magnesium because I'd read about the benefits. I was given magnesium during labour and am really grateful for this as my baby currently shows no signs of cerebral palsy"

"We arrived on labour ward at 13:55 and the first and only dose of Dexamethasone wasn't administered until 18:15. M was born at 23:42 while I was still on the Atosiban drip"

Phase Two: Develop a Shared Purpose

The evolution of the perinatal team

Midwifery, Obstetrics and Neonatal teams all have an important role to play in the safe delivery of care for women in preterm labour and the subsequent care of their baby. This care at times may be delivered in professional silos leading to potential poor communication and missed opportunities for antenatal interventions which may lead to suboptimal outcomes. Developing a strong perinatal team within your workplace will help facilitate communication, understanding and collaboration across departments and allow more cohesive implementation and imbedding of antenatal interventions. Having shared goals, a shared vision and sharing experience ensures your project has momentum and that barriers and enablers can be best appreciated and tackled. The benefits of actively seeking to create a perinatal team are highlighted in this video developed by the PReCePT2 study[49].

One of the key components to any successful project is having a team that is engaged, resilient, enthusiastic and committed to working together to create the right culture for change (NSQI 2, NSQI 15). Teams should ideally be around 8-10 members and include:

- An Obstetric lead
- A Midwifery lead
- A Neonatal or Paediatric lead (can be medical or nursing)
- Multidisciplinary representation including neonatologists/paediatricians, neonatal nurses, midwives, obstetricians, labour ward and theatre representatives
- Parent representation (NSQI 10)
- People with QI expertise- essential (NSQI 17)
- Data analyst- essential
- General services manager- ideal but not essential

When forming your team consider:
- **Who** are the most influential people within the maternity/neonatal team? – these may not be the most senior staff members. Consider inviting those who are unsure or oppositional to understand perspective and secure buy in from the outset.
- **Where** are the areas likely to be affected by any changes – consider staff in these areas.
- **Why** should people want to be involved in your project – not everyone understands the impact of the antenatal interventions, take time to share your vision and think how you are going to engage people and maintain their commitment
- **What** is your expectation of team members – what will they be required to do in terms of time and effort? How will you manage team members who do not deliver on tasks/actions?
- **When** are people available and are your time commitments realistic? **How** often are you going to meet? Keep up for momentum for change, short but frequent meetings.
- **What else** is going on? Are there existing workstreams with overlapping agendas that could be pulled together to prevent duplication. Are there other QI projects which may have to take priority?

Find out if your local hospital has a central improvement team who can facilitate projects and provide valuable skills and knowledge in designing and implementing improvement work. Local data analysts are valuable in helping to collect, analyse and display data.

Stakeholder engagement
Who else needs to be involved?
Start by brainstorming the groups of people likely to be affected by the proposed change (NSQI 2). Within the topic of antenatal optimisation, they are likely to include:

- Parent groups
- Senior and junior obstetricians
- Midwives of all grades of seniority
- Senior and junior paediatricians/neonatologists
- Neonatal nurses
- Transport teams
- Theatre staff
- Triage reception staff
- Pharmacists
- Sonographers

These groups need to be:
- **Prioritised**- in terms of the power and time they have to make your project succeed or fail
- **Understood**- how are they likely to feel or react to the proposed changes?
- **Informed**- devise a communication plan to sustain interest and win over doubters. This plan should include modalities of communication (eg presentations, emails, newsletters), frequency (monthly, weekly, daily) and key messages you want to deliver.

Context

It is a worthwhile activity at this stage to review the context in which you wish to implement your changes. Although the changes you wish to implement have been successful elsewhere, differences in the culture and the context between units may result in variable results. Useful information can be obtained from the results of your Safety Culture Survey which may indicate how well staff feel listened to, how ready your unit is for change, or what might be needed to optimise communication (NSQI 3). The BAPM Neonatal Service Quality Indicators resource provides a helpful framework for units and networks who wish to optimise their culture for delivering successful quality improvement projects[5].

Phase Three: Plan and Implement Changes

Project Charter

It can be useful to construct a Project Charter at the start of this phase to detail your proposed improvement, including the resources required and the potential benefits to patients. A Project Charter is a format endorsed by many Trust Improvement Teams and will provide direction and a sense of purpose and may give your project increased leverage with management (NSQI 15).

Resources:
NHS Improvement: Project Management
NHS Improvement Project Charter
NHS Education for Scotland Project Charter

Formulate, prioritise and test solutions

There are a number of methodologies that can be adopted to implement a quality improvement strategy, for example Lean, Six Sigma and the Model for Improvement which all draw on a similar set of principles tools. No single quality improvement method is better than others; what matters more is having a consistent approach that you are familiar with and skilled in applying. The Model for Improvement is a widely recognised approach within healthcare and is frequently associated with positive outcomes for improvement and will be used here as an illustration.

