The Necrotising Enterocolitis (NEC) care bundle
Working together to improve outcomes for families
This document was developed by clinicians in the East of England perinatal network, prior to its abolition in March 2013 and re-emergence as East of England Neonatal Operational Delivery Network (ODN). Hosted by Cambridge University Hospitals NHS Foundation Trust, the East of England ODN is the rightful owner of the material contained in this document.

Clinicians in the East of England hope that their experience of change and improvement can be used widely to improve outcomes for babies and families throughout the UK and beyond.

Sarah Rattigan, Director, East of England Neonatal ODN
Foreword

Quality improvement occupies an important place in healthcare. The term is a summary of a simple concept and a complex process that consists of everyone involved in healthcare – clinicians, managers, commissioners, patients and their families, researchers, and educators – collaborating to make changes that will lead to better health care delivery and better patient outcomes.

Quality improvement starts with generalisable scientific evidence, characterises the context of the health issue, delivers the planned change, and measures the impact on clearly defined outcomes.

Michele Upton and the East of England (EoE) team targeted what is probably the most fundamental of ‘therapies’ for preterm babies, breastfeeding. Maternal breast milk is more than nutrition; it is a crucial intervention, reducing infection and necrotising enterocolitis, and improving neurocognitive outcomes. Analyses by the Neonatal Data Analysis Unit for the Royal College of Paediatrics and Child Health National Neonatal Audit Programme have demonstrated the variability in preterm breastfeeding among neonatal units and that this variation is not explained by maternal or infant factors known to influence breastfeeding. This suggests that for many babies, breastfeeding could be improved by changes in the way in which their health care is delivered.

The EoE team introduced a package of care, a ‘care bundle’ designed to lead to improved preterm breastfeeding, and thus ultimately to a reduction in necrotising enterocolitis, and bring about other longer term health benefits.

Implementation took place over a period of time as many neonatal units and a very large number of staff were involved.

Measuring the impact of a quality improvement programme can be difficult, but is important. Health care professionals are busy and resources are stretched. If time and money are to be expended evidence of impact is essential. The EoE team approached the Neonatal Data Analysis Unit (NDAU) for assistance. Analyses of information held in the National Neonatal Research Database (NNRD) made it possible to show that over the four-year period spanning the introduction of the care bundle, and its incorporation into day-to-day care, exclusive breast feeding at discharge increased significantly in the EoE. Although exclusive breast feeding also increased in the rest of the country over the same period of time, the rate of change was faster in EoE.

The NNRD is created with the support of the UK Neonatal Collaborative, comprising neonatal teams throughout the country that have provided permission for the extraction of high quality data from neonatal Electronic Patient Records to populate this national resource.

The EoE team have shown the leadership that is essential to draw everyone into the process of testing change. They have demonstrated that everyone has a part to play, from the front-line staff that delivered the care bundle in the EoE neonatal units, to the clinical teams that enter data into neonatal Electronic Patient Records nationally, the team at the Neonatal Data Analysis Unit, and the Commissioners funding and supporting this programme.

My team and I have been proud to have been a part of it. I commend it to the NHS as an exemplar, showing that it is possible to make change happen for the benefit of the patients we are privileged to care for.

Neena Modi
Professor of Neonatal Medicine
Imperial College London
Chair, Neonatal Data Analysis Unit Steering Board
August 2013
The reasons for producing this document are:

To acknowledge and celebrate the journey that the East of England perinatal teams have made through the development and implementation of the NEC care bundle. Their ongoing collaboration, both locally and as a region, to improve standards and expect high quality provision of care has seen improvements at scale and led to national recognition of their work.

With the ethos of sharing and disseminating good practices, at a time of leanness and innovation in the new NHS, a call for national dissemination of the work and national drivers for improved breastfeeding rates, this document has been written as a user friendly guide for any unit, network, or region to implement the elements of the bundle.

Executive summary

Necrotising enterocolitis (NEC) is an inflammatory disease of the bowel, prevalent in premature babies and a major cause of morbidity and mortality.

Over the past 20 years, despite significant advances in neonatal care, the incidence of NEC has not changed. The cause of the disease remains unknown although factors relating to feeding, infection, gut maturity and prematurity are known contributory factors. NEC is an important issue due to its significant impact on families, neonatal units and staff. The long term morbidities result in a considerable burden on the NHS.

The NEC care bundle was developed in response to concerns from clinicians in the East of England about an increase in the incidence of NEC in their local units. A decision was taken to develop a network wide, quality improvement project across all seventeen units, using care bundle methodology.

A multidisciplinary team was brought together and a scoping exercise aimed at understanding local practices around feeding, management of NEC, milk preparation standards and dietetic support was carried out. A thorough literature search was undertaken to develop the care bundle.

