British Association of Perinatal Medicine

"During Lillie's birth, the doctors explained that they would be doing a delayed cord clamping but while doing this they would make her warm, safe and care for her during that time. They made sure I knew what was happening and I wasn't worried at all during that minute and Lillie was very happy! And I knew this would help with saving her life."

Amie, parent to Lillie, born at 28 weeks gestation.

Optimal Cord Management in Preterm Babies

A Quality Improvement Toolkit

Your Improvement Journey

December 2020

in collaboration with

NNAP
National Neonatal Audit Programme

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

Phase	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	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	Driver diagram 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 consider it 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. **Collecting and assessing data for Optimal Cord Management**
    Aim: All babies born <34 weeks gestation should have their umbilical cord clamped at least 60 seconds or more after birth, except when there are specific documented maternal or fetal conditions to justify earlier clamping.

    Ask:
    a. What proportion of babies born <34 weeks have their cord clamped *at or* after 1 minute?
    b. What proportion of babies born <34 weeks have their cord clamped *earlier* than 1 minute?
    c. Are the indications for early clamping documented, what are they, and are they appropriate?
    d. Have your normothermia data changed?

2. **Using NNAP Online from 2021 for babies born <32 weeks gestation, it may 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 preterm babies may not receive Optimal Cord Management (NSQI 13). You do not need to use all these tools but should explore which of these exercises works best for your team.

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

Understanding barriers and enablers and finding solutions

In this section we describe some of the commonly described barriers and enablers to Optimal Cord Management and provide you with quality improvement tools to interrogate your own context and processes, giving examples to get the discussion within your team rolling. We suggest solutions that have worked elsewhere (see Table 1 for references) but encourage you to find solutions which are appropriate for your local setting as a solution which works for one team may not be successful in another.

In general, barriers fall into one of these categories:
1. Lack of awareness of benefits of Optimal Cord Management:
    *   Carry out a rolling programme of education about Optimal Cord Management and its benefits: this may include face to face sessions, online tutorials, posters, safety briefs

- Develop a shared guideline for the perinatal team
- Enrol the enthusiasm of Optimal Cord Management Champions in both neonatal and maternity teams

2. Resistance to change:
   - Establish midwifery, obstetric and neonatal leads for Optimal Cord Management and build a culture of shared responsibility
   - Enrol the enthusiasm of Optimal Cord Management Champions in both neonatal and maternity teams
   - Encourage and share parental feedback about their experience of Optimal Cord Management
   - Ask high performing units to share their improvement journey for Optimal Cord Management
   - Start small, one birth at a time, build confidence
   - Provide regular feedback, invite feedback and address concerns of staff
   - Invite this individual or group to join the project team and find ways of working with and not against them

3. Concerns that Optimal Cord Management may harm the mother:
   - Educate with the evidence that shows Optimal Cord Management is safe for the mother
   - Encourage maternity and anaesthetic staff 'call out' during Optimal Cord Management if concerns arise
   - Make prebirth huddles with neonatal team routine, where plan is agreed and actions rehearsed if challenges encountered
   - If the woman is bleeding, initial obstetric management for e.g. assessing for trauma, clamping of bleeding vessels/applying pressure can continue during Optimal Cord Management
   - Ensure the team respects and maintains a sterile operating field during Optimal Cord Management

4. Concerns that Optimal Cord Management may harm the baby:
   - Educate with the evidence that shows Optimal Cord Management is safe for baby and that 'too early' cord clamping is harmful
   - Provide neonatal support for maternity staff during Optimal Cord Management, either by simply attending the birth of the baby, by providing gentle stimulation to the baby or where guidelines and training exist, in providing respiratory support
   - Ensure a package of normothermia care accompanies Optimal Cord Management

5. Logistical concerns and human factors in carrying out Optimal Cord Management particularly under sterile conditions:
   - Develop a shared guideline for the perinatal team that walks people through the actions and tasks required
   - Walk through the process and identify risk and logistical issues including human factors (see Figure 3)
   - Sketch out a diagram such as a positioning diagram relevant to your unit's layout (see Figure 4 for ideas) to guide attendees at birth
   - Conduct drills and simulation to improve confidence of staff

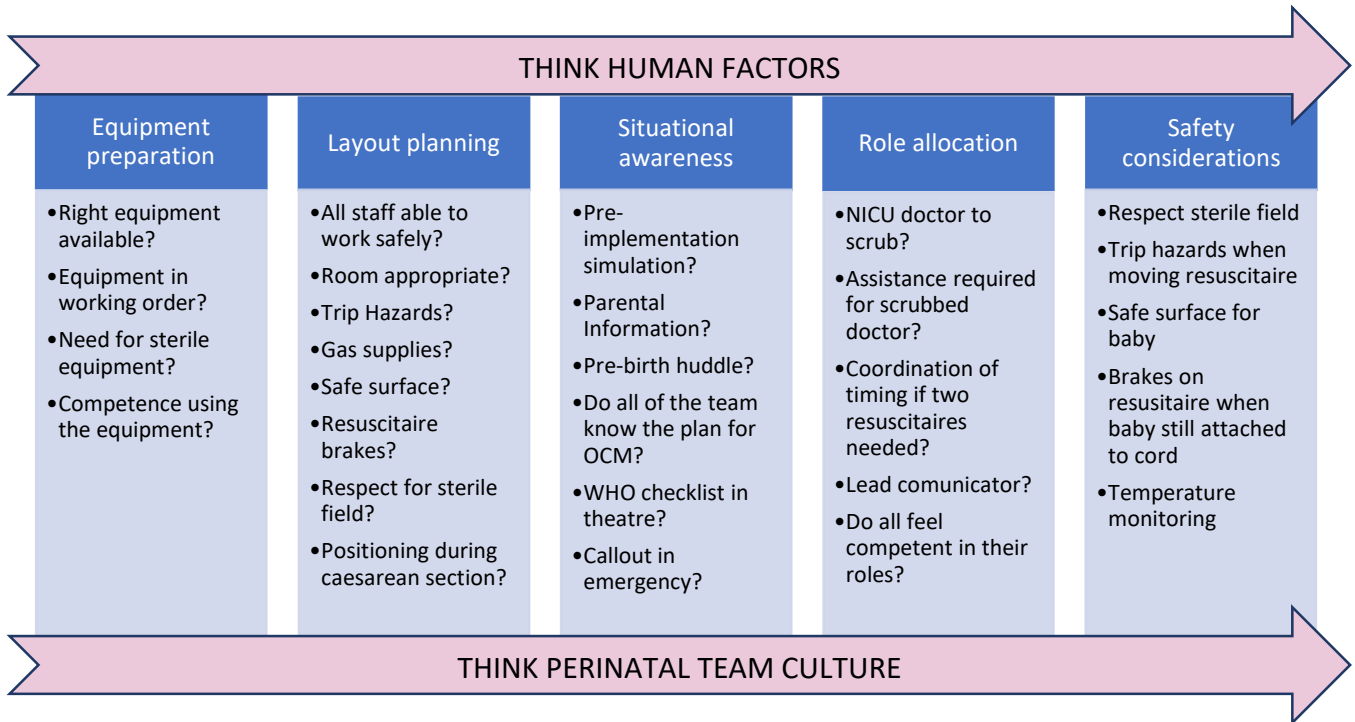**Figure 3. Issues to consider when walking through the process of Optimal Cord Management**