The Model for Improvement

Ask yourself:

- What is it you want to achieve?
- How will you know that a change is an improvement?
- What changes can you test that will result in an improvement?
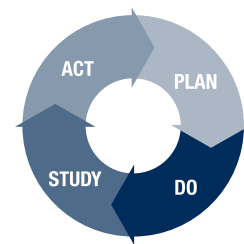
For each change idea, a PDSA cycle can be used:

1. **Plan**
   Which intervention(s) to try first? This may be the intervention most likely to make an impact, the easiest to implement or the one that will best win hearts and minds.
   How will this intervention be introduced into clinical practice?
   Who and what will be required to make this happen?
   Predict what you think the change might be?
2. **Do**
   When and how will this plan be carried out? A timescale is important. Document problems and unexpected observations.
3. **Study**
   Use established tools to analyse your data (see Phase 4). Has your change idea resulted in improvement? Is this a real improvement? Do your data suggest your change idea needs to be modified? Why might this be so? Compare your data to your predictions.
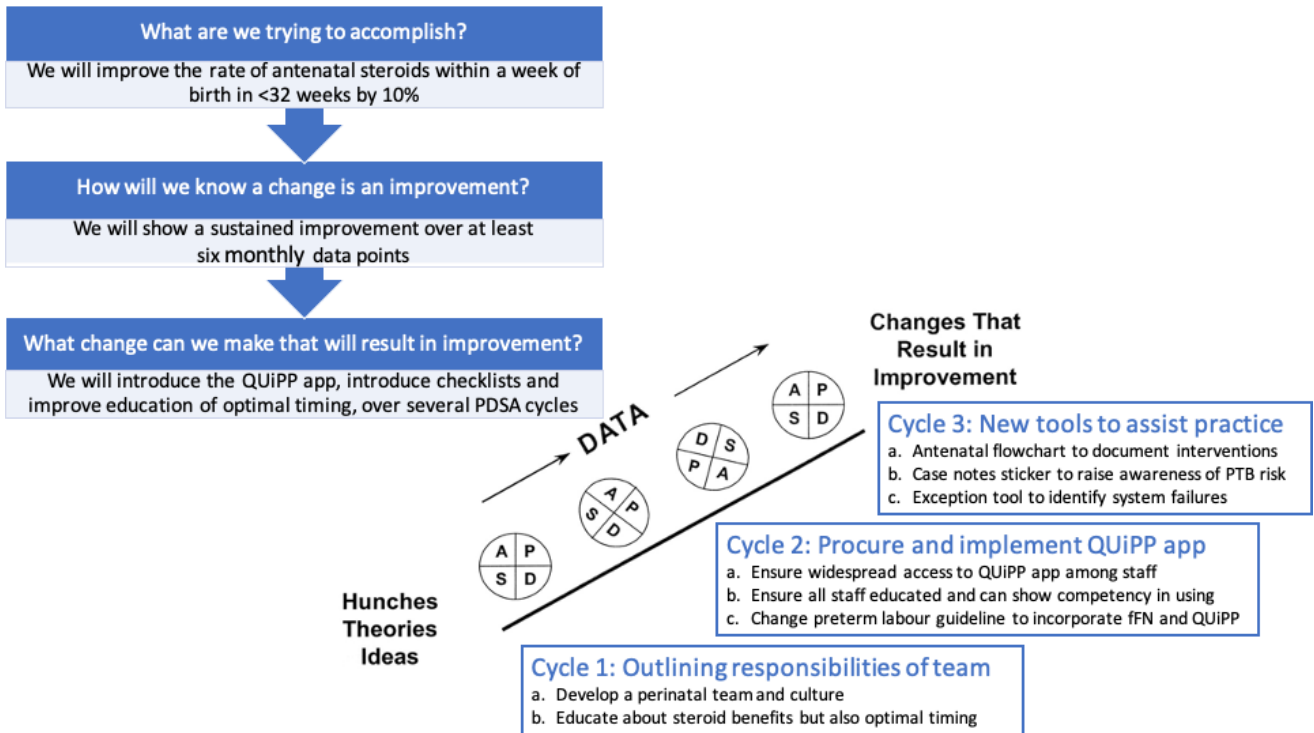4. **Act**
   Identify and carry out any modifications needed to this change idea to make it more effective, using further PDSA cycles as needed i.e. Adapt, Adopt or Abandon, Repeat. Start with rapid testing your change on a small scale for example small numbers of patients or a specific subgroup of patients. If effective, increase the numbers or widen to include other groups of patients. Test and repeat with increasing scale until you can show effectiveness throughout your patient group.

Resources:
BAPM QI Made Easy: 'Planning your Change Idea'
PReCePT Toolkit

Below, the Model for Improvement is used to work through an example of implementation in delivering antenatal steroids at an optimal time. A template can be found on the BAPM Quality webpages for your own use.

What are we trying to accomplish?
We will improve the rate of antenatal steroids within a week of birth in <32 weeks by 10%

How will we know a change is an improvement?
We will show a sustained improvement over at least six monthly data points

What change can we make that will result in improvement?
We will introduce the QUiPP app, introduce checklists and improve education of optimal timing, over several PDSA cycles

Changes That Result in Improvement

DATA

Hunches Theories Ideas

Cycle 3: New tools to assist practice
a. Antenatal flowchart to document interventions
b. Case notes sticker to raise awareness of PTB risk
c. Exception tool to identify system failures

Cycle 2: Procure and implement QUiPP app
a. Ensure widespread access to QUiPP app among staff
b. Ensure all staff educated and can show competency in using
c. Change preterm labour guideline to incorporate fFN and QUiPP

Cycle 1: Outlining responsibilities of team
a. Develop a perinatal team and culture
b. Educate about steroid benefits but also optimal timing

EXAMPLE

Phase Four: Test and Measure Improvement

In this phase, improvements are tested, reviewed and re-tested in order to find a solution.

Measures

Measuring for improvement is different to the data collected for research or to prove whether clinical interventions work or not. This type of measurement asks the questions 'how do we make it work in our context?' and 'how do we know that a change is an improvement?' It is important that you collect the right data for your project (NSQI 1).