The four final elements were:

1. Early promotion of expressing to enable the use of mothers’ own milk when enterally feeding
2. Ongoing support for expressing and breastfeeding up to discharge
3. Following a standardised enteral feeding guideline (SFR) when establishing enteral feeds
4. A standardised ‘clean’ approach to the preparation of milk feeds using an aseptic non touch technique (ANTT).

The bundle was implemented in January 2011 following a robust training programme supported by learning tools, posters and audit materials. Senior leadership through Heads of Midwifery, Medical Directors and Chief Executives was sought.

A monthly newsletter was used to communicate progress with the changes, share good practices, celebrate successes and dispel myths. The project collaborated with the national NDAU who measured several of the outcomes.

Findings show:
- Improved insights into strategies to reduce NEC
- Increasing rates of compliance with the bundle
- An increase in breastfeeding rates at discharge
- Improved and increased use of breastmilk during the neonatal stay
- Improved data collection.

The NEC care bundle has seen increasing national interest and has been shared widely with clinicians and industry partners across the UK and beyond. The work has prompted calls for wider dissemination, through protected and funded time.

This document has been produced, using the NHS Change Model as a framework to support clinicians in understanding the project more fully and to give due consideration to the resources required for successful local implementation, using the experiences and stories as shared by clinicians in the East of England.

We hope you find this a useful resource.

Michele Upton
NEC care bundle project lead
The East of England perinatal network

The East of England perinatal network

The East of England covers a large geographical area, covering approximately 10% of England with seventeen units across two networks.

The East of England perinatal network is made up of two networks: Bedfordshire and Hertfordshire, and Eastern (Norfolk, Suffolk, Cambridgeshire and Essex). The perinatal network supports over seventy thousand births a year, of which twelve thousand require admission to a neonatal unit. There are three tertiary level units, nine Local Neonatal Units and five Special Care Baby Units. Two of the tertiary units provide surgical care.

The care bundle required the collaboration of all disciplines within the neonatal and midwifery setting. Many hundreds of staff across these disciplines have been involved in practice changes as part of implementing and embedding the bundle into local practice. This has led to improved collaborative working across the multi-disciplinary team and an improved culture of change within the East of England perinatal network.

In addition, improvements in patient safety have been founded through the reduction in variation in practices, specifically in relation to enteral feeding practices through the standardised feeding guideline. Parent feedback indicates an increase in satisfaction in relation to consistent advice and support.

We present the success of the NEC care bundle project as the clinical findings relating to breastmilk usage and breastfeeding at discharge. However, the project achievements have to include the scale of human behaviour and practice changes along with the collaboration which has resulted in these clinical findings, holding true the view that in healthcare, innovation and change is the work of teams of people.
The NEC care bundle project

Introduction and background

Necrotising enterocolitis (NEC), an inflammatory disease of the bowel, prevalent in preterm neonates, is a major cause of morbidity and mortality in infants born before 32 weeks of gestation or with a birth weight less than 1500g. Over the past 20 years, despite significant advances in neonatal care, the incidence of NEC in very low birth weight (VLBW) infants has not changed markedly, presumably in part due to improved survival rates. The mortality rate in confirmed NEC remains greater than 20%.

The pathophysiology of NEC is widely considered to be multifactorial. Increases in gut pH, exposure to flora in the Intensive Care Unit (ITU) environment, an immature mucosal immune system and bacterial invasion predispose the infant to NEC. The use of mothers’ own milk is reported to decrease, but not eliminate, the risks of NEC. NEC can also appear in clusters in units where there have been outbreaks of infections with resistant organisms.

The NEC care bundle was developed in response to concerns from clinicians in the East of England about a perceived increase in NEC incidence in their units. With the exact aetiological factors contributing to the development of NEC still widely debated, a decision was taken to develop a network wide project across all seventeen of the East of England’s neonatal units.

The primary aim was to reduce the incidence of NEC across the region. This became the driving force for change, despite the recognition that it would be impossible to demonstrate a statistically significant reduction in NEC due to the small numbers of infants with definitive NEC.

Due to the nature of the bundle elements, secondary aims include improved outcomes for preterm infants through a number of key measures focused predominantly on support for and use of mothers’ own milk.

The NEC care bundle has brought an insight into NEC among preterms in a better way and definitely it has helped in reinforcing breast milk importance and initiating expressing among mothers.

Classifying babies into high, moderate and standard risk has been very helpful.

Sister, NNU, Chelmsford

The working group

A multidisciplinary team representing almost all the neonatal units in our network, was brought together by voluntary invitation. Expertise was initially largely neonatal, including Surgeons, Dietitians, Pharmacists, Neonatologists and Neonatal Nurses.

However as the care bundle elements were developed, expertise from Midwifery Colleagues as well as Lactation Specialists and Infection Leads was sought.

Care bundles are a group of evidence-based interventions related to a disease or care process that, when executed together, result in better outcomes than when implemented individually.