THINK HUMAN FACTORS

| Equipment preparation	Layout planning	Situational awareness	Role allocation	Safety considerations
• Right equipment available? • Equipment in working order? • Need for sterile equipment? • Competence using the equipment?	• All staff able to work safely? • Room appropriate? • Trip Hazards? • Gas supplies? • Safe surface? • Resuscitaire brakes? • Respect for sterile field? • Positioning during caesarean section?	• Pre-implementation simulation? • Parental Information? • Pre-birth huddle? • Do all of the team know the plan for OCM? • WHO checklist in theatre? • Callout in emergency?	• NICU doctor to scrub? • Assistance required for scrubbed doctor? • Coordination of timing if two resuscitaires needed? • Lead comunicator? • Do all feel competent in their roles?	• Respect sterile field • Trip hazards when moving resuscitaire • Safe surface for baby • Brakes on resusitaire when baby still attached to cord • Temperature monitoring

THINK PERINATAL TEAM CULTURE

Figure 4. Example of a positioning diagram for stabilisation on the cord at caesarean section
(provided courtesy of the Perinatal Team, Great Western Hospital, Swindon)
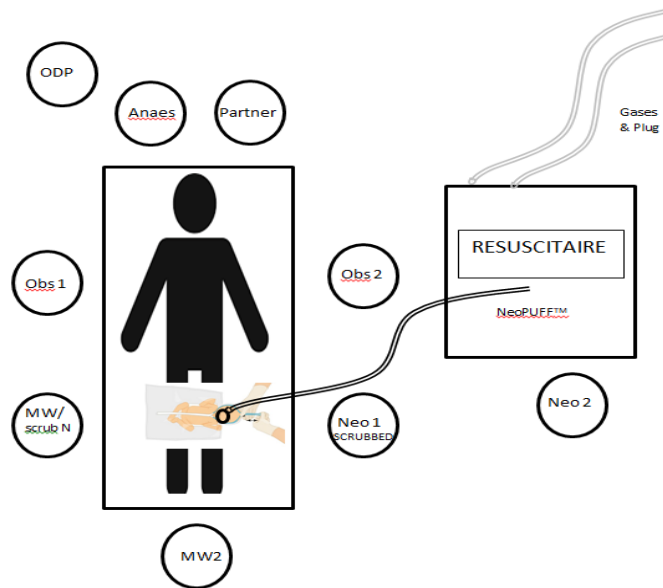
Use some of these improvement tools to survey barriers and enablers in your own service:

1. *Forcefield analysis-* this tool balances the positive and negative drivers influencing Optimal Cord Management, with 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 5). 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 6).
    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 optimal cord management (Figure 7). A template can be found on the BAPM Quality Webpages.

4. *Case review* – take the last 10-20 cases where Optimal Cord Management was not achieved and use a structured review tool (for example see Appendix 4) to identify any common themes. Consider reviewing 10 cases where optimal cord management was achieved and identify strengths.

5. *Process mapping* – walk through the journey that a preterm baby takes before birth, during birth and immediately after birth and think about the factors within the process and the environment that may contribute to optimal cord management.