Resources:
BAPM QI Made Easy: 'Planning and Implementing Change'
NHS Improvement: Project Management

1. **Outcome measures:** reflect the impact on the patient e.g. mortality, cerebral palsy, IVH, NEC
2. **Process measures:** the way systems and processes work to deliver the desired outcome e.g. number of women receiving antenatal steroids or magnesium; number of extreme preterm infants born in a neonatal intensive care unit; measures of parental satisfaction can help in improving your transfer pathway.
3. **Balancing measures:** this is what may be happening elsewhere in the system as a result of the change. The most important to study are those which may have negative impact on patients or the system e.g.
   a. **Place of birth:** number of women transferred but who do not give birth; number of women who give birth outside of hospital e.g. during transfer; number of low risk women who are transferred out from their primary choice of place of birth for capacity reasons; measures of labour ward and neonatal unit capacity
   b. **Antenatal steroids:** number of women who receive antenatal steroids but do not give birth within a week; number of women who receive antenatal steroids but deliver at term
   c. **Antenatal magnesium:** number of women who receive magnesium but who deliver at term; number of delayed inductions or low risk women transferred out due to lack of labour ward capacity.

Data analysis and display

How will change be measured, assessed and displayed in your unit or network? Common tools to present and analyse your data include run charts, statistical process control (SPC) charts and days between charts (see examples below). All require a level of knowledge and skill to collate and interpret correctly (NSQI 15). Importantly measurement should not be a 'before and after' audit which is unreliable in measuring true change, but a continuous process over time during which your changes can be evaluated and modified.

Note that you may choose a different type of chart to be understood by your audience. Run charts and statistical process control charts should always be used by the QI project team in understanding data and assessing change, while other charts and tools may be used to prepare your data in a format which is best understood by frontline staff (Example 4). You may need an easy to read key to explain your chart or provide a summary interpretation.
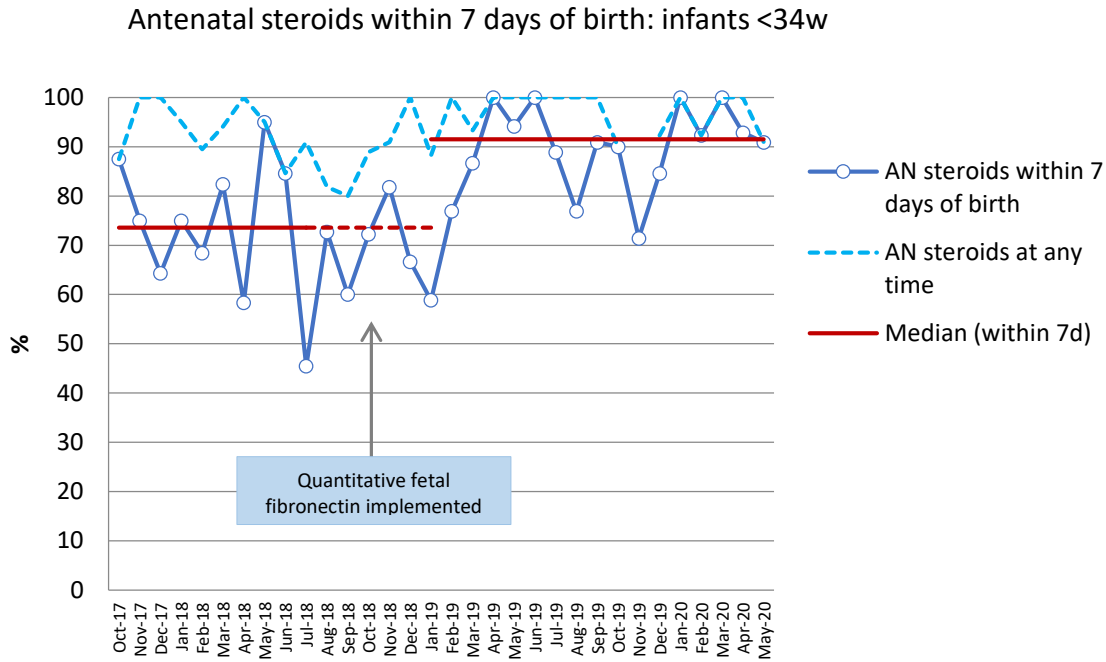
Resources:
BAPM QI Made Easy: 'Interpreting your Data'
NHS Improvement Statistical Process Control Charts
NHS Improvement Making Data Count
NHS Improvement: Project Management

1. Example Run Chart

Antenatal steroids within 7 days of birth: infants <34w

This chart shows that following the implementation of quantitative fetal fibronectin, a shift (with six points above the median) was seen in the proportion of women receiving steroids within 7d, from 74% to 92%. Run charts are relatively easier to understand than statistical process control charts. The live NNAP dashboard on BadgerNet can be used to generate live run charts.