Institute for Healthcare Improvement

Care bundle elements must be:

- Evidence-based
- Widely regarded as being best practice
- Simple to implement
- Part of day-to-day practice.
Developing the care bundle

Scoping of practice
A scoping exercise to understand individual units’ practices which might impact on the development or implementation of a care bundle was undertaken. Information we collected included:
- management of suspected NEC
- enteral feeding guidelines and practices
- levels of dietetic support
- milk feed preparation
- use of donor breast milk.

The findings showed significant variations in resources relating to dietetic support, enteral feeding guidelines, milk kitchen and milk preparation standards and feeding practices. This information was later used to inform care bundle elements.

Developing the bundle elements

At the same time as the project was developing, the need for a standardised approach to enteral feeding had been recognised.

Dietetic expertise was commissioned to write an agreed regional standardised enteral feeding guideline. This was later incorporated as a major element of the care bundle.

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The next stage in the development of the care bundle was to undertake a robust literature review which looked at all aspects of care or interventions which are thought to either contribute to or reduce the incidence of NEC. A summary of these are listed below.

Proposed bundle elements

The use of mothers’ own milk, following a standardised enteral feeding guideline and using an aseptic non touch technique (ANTT) when preparing and handling milk feeds were identified as having the highest level of evidence to support their implementation.

However the working group proposed that four elements be adopted for the care bundle. The quality of the evidence from the preventative and contributory factors reviewed was not considered strong enough to be able to identify a fourth element.

It was agreed that a review of babies who had NEC in 2009 in the East of England would be undertaken to look for themes or trends to support a fourth element. This also meant that the care bundle was built around our local population variances.

Case note review: 2009

The criteria for babies for inclusion in the case note review was refined to any baby who had a minimum of 7 days intravenous antibiotics and 7 days of being nil by mouth (at the same time). This was considered to include babies where there were more serious clinical concerns about NEC. Details of babies fulfilling these criteria was taken from BadgerNet and validated in each unit against their own BadgerNet database and local admissions book.

In the absence of a national definition, Bell’s staging was used to categorise cases according to severity.

<table>
<thead>
<tr>
<th>Stage</th>
<th>Systemic signs</th>
<th>Intestinal signs</th>
<th>Radiographic signs</th>
</tr>
</thead>
<tbody>
<tr>
<td>I: Suspected NEC</td>
<td>Temperature instability, apnea, bradycardia</td>
<td>Elevated gastric residuals, mild abdominal distension, occult blood in stool</td>
<td>Normal or mild ileus</td>
</tr>
<tr>
<td>IIA: Mild NEC</td>
<td>Similar to stage I</td>
<td>Prominent abdominal distension &amp; tenderness, absent bowel sounds, grossly bloody stools</td>
<td>Ileus, dilated bowel loops with focal pneumatosis</td>
</tr>
<tr>
<td>IIB: Moderate NEC</td>
<td>Mild acidosis and thrombocytopenia</td>
<td>Abdominal wall edema and tenderness &amp; palpable mass</td>
<td>Extensive pneumatosis, early ascites, &amp; PVG</td>
</tr>
<tr>
<td>IIIA: Advanced NEC</td>
<td>Respiratory and metabolic acidosis, mechanical ventilation, hypotension, oliguria, DIC</td>
<td>Worsening wall edema and erythema with induration</td>
<td>Prominent ascites, persistent bowel loop, no free air</td>
</tr>
<tr>
<td>IIIB: Advanced NEC</td>
<td>Vital sign and laboratory evidence of deterioration, shock</td>
<td>Evidence of perforation</td>
<td>Pneumoperitoneum</td>
</tr>
</tbody>
</table>

Table showing Bell’s staging to support management of NEC
Findings: the regional scoping exercise

Introduction
 Necrotising Enterocolitis (NEC) causes significant morbidity and mortality in the preterm population. In 2009, 15.8% of neonatal admissions in East of England received treatment for NEC during their hospital stay, raising concerns about the high incidence of NEC and its implications. In a recent prospective cross-sectional survey of all level 2 and 3 high dependency or intensive care neonatal units in the UK, the prevalence of NEC has been reported as 14% in infants with birth weight less than 1000 gms (Perrin 2010). The East of England Perinatal Networks are supporting the development and implementation of an evidence-based care bundle as part of a regional approach to reduce the incidence on Necrotising Enterocolitis. As part of this pathway, a more detailed understanding of current practice across our networks was needed.

A care bundle pathway is a group of evidence-based interventions related to a disease or care process, that, when executed together, result in better outcomes than when implemented individually (Institute for Healthcare Improvement, 2005). It is a quality improvement tool which focuses on a particular patient group and leads to new insights on care process by encouraging collaborative working.

Purpose
 We collected and analysed information, from all East of England neonatal units, regarding current practice relating to potential antecedent factors and the management of suspected and proven NEC.

Materials and methods
 A case of necrotising enterocolitis was defined for the purpose of the care bundle project as any infant who has developed clinical features of necrotising enterocolitis leading to commencement of intravenous antibiotics and stopping of feeds, for a minimum of seven days.