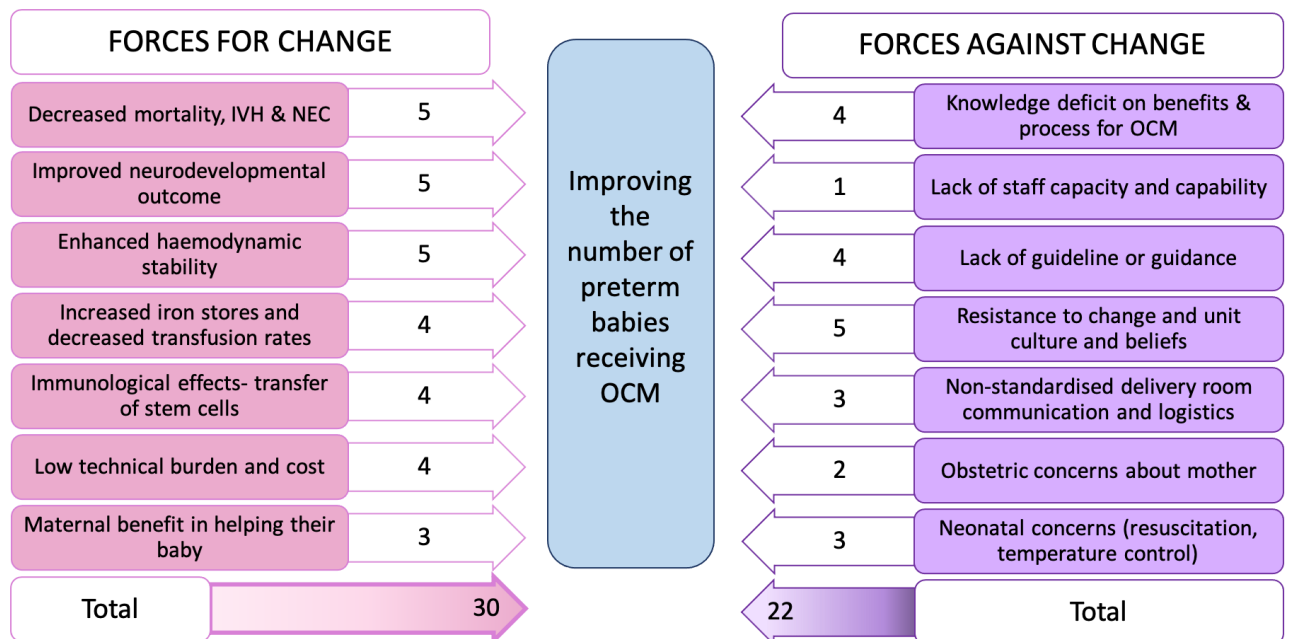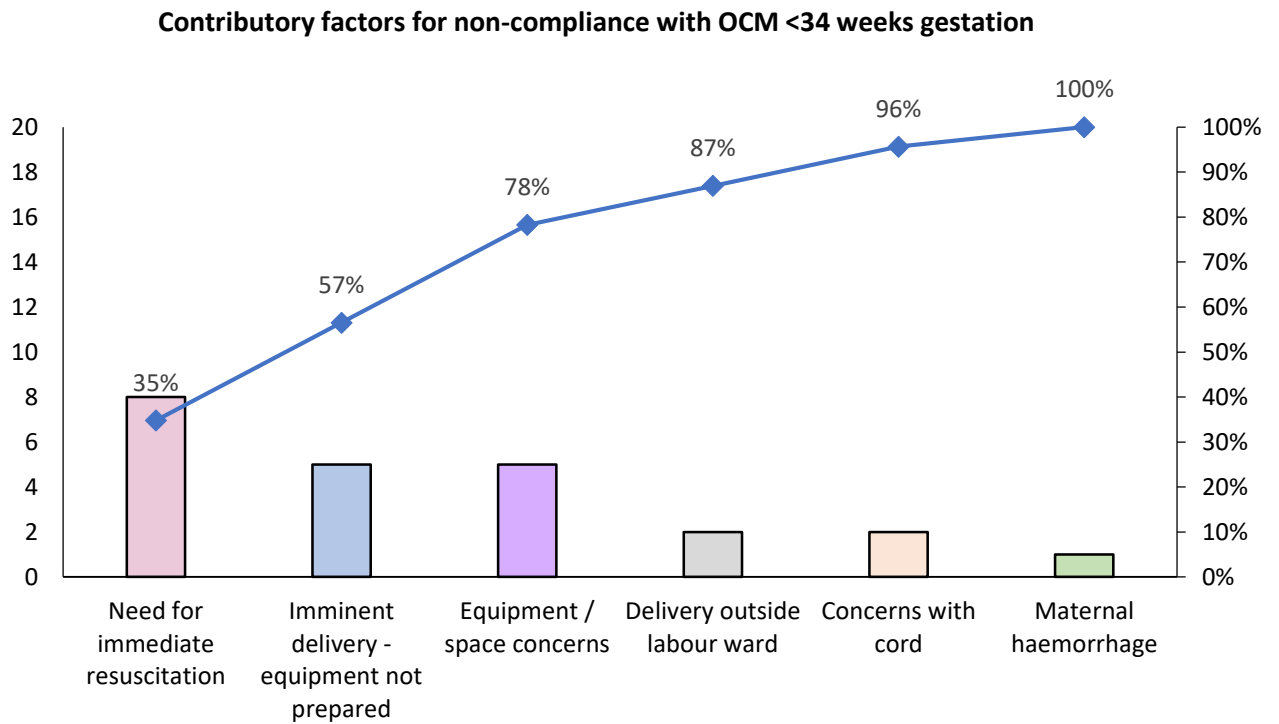**Figure 5. An example of a forcefield analysis for Optimal Cord Management**

FORCES FOR CHANGE		Improving the number of preterm babies receiving OCM		FORCES AGAINST CHANGE
Decreased mortality, IVH & NEC	5		4	Knowledge deficit on benefits & process for OCM
Improved neurodevelopmental outcome	5		1	Lack of staff capacity and capability
Enhanced haemodynamic stability	5		4	Lack of guideline or guidance
Increased iron stores and decreased transfusion rates	4		5	Resistance to change and unit culture and beliefs
Immunological effects- transfer of stem cells	4		3	Non-standardised delivery room communication and logistics
Low technical burden and cost	4		2	Obstetric concerns about mother
Maternal benefit in helping their baby	3		3	Neonatal concerns (resuscitation, temperature control)
Total	30		22	Total

EXAMPLE

Figure 6. An example of a Pareto chart for Optimal Cord Management

Contributory factors for non-compliance with OCM <34 weeks gestation

This chart shows that around 80% of causes can be explained by 3 factors: the need for immediate resuscitation, equipment preparation and equipment/space concerns. Focussing on resolution of these three issues is therefore likely to produce maximum gain in achieving optimal cord management implementation.

Figure 7. An example of a fishbone diagram for Optimal Cord Management
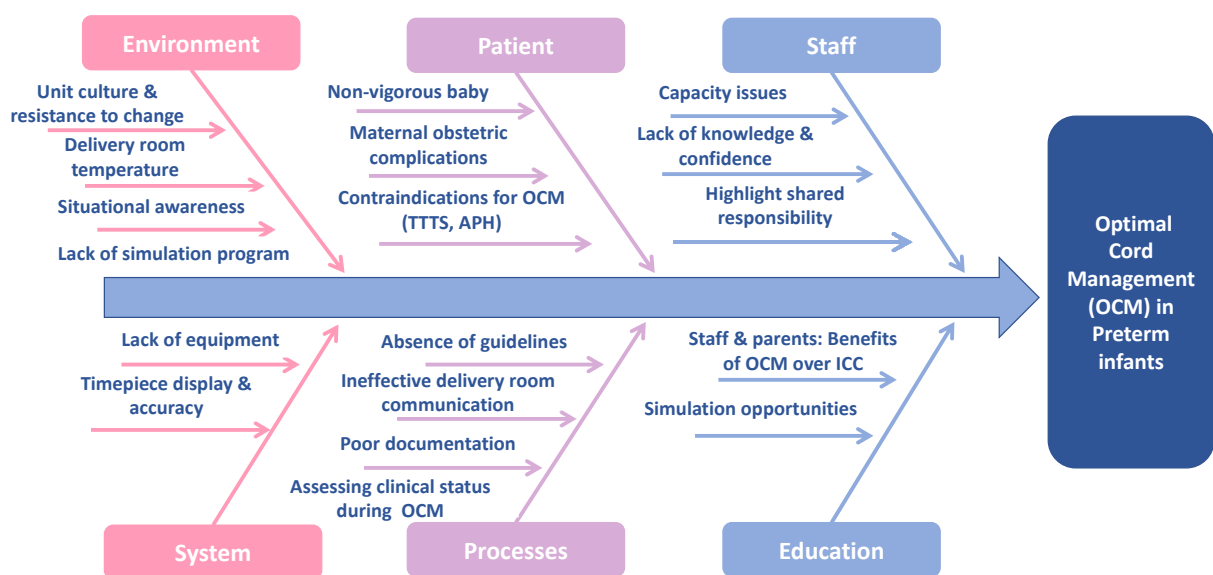
The Improvement Plan

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 diagram to allow you to apply a clear and organised structure to your project (Figure 8).