2. Example Statistical Process Control Chart

Antenatal steroids within 7 days of birth: infants <34w
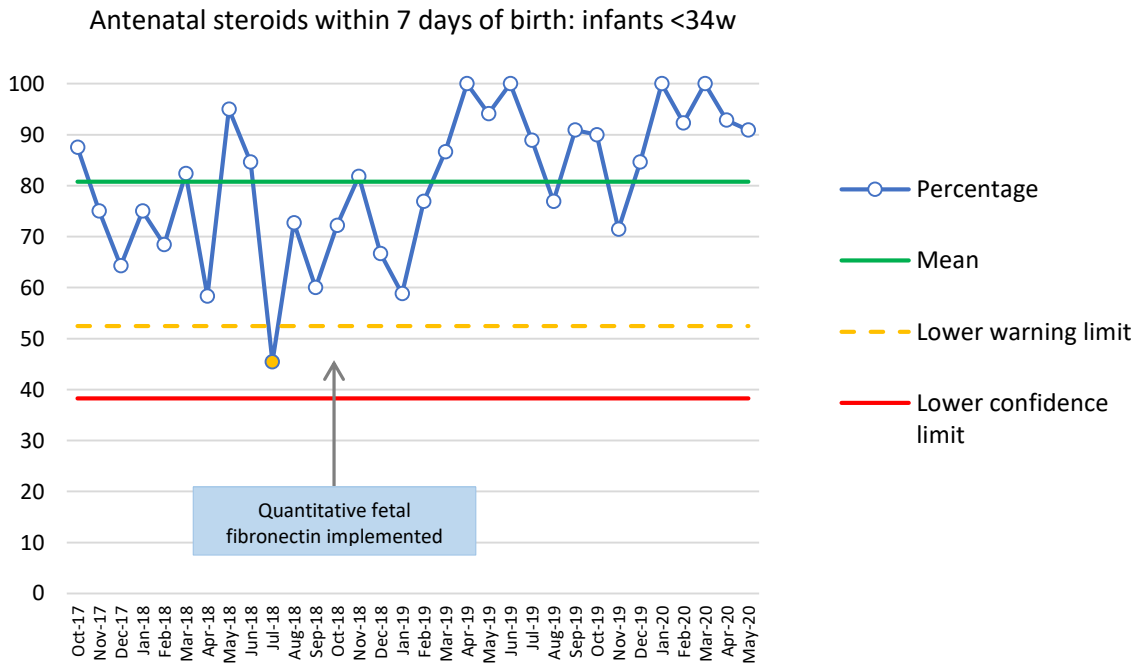
This chart, using identical data to the previous run chart, shows that while there appear to be more points sitting above the mean since quantitative fetal fibronectin was introduced, it is yet too early to say there has been a true shift (that is, 7 points or more above the mean). SPC charts are a better tool for looking at

the stability of your process over time and avoid overinterpretation of change occurring by chance (random variation).

3. Example Days between chart

Infant <27w born outside an NICU
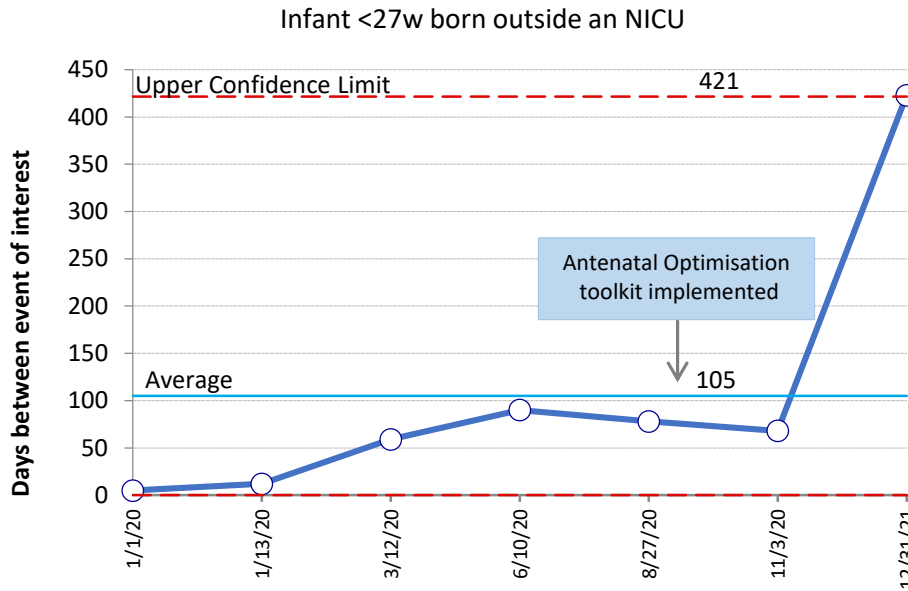
This chart shows that the number of days between the 'birth of an extreme preterm baby outside a NICU setting' has increased over time. At the beginning of study this event occurred once every 1-2 months but there has now been a year since the last baby was born outside of a NICU setting.

4. Example of feedback targeting frontline staff

Remember your target audience. Graphics and simple messages may be more impactful and less confusing than graphs and charts, although run charts/SPC charts remain essential in understanding the effectiveness of change.

Phase Five: Implement, Embed and Sustain

This phase involves the wider implementation of improvements such that change becomes embedded in routine practice throughout the system and is sustained with governance arrangements.

Spread

This can involve formal methods such as *dissemination* that includes presentations, publications, leaflets, learning boards, social media, some of which may have limited reach within your department and may be better disseminated via network/LMS meetings and GIRFT benchmarking mechanisms; or informal methods of *diffusion* where word of mouth, champions and opinion leaders can accelerate your message. Consider carefully what is required for the embedding of changes within your service (NSQI 2, NSQI 18).

Adverse event and exception reporting

Both the BAPM and the NNAP recommend that neonatal units should report all cases where antenatal optimisation measures are not achieved using local risk reporting mechanisms, including those cases where there was suboptimal timing of interventions (NSQI 13). A trigger list should be developed to inform the process of reporting. The case review tool (Appendix 4) can be used or adapted for review of such cases. However the network should have oversight of this process to encourage accountability of activity, to ensure learning from peers and to provide scrutiny of patient flow and capacity issues.