A detailed questionnaire was sent to each of the 17 neonatal units in the East of England. The questionnaire contained forty-five questions seeking information on the following headings: – education and training, feeding practices, dietetic support, preparation of milk feeds, use of antibiotics and other medications and any other additional pertinent information.

Conclusion
 There are significant differences in current practice in the region. Through implementation of the care bundle, we aim to unify practice across the network and reduce our incidence of NEC. This initial information will be helpful during the implementation process of the NEC care bundle and also during the review of the impact of this care bundle on the incidence on necrotising enterocolitis in East of England in the coming years.

Results
 Off the 17 units, 10 (58.8%) units have a formal enteral feeding guidelines, 7 (41.2%) units have some neonatal dietetic support and 15 (88.2%) units have a milk kitchen on the unit. One unit has a donor breast milk bank and 4 other units buy donor breast milk.

There are differences in the length of time babies being treated for NEC, are kept nil by mouth (7-14 days). The timing of commencing feeds, initiation milk in case EBM is not available, volume and frequency of trophic feeds, the interval between feeds and the rate of increasing feed volume in the at risk population varies widely in the region. There is also considerable variation in methods of preparing milk feeds including the addition of fortifier, defrosting milk and time-frames for use of defrosted milk.

Education and guidelines:
- General feeding guidelines
- Guidelines for management of absent or reserved EBM

Feeding practice:
- Commence feeds with UAC in situ
- Commence feeds with VAC in situ
- Donor milk bank
- Buy EBM from another unit
- Trophic feeds calculated on body weight

Preparation of milk feeds:
- Milk kitchen in the unit
- Guideline for introduction of breast milk fortifier

Use of antibiotics and other medication:
- Duration of minimum prophylactic IV antibiotics in suspected NEC
- 14 days
- 15 days
- 5 days
- 48 hrs pending blood cultures, X-Rays and review of clinical findings
- Antibiotics used as first line for suspected or confirmed NEC
- Cefotaxime
- Gentamicin
- Metronidazole
- Cefaclor
- Vancomycin
- Nal by mouth after a confirmed NEC episode
- 14 days
- 15 days
- 16 days
- 15 days

Use of dummies:
- Unit supporting the use of dummies or pacifiers

Findings: the 2009 case note review

- Mean gestation: 28 weeks and 3 days (range 23+2 – 40+6)
- Mean birth weight: 1021 grams (range 515 g – 3370 g)
- Male predominance (Male to Female ratio: 1.3:1)
- Day of onset of NEC – mean 21 days of life (range 1 day – 107 days)
- Mean corrected gestation at the onset of NEC: 31 weeks 3 days (range 24+5 – 42+0)
- Conservative medical treatment only – 60 cases (53.7% cases)
- Needed surgical intervention – 44.6% cases

A review of predisposing factors included:
- gender
- presence of a PDA
- umbilical lines
- type of milk being fed at onset of NEC
- blood transfusions; stool history

No clear trends which separated the East of England population from national findings were identified.
The justification for the final care bundle elements

The highest levels of evidence were sought on each theme. Evidence pointed most convincingly towards the use of maternal breastmilk. The group recognised the staged approach to managing initiation of expressing in mothers who could not breastfeed and the changes in support required up to discharge. For this reason, we agreed to separate the element relating to use of mothers’ own milk into two separate elements resulting in the following four elements making up the bundle.

1. Promotion of early expressing to enable use of mothers’ own milk

The preterm gut is highly susceptible to NEC. This is due to several factors including:
- Altered bacterial flora
- Immaturity of the intestinal epithelial barrier and mucosal immune system predispose the infant to bacterial invasion
- Pro-inflammatory cytokines further compromise intestinal defences
- Impaired epithelial cell repair leading to bacterial invasion, activation of the immune response and uncontrolled inflammation
- Decreased peristalsis
- Increased gastric pH.

Mothers’ own breast milk is known to have unparalleled advantages for the preterm infant. Able to respond advantageously to all of the above predisposing factors, maternal milk provides improved bacterial defence, gut absorption and nutritional composition. In addition, the long term developmental outcomes, psychological benefits and health economics are becoming increasingly highlighted and evidenced.

2. Ongoing support for expressing and breastfeeding to discharge

There is strong evidence that short periods of kangaroo skin-to-skin contact increase breastfeeding duration for up to six weeks post discharge. Although the evidence of multidisciplinary staff training increasing initiation rates and duration of breast feeding is limited, we recognised that lack of staff training is an important barrier to implementation of effective intervention.

Element 1 and 2 were aimed at staff training to provide consistent advice to mothers, support for early and sustained initiation of milk expressing to enable a solid ‘footprint’ to be embedded, as well as strategies to promote long term availability of breast milk through positive touch, skin-to-skin contact and staff support.