In developing your local driver diagram, both the BAPM and the NNAP strongly recommend that as part of a change programme to improve optimal cord management, 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 8. An example of a driver diagram to improve delivery of Optimal Cord Management

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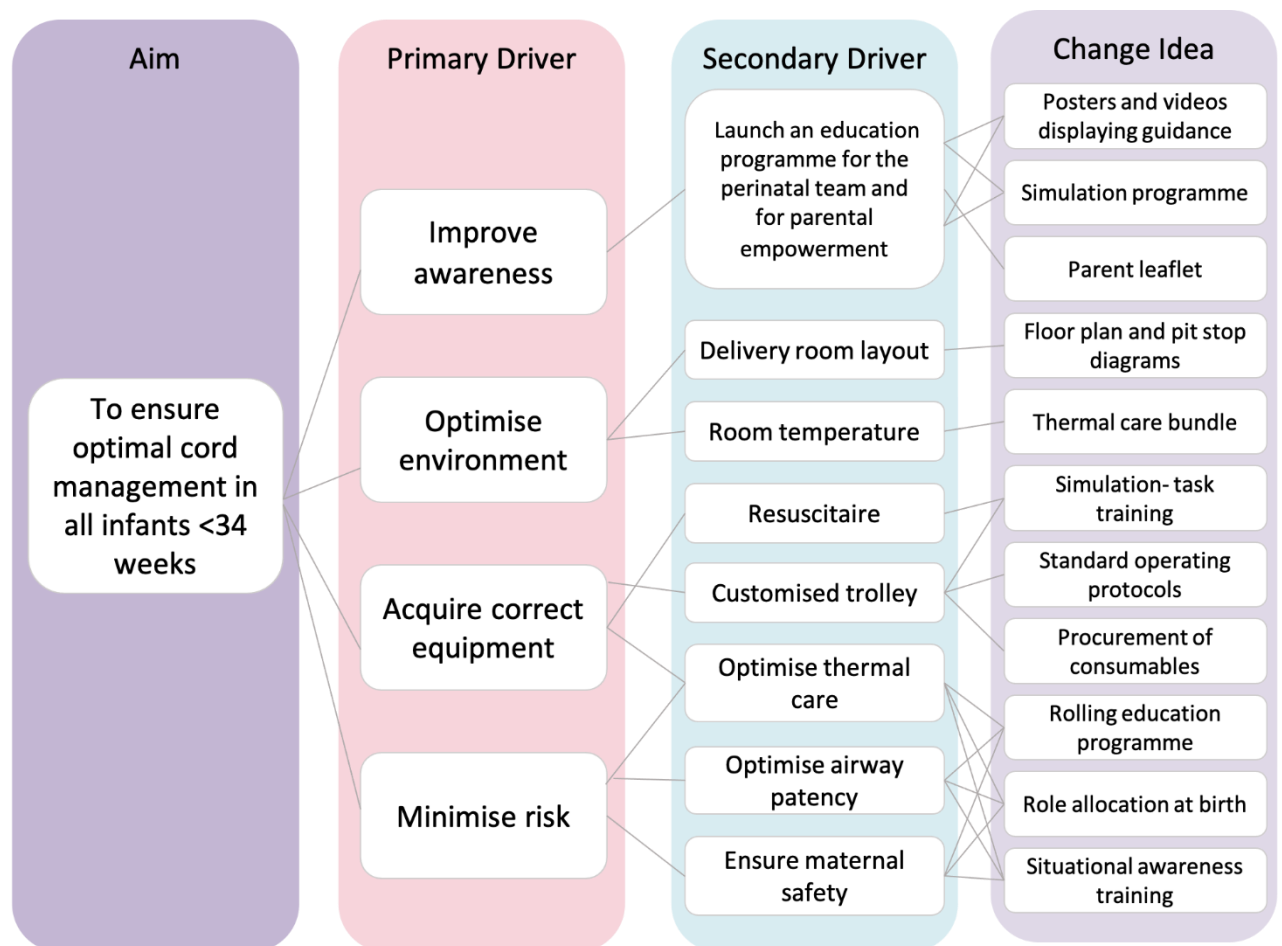
Learning from high performers

It can also 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 of these units have shared their learning below.

We successfully increased the optimal cord management rates in our preterm babies from 29% to over 90% in a 6-month period. These are our tips for implementing this change:

· *Establish an invested multi-disciplinary team with named champions in the different specialties.*
· *Develop a clear aim and agree on change ideas. We decided to use a purpose built bedside resuscitaire to help facilitate optimal cord management.*
· *Identify and engage stakeholders. These may not always be the obvious people; for us this included theatre staff and clinical engineering.*
· *Educate, train and promote. If staff understand the significance of optimal cord management for babies, they will be more motivated to support change in practice.*
· *Persevere when facing the inevitable barriers. There will always be a solution. We had an issue with the gas supply for the resuscitaire which we managed to overcome and found an alternative.*
· *Be passionate and retain this throughout the project. Your passion will drive and enthuse others*

Julia Arthur, ST8 Neonatal GRID Trainee, Luton and Dunstable Hospital

The day that I realised that we had reached a key milestone was when a member of our theatre team was excited to tell me about the part she had played in ensuring that deferred cord clamping was given and how proud she was to have made a significant impact on that baby and their chances of survival. Our success has very much been determined by the collective ownership by all members of the MDT of our vision for all babies to have deferred cord clamping.

Emma Burdon, Midwife, Plymouth

We successfully increased the rate of optimal cord management in infants born <32ws gestation from 0 – 80% over the past 12 mo and achieved 72% in infants born <28w gestation. We also managed to defer until 2m in certain situations.