Exception Reporting for Place of Birth: Karen Mainwaring, Senior Lead Nurse, NWODN

88% of our <27w infants in the last three years have been born in a NICU setting. A strong exception reporting process has supported this. Our data are highlighted in quarterly dashboard reports and our Annual Capacity and Demand Report. What has worked is:
- A clear designation of NICUs, admission criteria and activity allocation by postcode were set following the Making it Better Transformation
- Establishment of exception reporting principles and guidelines for investigation, closure and escalation
- Exceptions are reported weekly with a ten day turnaround for completion of data
- Exceptions are discussed at the Neonatal Steering Group which has helped to bring about a wider change in culture
- Lessons learned about missed opportunities for transfer are shared through the LMS/SCN

We have had some challenges which we have been able to overcome:
- Ensuring the message about the benefit of in utero transfer is heard throughout all of maternity
- Reluctance of some units to transfer babies – support given by ODN Clinical Lead/Lead Nurse
- Nursing and medical staff who were not familiar with this way of working- we improved sharing of information with them
- Initial proforma was not adequate- multiple revisions such that now themes can be collated
- Initial high number of exceptions resulted in high workload, delayed returns, difficulty in tracking- resolved through making it a Neonatal Steering Group Standing item, and working with unit leads.

Sustainability

The ability of a service to implement and sustain change is dependent on various strengths and weaknesses of any one project. These can be assessed and addressed from the outset of a project and be reviewed regularly throughout the time course to improve the likelihood of sustaining improvement beyond its lifespan. A useful tool to do so is the NHS Sustainability Model (below).

Barriers and loss of motivation

It is not unusual to find the impact of a previous improvement lessen over time. It is important to understand why so that solutions can be tailored to the problem. Different approaches will be effective for different people and different situations. The following activities may be useful: talk to key individuals, observe clinical practice in action, use a questionnaire to survey staff, brainstorm with a focus group. Education is a key element of overcoming barriers particularly within an interactive forum; using opinion leaders to influence others within your staffing structure; reminder systems to prompt clinicians; and ensuring feedback of data to staff in a format that they find useful; all these can help to reinvigorate and embed your changes for improvement (NSQI 2, NSQI 18).

Resources:
NHS Improvement: Project Management
NHS Improvement: Sustainability Model and Guide
PERIPrem

The following ideas may be helpful in reinvigorating your efforts:

1. **Re-examine your change idea:**
   Can it be simplified, can it be streamlined, is it fit for purpose, do frontline staff feel it could be improved? Do you need a checklist or a communication tool? Can you use a stamp to make documentation easier or logos to brand your change idea?

   Note: S.T.A.M.P.E.D has been adapted from STEAMED in the QUiPP Toolkit in order to prioritise parents. STEAMED, S.T.A.M.P.E.D or any other memory aid can be used to improve delivery of interventions.

Antenatal Optimisation Bundle Checklist

Patient Addressograph Label

Date of presentation:
Gestation at presentation:
Single or multiple pregnancy:
Known GBS •
Are GBS swab results to be chased Y/N

S: Steroids 1st dose • Date given............................ Time ....
               2nd dose • Date given............................ Time ....
T: Transfer needed • Date of IUT .... Time ....
A: Antibiotics GBS • Date given............................ Time ....
M: Mg   Loading • Date given............................ Time ....
            Infusion • Date started......................... Time ....
P: Parent discussion • Date seen............................. Time ....
E: Evaluate for tocolysis • Date given............................ Time ....
D: Delivery plan made • Monitoring, mode of birth, resuscitation plan

EXAMPLE

EXAMPLE

2. **Use impactful parent stories:**
    Encourage staff to watch the videos on the PReCePT website in which parents speak of the benefits of magnesium. Or find your own local parent stories to share, like these:

> **Vivian, mother of Matti (27w) and Luca (30w)**
> "When my waters broke with Luca, I was transferred from [the local SCU] where I'd received all my antenatal care to [the local NICU]. During bedrest there I was given steroid injections for Luca's lungs, and on the day I went into labour I was given antibiotics as I had Group B strep, and I got magnesium sulphate to protect Luca's brain. After birth he got my expressed breast milk and caffeine. He is thriving every day and turning into a beautiful human being.
> When I went into labour with Matti this time I was assessed in [a local LNU] and again was transferred straight away to [the local NICU]. Again I received steroids, antibiotics and magnesium. I know he is in the best place, receiving the best care and that this move gave him the best chance of survival."

EXAMPLE

> **Ketan and Yogini, parents of Kira (23w)**
> "With specialist intervention using a scan of my wife's cervix and fetal fibronectin, we were able to save our daughter. We used a stitch to gain another 2 weeks of pregnancy to help her development. During the days leading up to her delivery, the consultant timed when to deliver her while managing the risk of infection. She timed the steroids and magnesium which was vital to saving our daughter and having a successful vaginal delivery at 23w. Today our daughter is 38 weeks old and we are expecting her home in the next week. She has no long-term health concerns and melts us with her little smile."

3. **Use lessons from high performers about how they managed their challenges**

Mandish Dhanjal, North West London
"We have sustained an implementation rate of over 95% in magnesium administration. It was not easy and yes there were obstacles! What worked was having local obstetric leads who nominated themselves and were just as passionate as the regional team. This passion was invigorated by regular meetings where we planned our approach, tracked improvement, discussed any issues, and provided central and peer to peer support. Issues with consistently underperforming units required a direct approach from the regional and Imperial College Health Partners leads and involved meeting with clinicians, identifying and resolving issues experienced. Sometimes this required a change in local lead. The local leads were instrumental in ensuring the dissemination of learning to all members of the maternity team. They also checked any missed cases which were all discussed at regional meetings to identify areas which could be improved and offering guidance as to how to approach giving feedback to our local clinicians. We regularly celebrate our small victories and now this preventative treatment is part of business as usual."

4. **Re-market your message** so that the benefit to babies is clearly conveyed. PERIPrem has excellent resources and information you can use or modify to get your message across[7].

Steroids have far more important roles than maturing the fetal lung….

- they reduce the number of babies dying by a third…

- they halve the risk of severe brain bleeds…

- they halve the risk of the serious gut disease, NEC…

Best timing is between 24h-7d before birth. Think life, think healthy life.