3. Following a standardised enteral feeding guideline

Nutritional management in Neonatal Units across the Network is marked by a lack of uniformity. In the United States as noted in our region, differences in practice were found to be greatest between Neonatal Units, though they also existed between individual Neonatologists within the same institutions.

Although there is uncertainty around the definitive practice of nutritional support in preterm infants, standardisation of practice across the Network is recommended for two reasons:

1. A significant and prolonged decline in the incidence of NEC, nearing virtual elimination in some centres, has been reported consistently since the implementation of a standardised feeding regimen (SFR) in the form of clinical practice guidelines.

2. Quality improvement literature suggests that a continuing cycle of process planning, consistent implementation, review and audit of practice is highly effective in clinical medicine.

4. Following an aseptic non touch technique (ANTT) when preparing milk feeds

Evidence from the United States showed that there was a higher incidence and clusters of NEC outbreaks in units which had seen outbreaks of resistant organisms.

The scoping exercise had provided evidence of substandard milk feed preparation techniques, prompting the standardisation of the approach to milk feed preparation. This approach adopted an aseptic non touch technique (ANTT) when preparing milk feeds and could be adopted regardless of individual unit resources.

Guidance was given on how to store both frozen and fresh breast milk as well as defrosting milk from frozen. This aspect of the bundle led to significant changes in practice for many units. Some units went to extraordinary lengths to improve milk kitchen conditions, including structural changes and reorganisation of the layout to include separate areas for expressing and preparation.

Many units changed practice by moving to single use milk storage containers instead of sterilising bottles – a criteria of the project for full compliance. This change had financial implications for these units, who met these challenges as part of meeting the standards expected of the project.
Necrotising Enterocolitis (NEC)
Implementation of a Care Bundle to reduce the incidence of NEC

**Element 1**
Breast feeding leaflet discussion re: feeding
Midwives, Neonatologists, Neonatal Nurses

**Element 2**
Breast feeding leaflet, discussion re: feeding, Care Plan day 0-9.
Neonatal Nurses, Midwives on PNW, Lactation Specialists, Neonatologists

**Element 3**
Care Plan day 10 to discharge
Neonatal Nurses, Lactation Specialists, Health Visitors

**Element 4**
Follow a Standardised Feeding Regimen (SFR)
Neonatologists, ANNPs, Neonatal Nurses and Dietitians

Follow a double checking prompt when preparing milk feeds
Neonatal Nurses who prepare feeds

Antenatal period

Discharge home
Project aims

Primary aim

The primary aim of the project was to reduce the incidence of NEC in the East of England.

There were major challenges in being able to demonstrate statistically that the care bundle alone had directly reduced NEC rates.

Reasons included:
- Lack of a national definition for NEC
- The small numbers of cases of NEC in the region resulting in insufficient power to be a convincing study unless undertaken as a longitudinal study.

Despite this, reducing NEC incidence was the vision that had been the inspiration for the project. Knowing we were actively doing something to try to reduce NEC rates was the driver and motivator for the entire team. Thus, although it was acknowledged early on in the project that we would never be able to prove our mission in the short or medium term, this had always been the primary aim of our project.

With the possibility of national dissemination, a national definition for NEC and wider collaboration through networks, there is increasing possibility that, over time, we may be able to correlate improvements in NEC incidence with a correlation in increased breastmilk usage, captured through the NNRD.

Secondary aims

Because of the nature of the elements themselves we introduced five secondary process and outcome measures:
1. Compliance with the four care bundle elements
2. The impact of the care bundle on breastmilk rates at discharge
3. The impact of the care bundle on use of human milk during the hospital stay
4. The impact of the care bundle on developmental outcomes
5. The impact of the care bundle on parent satisfaction.

Collaboration with the Neonatal Data Analysis Unit (NDAU) at this point, suggested that we include two additional measures:
1. Catheter associated bloodstream infection rates (CABSI)
2. Use of parenteral nutrition.

Implementing at scale

Change through our champions

Using a distributed leadership model, ‘champions’ were identified as key links for the teaching, implementation and change cycle processes in each unit.

To facilitate engagement and allow for multidisciplinary discussion of the evidence behind the chosen interventions, teaching was carried out across network units by the project lead and neonatal dietitian responsible for writing the enteral feeding guideline.

Nursing care plans and ‘Top Tips’ for expressing were key tools to support implementation of the two elements relating to expressing and breastfeeding support.

An ANTT milk preparation prompt was designed to guide staff through the milk preparation processes for use in milk preparation areas.

To aid simplicity of use, the standardised enteral feeding guideline included two algorithms.

The first detailed feed volume and advancement rates based on the assessed risk of NEC (‘high’, ‘moderate’ or ‘standard’ based on defined clinical criteria). The second algorithm provided guidance on milk choice and breast milk fortification.

Communicating the changes

To further support the change process, information folders, posters, electronic presentations and monthly electronic newsletters were produced.