Tips for implementation:

• *Identify dedicated champions among neonatal, obstetric and midwifery staff*
• *Ensure multiple sessions of education with simple presentation of the evidence*
• *Dedicated simulation sessions to train and embed this practice.*
• *Trouble shooting and careful analysis of missed events*
• *Create a positive experience and share news of positive change*
• *Be passionate but patient*

Amitava Sur, Consultant Neonatologist, Lancashire Women and Newborn Centre

We introduced and maintained 97% optimal cord management rates using a lead by example approach, we ensured that a neonatal practitioner experienced in optimal cord management attended deliveries to support clinicians and to facilitate the practicalities of caring for the infant whilst the cord was intact.

George Brooks, Nurse Consultant, Northumbria Hospital

As a unit we have been focusing on OCM for the last 6 months. It has been fantastic to work alongside my neonatal colleagues to form a true perinatal team ensuring improved outcomes for our preterm infants. OCM is used routinely in our term deliveries but staff were anxious about the preterm infants. Following collaborative support and education, our OCM rates in < 34 week babies has increased from 64% to 100% in November.

Tracey Kay, Consultant Obstetrician, Royal Devon and Exeter Hospital

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 parents who have shared their experience of optimal cord management in the examples below:

"Delaying clamping the cord was discussed with me and my partner by the neonatal nurse before delivery. At birth our little boy was covered in plastic wrap and given oxygen and other treatment at my bedside before the midwife clamped his cord. We have since read about the benefits of him getting extra blood from the placenta at birth and are glad they did this …to give him the best possible start."

"Before Ollie was born, my midwife Lorna, explained the delayed cord clamping to me and why this was especially beneficial for him as he was going to be born early. Though, I was initially concerned Lorna talked me through the process, explaining the benefits and how it would be done safely. I was reassured and very keen to do anything that will improve my Ollie's outcome. I was also surprised that a blood transfusion from my placenta could do a world of good for him. I was pleased I was able to do that for my baby".

"Just before he was born the Nurse Practitioner explained that the baby would be covered in plastic wrap and he would get a hat to keep him warm. I'd read about delayed cord clamping and was pleased this was done for my son. He was cared for on a small trolley (Lifestart™) close to me for a few minutes so he would benefit from getting some cord blood. I loved being able to see how they were caring for him; they were so confident and gentle…. I often thought of this time when we were apart as he was soon transferred to a bigger baby unit."

"During Lillie's birth, the doctors explained that they would be doing a delayed cord clamping but while doing this they would make her warm, safe and care for her during that time. They made sure I knew what was happening and I wasn't worried at all during that minute and Lillie was very happy! And I knew this would help with saving her life."

"My wee Brodie was born at 25 weeks. Before his birth, I had a discussion with the doctors, they explained to me what would be done to help him at delivery and afterwards. They talked about the steroids, delayed cord clamping, breast milk and other medicines that would help improve his chances of survival. The delayed cord clamping benefits and how it would be done safely was explained more by my midwife.
Brodie was delivered into a plastic bag, I remember how tiny and feisty he was, the midwives kept a close eye on him to make sure he was okay and like she had told me before, after one minute she clamped the cord. Though I was frightened as my baby was coming early, I was consoled that there was something I could be part of that would be benefit him"

Phase Two: Develop a Shared Purpose

The evolution of the perinatal team

Midwifery, Obstetric 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 embedding 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[72].

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 overall project lead (can be medical or nursing)
- Parent representation (NSQI 10)
- People with QI expertise (NSQI 17)
- Data analyst
- Service manager
- Staff educators (maternity and neonatal)
- Other multidisciplinary representation including a range of seniority from neonatologists/paediatricians, neonatal nurses, midwives, obstetricians, labour ward and maternity operating theatre representatives

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 and harms of 'too early' cord clamping, 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 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 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 optimal cord management, they are likely to include:
- Senior and junior paediatricians/neonatologists

- Neonatal nurses
- Senior and junior obstetricians
- Midwives of all grades of seniority
- Maternity Care Assistants and Maternity Support Workers
- Maternity operating theatre staff including anaesthetic teams
- Parent groups

These groups need to be:
- **Prioritised**- in terms of the power 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 (e.g. presentations, emails, newsletters), frequency (monthly, weekly, daily) and key messages you want to deliver.

Examples of perinatal team and stakeholder engagement are shown below:

"I have never met a parent when given the evidence about the benefits of OCM, who has not been on board. In my experience educated parents have been some of the biggest change agents. We need to involve them more."
Amanda Burleigh, Midwifery Consultant

"A memorable case for me was that of a first time mother who required to be delivered by emergency Caesarean section in the maternal interests because of severe preeclampsia. Delivery took place at 30w and surgery was carried out under spinal anaesthesia. Her baby son was born in good condition weighing 1500g.We had a team brief prior to surgery to enable correct use of the Lifestart, and this went well. As an obstetrician I found it fascinating to see the neonatal team begin the care of the baby while he was still attached to his placenta. It really felt like patient centred care for both the mother and the baby - an obstetric/neonatal team effort with the desire for best outcomes at the heart of it."
Judith Roberts, Consultant Obstetrician, Queen Elizabeth University Hospital, Glasgow

"We love the approach to cord clamping with very premature babies. The mother can sit up and see their preterm baby and even touch them during OCM. It's wonderful they can do that before baby goes to the resuscitaire."
Tina Smith, Midwife, Queen Elizabeth University Hospital, Glasgow

"In our Local Neonatal Unit, we started working on OCM in 2017. Key to success was working together as a perinatal team, with obstetric, midwifery and neonatal involvement. We worked together in simulation sessions to develop a simple low-cost technique and recruited champions from all members the maternity team to promote this. Including OCM in our WHO checklist at Caesarean sections was also crucial. By 2019, our rates of babies born <32 weeks who had their cord clamped at or after 60 seconds was 90-95%."
Sarah Bates, Consultant Paediatrician and Neonatologist, GWH, Swindon

"I was only able to stop early and immediate clamping myself when I realised the harm I must have done to so many babies for so many years by not thinking more carefully. I knew about the incredible fetal-to-neonatal transition that must take place in the minutes after birth. Of course, babies have been coping without breathing for 9 months and don't need to have the placental circulation cut off, nor do they have to cry immediately. They are protected by fetal haemoglobin's affinity for oxygen, they need the placental transfusion to fill the new pulmonary circulation. If there is a decent heartbeat there is absolutely no urgency to 'hand the baby over' to someone else in the mistaken belief that interference with this transition is benign. It is not. I gradually realized there are no real indications to clamp the cord at all, especially when full and pulsating. We need the neonatologist to come to the baby, not the other way around. It's a human rights abuse to remove a baby from its mother without good cause"

A 'rueful' reflection from a retired Obstetrician, London

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.