Photo of Cormac, now a healthy preterm survivor, courtesy of his mother

If all babies < 30 weeks were exposed to magnesium before birth, then over 200 babies each year could grow up healthier and free from cerebral palsy.

Having cerebral palsy means:
- 1 out of 3 children is unable to walk
- 1 out of 4 children is unable to talk
- 1 out of 4 children has epilepsy
- 3 out of 4 children experience pain
- 1 out of 2 children has learning difficulties

Photo of Cormac, a healthy preterm survivor, courtesy of his mother

EXAMPLE

5. Use incentivisation to engage senior leadership

In England, frontline midwifery, obstetric and neonatal safety champions have been appointed in every Trust, working closely with their Board safety champion to support full implementation of the range of improvement initiatives aimed at achieving the national ambition. Barriers to implementing initiatives which will improve the safety and outcomes of women and babies should be escalated to the Board safety champion as part of a two-way feedback system. Implementation of key safety initiatives have been included in the NHS Standard Contract as well as being incentivised financially through the Maternity Incentive Scheme.

The Maternity Incentive Scheme rewards Trusts who meet ten maternity safety actions, one of which relates to Element 5 of the SBLCBv2 (preterm birth reduction and optimising care when preterm delivery cannot be prevented including optimal place of birth, antenatal steroids and magnesium). If Trusts can demonstrate progress against all ten of the safety actions they qualify for a minimum rebate of their contribution to the incentive fund, calculated at 10% of their maternity premia.

Highlighting the cost benefit to Trusts through implementing key interventions in Antenatal Optimisation may help to engage senior leaders. These individuals may be instrumental in helping you break down both the high and low-level barriers which are preventing successful implementation.

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Appendix 1: Members of the Antenatal Optimisation Toolkit Group

Julie-Clare Becher Lead for Quality, British Association of Perinatal Medicine;

Consultant Neonatologist, Royal Infirmary of Edinburgh (Chair)

Debbie Bezalel Head of Services, Bliss

Josie Anderson Campaigns and Policy Manager, Bliss

Manju Chandiramani Consultant Obstetrician, Guy's & St Thomas' NHS Trust

Cora Doherty Consultant Neonatologist, University Hospital of Wales, Cardiff

Cath Harrison Chair of Neonatal Transport Group UK;

Consultant Neonatologist, Leeds Teaching Hospital NHS Trust

Kelly Harvey Quality Improvement Lead Nurse, North West Neonatal Network

Vicky Hodgetts-Morton Clinical Research Fellow, University of Birmingham

Lawrence Impey Consultant in Obstetrics and Fetal Medicine, John Radcliffe Hospital, Oxford

Tracey Kay SW Obstetric Lead for PERIPrem;

Consultant Obstetrician, Royal Devon & Exeter NHS Trust

Karen Luyt Clinical Lead for the National PReCePT QI Programme; Strategic Clinical Lead

for PERIPrem; Consultant Neonatologist, St Michael's Hospital, Bristol

Stephanie Michaelides Midwife, Royal College of Midwives Representative

Katie Morris Consultant in Maternal and Fetal Medicine, Birmingham Women's NHS Trust

Sankara Narayanan Consultant Neonatologist, West Hertfordshire Hospitals NHS Trust

Elizabeth Osmond Consultant Neonatologist, St Michael's Hospital, Bristol

Colin Peters Neonatal Clinical Lead, SPSP-MCQIC;

Consultant Neonatologist, Royal Hospital for Children, Glasgow

Ann Remmers Maternal & Neonatal Clinical Lead, West of England AHSN;

Midwifery Lead PERIPrem

Lauren Shaw Neonatal Grid Trainee, Southeast Deanery, Scotland

Meekai To Consultant in Obstetrics and Fetal Medicine, Kings College Hospital, London

Michele Upton Head of Maternity & Neonatal Transformation Programme, NHS Improvement

Alison Walker Consultant Neonatologist, Royal Maternity Hospital, Belfast

Additional stakeholders involved in consultation:

- Lead Maternity Safety Champions, NHS England: Matthew Jolly, National Clinical Director for Maternity and Women's Health and Jacqueline Dunkley-Bent, Chief Midwifery Officer

- Maternity and Neonatal Safety Improvement Programme

- Royal College of Obstetrics and Gynaecology

- British Intrapartum Care Society

- British Maternal and Fetal Medicine Society

- UK Preterm Clinical Network

- QUiPP Toolkit Group

Appendix 2: BAPM Neonatal Service Quality Indicators[5]

Evidence-based care
NSQI 1 Care Guidelines supported by Audit

Team working and communication
NSQI 2 Team communication
NSQI 3 Staff Safety Culture
NSQI 4 Pathways of Care and Referral for high risk babies
NSQI 5 Collaborative multidisciplinary care for babies with complex conditions

Parental partnership in care
NSQI 6 Family facilities
NSQI 7 Family involvement in care planning and delivery
NSQI 8 Parent information
NSQI 9 Parent feedback
NSQI 10 Parent involvement in service development

Benchmarking
NSQI 11 Other Neonatal Service Standards
NSQI 12 Engagement in National and International Audit and Benchmarking

Patient Safety
NSQI 13 Adverse Event Review
NSQI 14 Death and Serious Adverse Event Review

Quality Improvement
NSQI 15 Structure and Resources for Quality Improvement
NSQI 16 Annual Quality Strategy and Quality Report

Education and Training
NSQI 17 Training for Quality and Patient Safety
NSQI 18 Engagement in shared learning about Quality of Care