A letter was sent to Chief Executives, Medical Directors and Commissioners to outline the project and its aims and to promote senior leadership.

The use of parent stories through a regional launch of the project and a focus on reducing incidence of a devastating disease through the provision of optimal, evidence-based care were additional strategies used.

Implementation of the care bundle took place during January and February of 2011 following a formal launch. Changes were led by champions in each unit, supported by the project lead and network neonatal dietitian.

Julia’s story

The launch day led by the project leads helped to combat and quieten the fears with the simple, clear breakdown and layout of the four elements.

An action plan was designed… so that staff understood the aims and were involved in the plans for the launch on the unit. The training guides aimed at specific audiences (neonatal and midwifery staff) along with the project leads attending training days in the pre implementation stages were invaluable.

Setting a launch date on the unit with posters announcing it was used to enable staff to feel involved and encouraged participation.

By the launch day everyone in the team knew ‘Today is the Day’!”

Julia Cooper, NEC champion, Ipswich neonatal unit

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The change process: after implementation

Feedback and support
It was crucial that champions were supported through the change processes following implementation. Queries relating to the feeding guidelines were responded to promptly by phone or email. A log of queries was kept with FAQs and answers published in the newsletters.

Measuring for improvement
Adherence to care bundle elements was audited throughout the first year of implementation. Ten randomly selected babies born at <35 weeks gestation were audited each month by local champions or network personnel using a standardised network audit proforma. An ‘All or None’ approach was adopted, with the expectation that every aspect of each element had to be met to be considered fully compliant.

Units progressed to three monthly auditing when 100% compliance was achieved in all four elements for two consecutive months. It was considered that the bundle had been well embedded once this level of compliance had been reached.

At this point audit criteria were changed by increased expectations of compliance in that expressing would commence within six hours of delivery to achieve full compliance along with the previous criteria. This was part of a staged approach to improving practice and bringing it in line with best evidence, whilst recognising the number of changes the initial implementation criteria demanded. As anticipated, the overall percentage compliance with all four elements dipped while units worked towards achieving the stricter criteria. Three units were able to maintain the high compliance rates despite these increased expectations.

Staff involved in delivering the changes needed to be made aware of progress and issues which may have shared learning for all. A monthly newsletter was the vehicle used to communicate progress with the changes, share good practices, celebrate successes and dispel myths.

The newsletter was produced by the project lead on a monthly basis to provide regular updates but as the work was embedded and changes became familiar and accepted practice, the newsletters were produced bimonthly and then quarterly. Improvements were noted through increasing compliance rates with the bundle as seen through audits.

Maintaining the focus

Kathy’s story
The regular audits of compliance with the care bundle have been essential to maintain its profile, identify problems with implementation and compliance and enable decisions to be made as to how to make the care bundle work in our unit. Feedback of audit results from the whole region has helped through a sense of competitive pride to embed the programme in our unit, and enables further pinpointing of areas to be improved on.

Continued audits on an ongoing basis will be necessary to ensure continued and improved completion of the breast feeding care plans, compliance with the six hour expressing window and to ensure compliance with ANTT for milk feeds.

Kathy May, NEC champion, West Suffolk

Individualised reports
Each unit received an individualised end of year report detailing feedback on local compliance with the NEC care bundle since implementation in January 2011 and providing specific feedback and points for practice on use of the enteral feeding guideline.

Julia’s story
The road was long with many a winding road, lots of nagging and moments of despair. Huge team effort to lead us to where?

Excellent audit results: Increased use of fresh expressed breast milk and improved breast feeding rates and EBM at discharge.

Standard risk babies happily fed and tucked up in cots with less/no IV fluids and improved growth. High and Moderate risk babies feed advancement improved with less use of TPN, reduced central lines days.

Julia Green, NEC champion, Princess Alexandra, Harlow
The change process: after implementation

Auditing enteral feeding practices

The audit tool was used to measure both unit compliance with the care bundle and to evaluate use of the network enteral feeding guideline.

Audits ascertained accuracy on classification of babies into the three NEC risk categories as well as adherence to guidance on feed management following classification. Deviations from the guidance, both justified and non-justified were recorded.

The data we captured also supported the identification of non-audited feeding trends across the network, including time to first feed and milk used for first feed.

The percentage of babies receiving expressed breast milk (EBM) as their first feed in 2011. Our first year of implementation.