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. 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? **Aim**
- How will you know that a change is an improvement? **Measures**
- What changes can you test that will result in an improvement? **Changes**
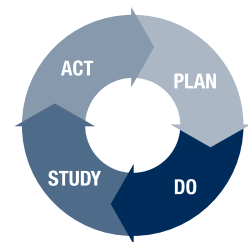
For each change idea, a PDSA cycle can be used:

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? Does 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'](#)
[BloodtoBaby 'Stabilisation with an Intact Cord' module](#)

Below in Figure 8 the Model for Improvement is used to work through an example of implementation in delivering optimal cord management. A template can be found on the [BAPM Quality webpages](#) for your own use.

Figure 8. Example of a Model for Improvement
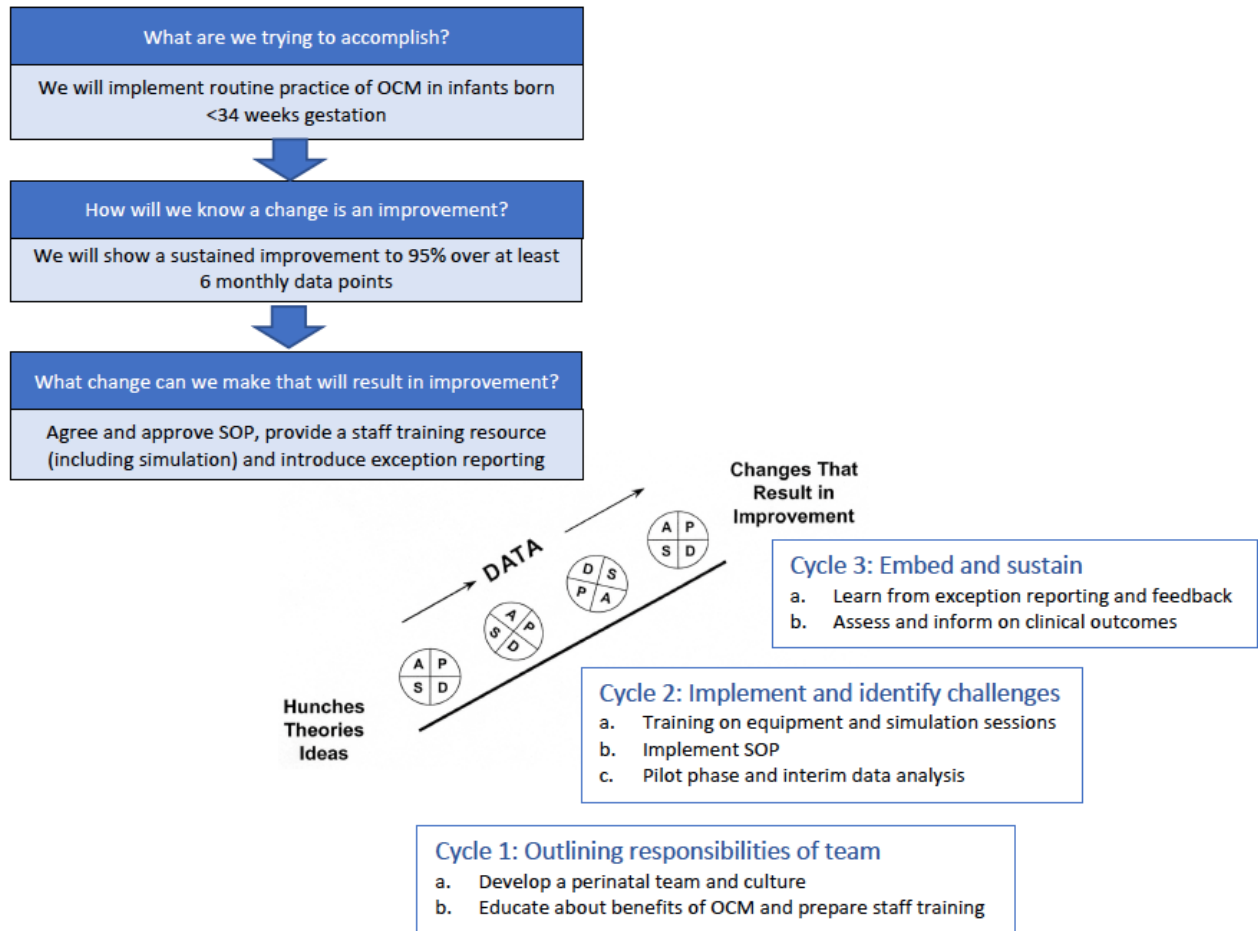
Phase Four: Test and Measure Improvement

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. survival, necrotising enterocolitis, intraventricular haemorrhage, requirement for blood transfusion during the first six weeks of life etc.
2. **Process measures:** the way systems and processes work to deliver the desired outcome, e.g. number of babies receiving optimal cord management with cord clamping at or greater than 60 seconds.
3. **Balancing measures:** this is what may be happening elsewhere in the system as a result of the change, e.g. the number of babies admitted with a temperature outside the normothermic range