Research
NSQI 19 Engagement in Research

Appendix 3. Evidence Summary and Key Drivers

Prediction of Preterm Birth		
Objective: All women who are at risk of preterm birth (including both those in threatened preterm labour and those requiring to be delivered because of maternal or fetal indications), are identified appropriately and in a timely manner using evidence-based methods.		
Evidence-based interventions	**Professional Recommendations**	**Quality Improvement Initiatives**
QUiPP app: Using a 5% chance of birth, predicts PTB in next 7d in women <37w and avoids 90% of admissions[20][50] **Quantitative fetal fibronectin (qfFN):** Growing body of evidence for predictive utility across risk range Predicts PTB <30w in singleton/multiple pregnancy[51][52] Given the linear relationship between qfFN and preterm birth a variable threshold better reflects individual patient circumstances and different treatment options (awaiting QUIDS study[53]) **Cervical length (CL):** A meta-analysis of 28 studies reported a pooled PLR of 5.71 (3.77–8.65) and a NLR 0.51 (0.33–0.80) (69) suggesting that cervical length is a moderately useful test for PTB prediction[54]. The risk of PTB changes across the range of cervical lengths and gestations. **Combination of CL and qfFN:** Addition of CL refines predictive ability of qfFN[55][56] and may save €480 per patient[55] **Preterm birth history alone:** 10-57% of pregnant women with a PTB history will give birth preterm[57] **Placental growth factor and sFlt-1/PGF ratio:** Rules out pre-eclampsia within the next 7d in women with suspected pre-eclampsia <35w[58][59]	NHS England, SBLCBv2[60]: Diagnosis of preterm labour can be optimised by use of qfFN, cervical length and the QUiPP app. BAPM[14]: Endorsement of QUiPP app NICE[11]: • CL and qfFN for suspected preterm labour >30w gestation with CL <15mm deemed to be high risk. • Treat-all policy for those presenting below 30w UK Preterm Clinical Network and the RCOG Preterm CSG[12][61]: • Recommend the use of cervical length, quantitative fFN and decision aids such as the QUiPP app to facilitate prediction and management of threated preterm labour which is in line with the SBLCBv2 NICE[42]: PlGF is recommended to hep rule out pre-eclampsia in women between 20 and 34+6 weeks	• PERIPrem care bundle of the West of England AHSN[7]: use of qfFN to predict PTL • Pan London guideline for in utero transfer[62] • NHS England Accelerated Access Programme: Placental Growth Factor for improved diagnosis of pre-eclampsia[63]

Antenatal Steroids		
Objective: All women giving birth before 34 weeks of gestation, should receive a full course of antenatal steroids no longer than 7 days prior to birth, and ideally within 24-48 hours.		
Evidence	**Professional Recommendations**	**Standards and Quality Improvement Initiatives**
Antenatal steroids: • Single course <34w reduces risk of death and major morbidity in absence of risk to mother or fetus[64] • ANS <25w may reduce mortality by 50% and severe IVH, PVL[65][66] **Optimum Timing:** • Within 7d of birth, and maximum effect on reduction of IVH and mortality if given within 48h of birth[67][68] • Benefits of steroids plateau at 12-36h and do not exceed 7d. 51% reduction in mortality if given even 6-12h before birth[68] • Only 55-68% of women receiving steroids give birth preterm[69][70] • Only 22% of women receive steroids at optimal time[71][72] **Repeat courses:** • Reduce respiratory morbidity but do not reduce mortality and may impact fetal growth[73] • Number of repeat treatment courses to be limited to 3 with total dose 24-48mg[73]	Offer ANS to women at risk of preterm birth within the next 7d: • WHO, NICE and RCOG[57][72][73]: from 24-33+6w[11][74][75] Discuss the use of ANS: •NICE[11]: between 23+0-23+6w •BAPM[10]: from 22w where active resuscitation is planned •European Consensus Guideline on the Management of Respiratory Distress Syndrome[76]: from when infant is considered viable •UK Preterm Clinical Network[12]: highlights importance of dosing between 1-7d WHO and European Consensus Guideline on the Management of Respiratory Distress Syndrome[74][76]: • Single repeat course if birth does not occur within 7d and high risk of birth within the subsequent 7d	NNAP[1]: • At least 85% of mothers who give birth 23-33+6w should receive at least one dose of steroids prior to birth • MatNeoSIP[2] • NHS England Neonatal Critical Care Quality Dashboard[77] • MCQIC-SPSP in Scotland. Preterm Perinatal Wellbeing package[8] • PERIPrem care bundle of the West of England AHSN[7]
Magnesium Sulphate		
Objective: All women giving birth before 30 weeks of gestation, should receive antenatal magnesium sulphate within the 24 hours prior to birth.		
Evidence	**Professional Recommendations**	**Standards and Quality Improvement Initiatives**
Antenatal magnesium sulphate: • Given <24h prior to birth less than 32w reduces the risk of cerebral palsy and death without risk to mother or fetus[73][78][79] **Gestation <24w:** • Limited evidence for magnesium administration but similar effects seen across range of gestations[80] • Infants have highest risk of neurodevelopmental	Offer Mg to women at risk of imminent PTB: • WHO[74]: <32w • NICE[11] and RCOG: <30w Discuss the use of Mg: •NICE[11]: between 23+0-23+6w •BAPM[10]: from 22w where active resuscitation is planned. Consider the use of Mg: •NICE[11]: Between 30-33+6w	NNAP[1]: • At least 85% of mothers who give birth <30w should receive magnesium sulphate in the 24h prior to birth • MatNeoSIP[2] • PReCePT Quality Improvement toolkit[46] • PERIPrem care bundle of the West of England AHSN-magesium[43]

impairment[10] and may be most likely to benefit • Optimum level is at least 4h after loading dose[81]	Timing: • NICE[11] and UKPCN[12]: A loading dose of 4g followed by infusion of 1g/h until birth or for 24h whichever sooner	• MCQIC-SPSP in Scotland. Preterm Perinatal Wellbeing package[8]

Antibiotics

Objective: All women in established preterm labour should receive intrapartum antibiotic prophylaxis to prevent early onset neonatal Group B Streptococcal (GBS) infection irrespective of whether they have ruptured amniotic membranes.