<table>
<thead>
<tr>
<th>Unit level and risk category</th>
<th>4 months post implementation</th>
<th>12 months post implementation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level 3 – High</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>Level 3 – Moderate</td>
<td>76%</td>
<td>91%</td>
</tr>
<tr>
<td>Level 3 – Standard</td>
<td>35%</td>
<td>60%</td>
</tr>
<tr>
<td>Level 2 – High</td>
<td>67%</td>
<td>70%</td>
</tr>
<tr>
<td>Level 2 – Moderate</td>
<td>58%</td>
<td>67%</td>
</tr>
<tr>
<td>Level 2 – Standard</td>
<td>38%</td>
<td>19%</td>
</tr>
<tr>
<td>Level 1 – High</td>
<td>73%</td>
<td>100%</td>
</tr>
<tr>
<td>Level 1 – Moderate</td>
<td>69%</td>
<td>83%</td>
</tr>
<tr>
<td>Level 1 – Standard</td>
<td>37%</td>
<td>32%</td>
</tr>
</tbody>
</table>

Time to first feed in 2011. Our first year of implementation.

<table>
<thead>
<tr>
<th>Risk category for NEC</th>
<th>Within 24 hours of birth</th>
<th>Within 48 hours of birth</th>
</tr>
</thead>
<tbody>
<tr>
<td>High risk (86% completion)</td>
<td>24%</td>
<td>46%</td>
</tr>
<tr>
<td>Moderate risk (50% completion)</td>
<td>25%</td>
<td>71%</td>
</tr>
<tr>
<td>Standard risk (100% completion)</td>
<td>79%</td>
<td>91%</td>
</tr>
</tbody>
</table>

Compliance with feed advancement algorithm in 2011. Our first year of implementation.

<table>
<thead>
<tr>
<th>Month of implementation</th>
<th>Percentage compliance with Algorithm 1 across all 17 units in the EoE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Month 2</td>
<td>69%</td>
</tr>
<tr>
<td>Month 4</td>
<td>85%</td>
</tr>
<tr>
<td>Month 6</td>
<td>92%</td>
</tr>
<tr>
<td>Month 8</td>
<td>100%</td>
</tr>
<tr>
<td>Month 11 and 12 combined</td>
<td>98%</td>
</tr>
</tbody>
</table>

How we improved in our first year

The graph below shows overall network compliance with all care bundle elements in the first 11 months of the implementation period.

The dip in compliance seen in months 7–9 indicates the transition of some units to the stricter audit criteria for early expression. Throughout this time period compliance with the ANTT guidance was consistently high whilst cross-network compliance with the standardised enteral feeding guideline increased from 68% at the end of March to 98% at the end of November and December.

Gaining 100% compliance with all four elements in 2011. Our first year of implementation.
Collaboration with the Neonatal Data Analysis Unit

In January 2011, early discussions were held regarding a collaboration with the Neonatal Data Analysis Unit (NDAU), led by Professor Neena Modi, to provide advice and analysis of the project outcomes. The ‘Medicines for Neonates’ (MfN) research programme led by Professor Modi aims to utilise operational clinical electronic data captured at the point of care for multiple purposes, avoiding the unnecessary duplication of data. MfN is funded by the UK National Institute for Health Research through a Programme Grant for Applied Research. All English neonatal units were invited to join the UK Neonatal Collaborative (UKNC) in August 2011.

By February 2012, 153 neonatal units in England had formed the UKNC, committed to submitting high quality operational electronic data to the Neonatal Data Analysis Unit (NDAU) led by Professor Modi. These data are used to create a National Neonatal Research Database (NNRD) that in turn is used to support clinical neonatal services, quality improvement initiatives, audits and research. Collaboration between the EoE and NDAU was formalised by late March 2011. At the same time the UK Neonatal Collaborative NEC study was about to commence and the East of England were one of the first regions to join the study.

The UKNC-NEC study: background

The UK Neonatal Collaborative Necrotising Enterocolitis (UKNC-NEC) study is a component of the MfN research programme. Feeding practices are widely believed to influence susceptibility to NEC, but as yet there is no agreed optimum feeding strategy if mothers’ own milk is not available. Previous randomised controlled trials (RCTs) have lacked power to address feeding interventions so their conclusions are unreliable. The design of high quality RCTs and evaluation of quality improvement initiatives are hindered by the lack of a case definition and scant baseline incidence data. As a consequence, the incidence of NEC in the UK remains unknown. In this study, three crucial prior requirements necessary for the conduct of high quality, adequately powered, interventional randomised trials related to feeding were addressed.

Aims of the study

The first aim was to establish an evidence-based case definition for NEC surveillance. The second aim was to determine the incidence of NEC (applying the developed case definition) over a geographically defined area. The third aim was to examine whether enteral feeding factors are associated with the development of NEC.

Data validation

The East of England was one of the first regions to join the UKNC-NEC study, committed to collecting high quality data for this national study. Common variables (e.g., feeding) are required for both the UKNC-NEC study and the East of England care bundle project. Therefore, an advantage of using data from the NNRD for analysis of the care bundle project is the avoidance of unnecessary duplication of data collection. However, to ensure that conclusions from the analysis of NNRD data are valid, it is essential that data submitted to the NNRD are complete and accurate. Our collaboration with the NDAU was instrumental in improving data completion and accuracy. As a prelude to a formal evaluation of the care bundle, the NDAU carried out an assessment of data completeness and accuracy, comparing what was held on the NNRD with information in the medical case notes.
Collaboration with the Neonatal Data Analysis Unit

Validation methods
This was achieved through monthly data validation studies undertaken in each unit. Validation studies themselves were a project within a project, the two strengthening each other through improved data completeness. This led to improved and accurate data collection which allowed us to ascertain improvements, specifically in breastfeeding and milk use.