Data analysis and display

How will any 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, Figures 9, 10 and 11). 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 (Figure 12). You may need an easy to read key to explain your chart or provide a summary interpretation.
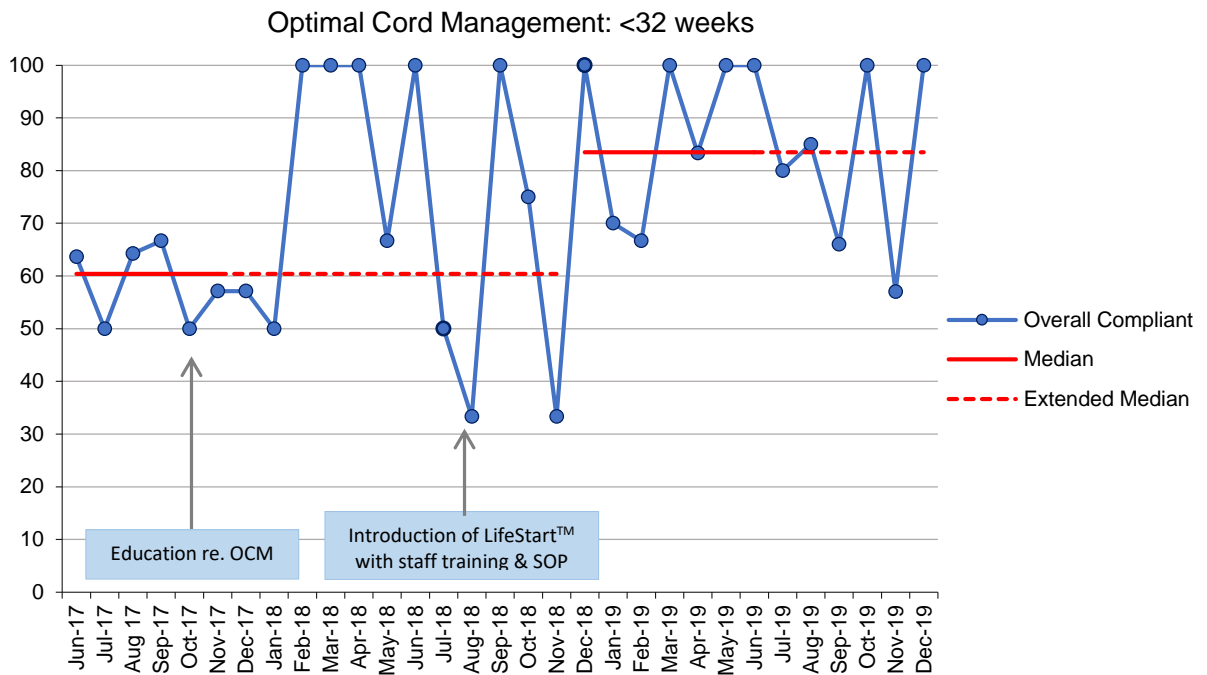
Resources:
BAPM QI Made Easy: 'Interpreting your Data'
NHS Improvement Statistical Process Control Charts
NHS Improvement Making Data Count
NHS Improvement: Project Management

Figure 9. Example Run Chart

Optimal Cord Management: <32 weeks

This chart shows that following the implementation of Optimal Cord Clamping in two phases, a shift (with six points above the median) was seen in the percentage of babies born at <32w gestation having Optimal Cord Clamping (i.e. cord clamping at or > 60 seconds), from 60.4% to 83.5%. 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.

Figure 10. Example of a Statistical Process Control Chart

Optimal cord management: <34 weeks
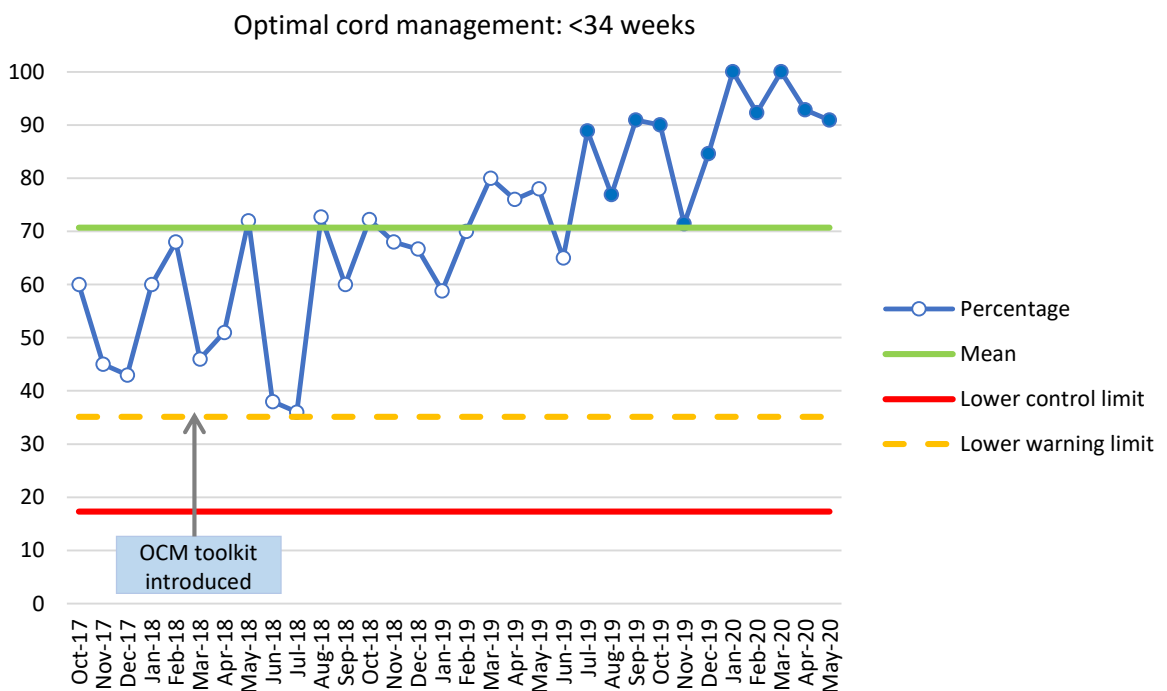
This chart shows the mean (solid green line), lower warning limit (dotted yellow line) and lower confidence limit (solid red line). It shows that while there appear to be more points sitting above the mean since Optimal Cord Clamping was introduced, it is yet too early to say there has been a true shift (that is, 7 consecutive points or more above the mean). SPC charts are a better tool for looking at the stability of your process over time and avoid over interpretation of change occurring by chance (random variation).