Evidence	Professional Recommendations	Quality Improvement Initiatives
Preterm prelabour rupture of the membranes and preterm labour are associated with early onset neonatal infection with GBS[82] Antibiotics given at least 4h before birth reduces the risk of GBS sepsis from 12.5% to 1.6%[17]	WHO, NICE, RCOG[11 74 82]: Antibiotic administration is recommended in preterm prelabour rupture of membranes. NICE[11]: Antibiotics can delay PTB and reduce mortality and morbidity associated with congenital infection NICE[11] and RCOG[82]: penicillin in the context of preterm labour or GBS	Neither the NNAP nor the NMPA currently collect data on administration of maternal antibiotics in these contexts. We recommend that units consider undertaking audit of this intervention to ensure optimal compliance with professional recommendations.

Place of Birth

Objective: Singleton infants less than 27 weeks of gestation, multiples less than 28 weeks of gestation and infants with an estimated fetal weight of less than 800g should be born in a maternity service on the same site as a neonatal intensive care unit (NICU).

Evidence	Professional Recommendations	Standards and Quality Improvement Initiatives
Reduced risk of death of extreme preterm infants if birth occurs in a high volume, neonatal intensive care setting [18 83-85] Reduction in mortality is ~50%[84] Reduction in major morbidities of extreme preterm infants if born in a tertiary centre (NEC[86] and PVL[87]) Being born in a non-NICU setting +/- transfer is associated with increased risks of mortality, IVH and severe brain injury in extreme preterm infants [18 88-90]	BAPM[10]: • In utero transfer to facilitate birth of extremely preterm infants in a tertiary centre NHS England[91]: • Infants <27w to be treated in high volume centres with sufficiently expert and experienced staff The Scottish Maternity and Neonatal Services Review[92]: • Develop formal pathways to ensure that clear agreements are in place to treat the highest risk preterm babies in fewer centres, while returning babies to their local area as soon as clinically appropriate	NNAP[1]: 85% of babies less than 27w should be born in a maternity service on the same site as a NICU The European Standards of Care for Newborn Health[93]: Perinatal centralisation of extremely preterm infants with well-organised perinatal networks • MatNeoSIP[2] • Neonatal Critical Care Quality Dashboard[77] • MCQIC-SPSP in Scotland. Preterm Perinatal Wellbeing package[8] • PERIPrem care bundle of the West of England AHSN[7]

Appendix 4. Example of a Case Review or Exception Reporting Tool

Exception identified from BadgerNet:		Infant <27/40 born in an LNU	
Provider/Unit		Date of Report	
Maternal Badger ID		Baby Badger ID	
Date of birth		Time of birth	

Part A: Antenatal Care to be completed by the Obstetric Team Name of person completing Part A:			
Date and time of final antenatal admission		Mode of birth	
Detail nature of signs of PTL in previous 24h and the duration of these			
Detail antenatal admissions within the 2 weeks prior to birth and any discharges/transfers			
Please comment on the use of PTL prediction tools eg fFN, QUiPP, cervical length etc			
Please provide further details of antenatal management in this case where relevant:			
Did the mother receive magnesium? If no, please give detail If yes, give date and time of all doses		Did the mother receive steroids? If no, please give detail If yes, give date and time of all doses	
Did the mother receive tocolysis? Give details		Did the mother receive antibiotics? Give details	
For the final admission was a transfer request made via Cot Bureau? Date and time:		Was the network policy for in utero transfer utilised during the final admission?	
Why did transfer not take place? • Lack of maternal bed • Lack of neonatal cot • Lack of transport capacity • Labour too rapid • Consider time arrival to time assessed • Staff concern of birth during transfer • Mother too unwell			
Was an Obstetric Consultant involved in this decision?		Was a Neonatologist involved in this decision?	

EXAMPLE

Part B: Neonatal Care- To be completed by Neonatal/Paediatric Team			
Name of person completing Part B:			
Gestation		Weight	
Apgar scores		Admission Temperature	
Cord gas results	Arterial Venous		
Was the neonatal team in attendance at birth <u>and</u> of appropriate seniority?			
Brief details of delivery room management:			
Brief summary of care received during stay on local unit including any cranial ultrasound findings			
Time contacted cot bureau:		Time of transport team arrival:	
Time infant left your organisation:		Destination hospital:	
Details of any significant events during postnatal transfer			
Outcome including any cranial ultrasound finding before or following transfer			

EXAMPLE

Part C: Governance			
Was an incident form submitted locally?		Has there been a local maternity review?	
Were the neonatal team included in review?			
Was there a missed opportunity for identifying PTL?			
Was there a missed opportunity for IUT?			
Was this birth in an LNU avoidable?			
Learning identified following local review: Including changes to practice as a result of this case/review for both antenatal & postnatal care			
Any communication issues identified within this case: Comment specifically on communication with parents, with the wider maternity/neonatal/transfer teams and internally/ externally			
Network Office Use Only:			
Date Part A returned		Name of respondent:	
Date Part B returned		Name of respondent:	
Further action required:		Details of additional actions:	
Date completed and closed:		Name of person closing exception:	