Figure 11. Example of a Days Between Chart

Days between OCM not achieved for infants <34w gestation
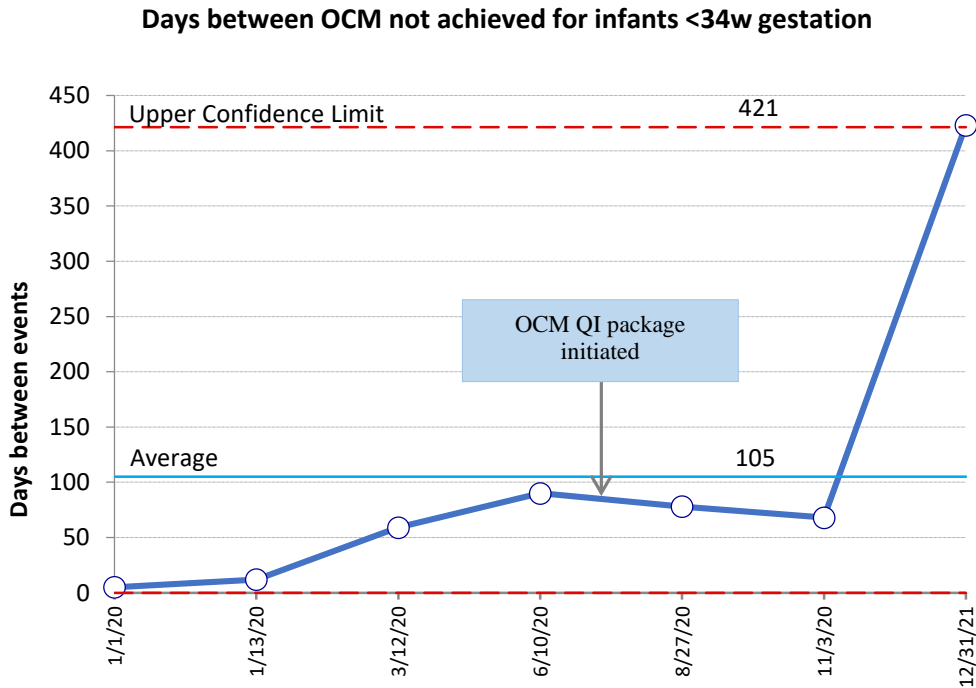
This chart shows that the days between Optimal Cord Clamping not being achieved in babies born <34 weeks gestation has increased over time. At the beginning of study this event occurred once every 1-2 months but there has now been a year since the last baby born <34 weeks had cord clamping <60 seconds.

Figure 12. 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.

Optimal Cord Management July 2020	
7 out of 10 babies born less than 34 weeks received OCM this month = 70%	⏳⏳⏳⏳⏳ ⏳⏳⏳⏳⏳
Recommendations for August 2020	
1. Perinatal team to make OCM plan together before every birth	2. Neonatal team to support the maternity team in OCM at every birth

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 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).

Exception reporting

We recommend that neonatal units undertake a case review when optimal cord management is not achieved in preterm babies <34 weeks gestation using local risk reporting mechanisms (NSQI 13). The case review tool (Appendix 4) can be used or adapted for this purpose.

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 (see resources below).

Barriers and loss of motivation

It is not unusual to find the size 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; use of parent stories; all these can help to reinvigorate and embed your changes for improvement (NSQI 2, NSQI 18).

One Trust identified and overcame barriers to implementing Optimal Cord Management as below:

Barrier	Action	Outcome
Clinical Engineering & Infection control approval	Relevant forms signed off	Approved for use
Theatre Layout	MDT Simulations to identify agreed positioning of LifeStart	Position diagrams created for guidelines.
No piped air in Labour ward, no small air cylinders stocked in hospital	Small air cylinders sourced from gas supplier after approval from managers	Small air and oxygen cylinders available for use
Training time and staff engagement	Regular MDT education & training session held. Training videos were created for those who could not make face –face training.	Sign off sheet for staff who had been trained and videos available on staff share drive.
Awaiting guideline approval	Guidelines reviewed by Neonatal and Maternity teams	Guidelines ratified and put on intranet

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

Incentivising stories from high performers

Examples of high performing units implementing, embedding and sustaining Optimal Cord Clamping are shown below:

"Northumbria introduced optimal cord management (OCM) in 2009, though there have been periods of reduced compliance to the guidance since then. Whilst the midwifery and nursing workforce is largely consistent, junior doctors rotate frequently through the obstetric unit, with varied experiences of OCM. To promote OCM, a neonatal nurse practitioner started to assist with the induction of newly appointed staff to provide information and discuss through scenarios the practicalities of doing OCM safely. This has helped considerably with maintaining high levels of compliance to our OCM guideline."

George Brooks, Neonatal Nurse Consultant, Northumbria Healthcare Foundation NHS Trust

*"We used QI methodology within a multidisciplinary team framework involving staff education, clear OCM guidance, simulation and a buddy system, with more experienced staff guiding less experienced staff in administering OCM. With this approach we were delighted to achieve and maintain an 86.5% implementation rate of OCM in our preterm deliveries and these babies also had admission temperatures within the normal range. In cases where OMC was not achieved, this was due to baby being non vigorous at birth or due to APH.
In the initial month of the Covid-19 pandemic restrictions, we noted a reduction in reliability with OCM in preterm babies with only 48.6% receiving it. Further investigation using both maternal and neonatal records highlighted several issues especially around the number of babies who had received OCM for only 50 - 60 seconds. On review, it became apparent, different timers were being used simultaneously in the delivery theatre, resulting in differing records of OCM clamping times. By addressing the problem and making slight changes, our reliability improved. This highlighted the importance of real time data review and keeping unintended variation to a minimum.
On a personal note, as a QI midwife involved in the implementation of preterm OCM, one of my highlights was listening to a junior midwifery colleague speak excitedly about how proud she was when she, an obstetrician and the attending neonatal staff were able to facilitate OCM for preterm twins, especially in a unit that does not have access to a Lifestart trolley. It was reassuring to see staff take "ownership" of this improvement work and become completely engaged because they understand the benefits of OCM to preterm babies and their mothers."*

Lorna Lennox, Staff Midwife, University Hospital Wishaw, NHS Lanarkshire, Scotland

"We designed a Labour Ward optimisation package which included optimal cord management (OCM) for preterm deliveries. Post-implementation data collection showed that of 88 infants (23-31 weeks), 72% (85% of these on Lifestart) received OCM >60 seconds with a median cord clamp time of 2 mins (mean 2.5 and max 4.4). All were normothermic on admission. Those who didn't get OCM >60 seconds (mean 30) were significantly more likely to require an early blood transfusion despite being well matched for gestation, birth weight and maternal antenatal factors. Within the wider perinatal multidisciplinary team, we explored the barriers to receiving OCM which were clinician anxiety, GA section and placental separation."

Dr Anne Marie Heuchan, Consultant Neonatologist, Royal Hospital for Children, Glasgow

*"For 13 months 100% eligible babies have had their cord clamped at 60 seconds or longer after birth. Although we do not provide stabilisation manoeuvres prior to cord clamping, we do apply a plastic bag and have not seen an increase in hypothermia.
The key to this success has been:*
1. *Establishment of a perinatal team approach with shared goals and joint responsibilities*
2. *Streamlining of guidelines to ensure a clear message about the benefits to babies*
3. *Neonatal support at the time of birth. With a member of the neonatal team present, our obstetric and midwifery colleagues feel more confident in babies' wellbeing during the first minutes of life."*

Dr Julie-Clare Becher, Consultant Neonatologist, Simpson Centre for Reproductive Health, Edinburgh