Validation studies were led by a named champion, often a medical lead, a trainee or in some cases, the NEC care bundle champion. A Microsoft PowerPoint presentation and printed guides were available to direct completion of specific data variables relevant to the care bundle. Two babies from each unit, born at <33 weeks and who had been discharged the previous month, were randomly selected by our network data analyst. Details of the infant and the episode of care were faxed to the named validation champion in each unit.

Improved data collection
The champion would then complete a standard proforma using only information from the medical notes. Variables collected include admission and discharge dates, gender, gestation, birth weight, milk at discharge, NEC surgery details, parenteral nutrition days (PN days), central line days, abdominal X-rays (AXR) and blood cultures (BC) performed. The completed proforma were faxed to NDAU where the agreement between data held on the NNRD and the medical notes was determined. Key to the success of both projects was accurate and complete data entry, relying on all who enter data into BadgerNet. Once again, this required a specific focus for staff on the importance of data completeness and accuracy, another change in culture for the teams.

With over 20% of feeding data missing in 2010 it was not possible to ascertain whether there had been improvements in breastfeeding at discharge until data completion had improved. The table opposite demonstrates improvements in the agreement of data regarding variables including feed at discharge. Data accuracy regarding discharge feed increased from 50–60% in 2011 to 70–80% by 2012.

Feeding back results to staff
Getting staff to understand that we could not measure our outcomes without accurate data completion was a motivating force to improve data. Monthly data validation findings were fed back to units both individually and through the regular NEC newsletters.

With open publication of results, units were motivated to improve data accuracy. By late 2012 there was a notable improvement in data completion relating to the blood cultures: whereas prior to this around 30–40% of blood cultures were being entered onto BadgerNet, this had improved to around 60–70%.

The project groups promote the use of validation studies to improve data collection in other units. In addition, the validation study provided us with the confidence that regional NNRD data regarding parenteral nutrition and central line days had an agreement greater than 80%.

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<th></th>
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</thead>
<tbody>
<tr>
<td>Discharge feed</td>
<td>57</td>
<td>72</td>
<td>67</td>
<td>82</td>
<td>74</td>
<td>78</td>
</tr>
<tr>
<td>PN days</td>
<td>93</td>
<td>81</td>
<td>87</td>
<td>89</td>
<td>93</td>
<td>92</td>
</tr>
<tr>
<td>Central line days</td>
<td>80</td>
<td>90</td>
<td>91</td>
<td>89</td>
<td>93</td>
<td>89</td>
</tr>
<tr>
<td>AXR performed</td>
<td>54</td>
<td>51</td>
<td>49</td>
<td>52</td>
<td>53</td>
<td>51</td>
</tr>
<tr>
<td>BC performed</td>
<td>35</td>
<td>41</td>
<td>43</td>
<td>48</td>
<td>51</td>
<td>63</td>
</tr>
</tbody>
</table>
Outcomes and findings

The primary aim of the care bundle was to reduce the incidence of NEC. This was the vision which inspired clinicians to adopt the practice changes. Although we understood that due to the small numbers of cases we would have insufficient power to identify a statistically significant reduction in NEC that could be attributed directly to the care bundle, this had nonetheless been our primary aim.

If the care bundle did reduce NEC, we would expect the pathway to be through improvements in breastfeeding. For these outcomes, there were sufficient numbers to enable a comparison of East of England (EoE) with national data from the UK Neonatal Collaborative (UKNC) using interrupted time series methodology.

The tables on the next few pages detail the findings from the various analyses undertaken by the NDAU.

Daily feeding of mother’s milk

Figure 1 shows the percentage of care days each month where the baby received mother’s milk in the EoE and in the rest of the UKNC neonatal units. Following the introduction of the care bundle (February 2011, marked by the red line), there was a significant improvement in the trend in the EoE. However the pattern observed in the EoE was also seen in the rest of the UKNC. There was no statistically significant difference between the two regions.

Receiving only mother’s own milk at discharge

Figure 2 shows the percentage of babies receiving only mother’s own milk (MOM) at discharge in the EoE and in the rest of the UKNC. Exclusive MOM rates in the EoE region (green line) improved significantly faster than the rest of the UKNC (yellow line) over the whole 4-year evaluation period, though improvement was not accelerated after the implementation of the care bundle.

The same pattern was observed after adjustment for confounders (gestational age, maternal age, smoking during pregnancy, birth weight and multiple pregnancy).

Figure 2: Monthly percentage of babies receiving only mother’s own milk at discharge in the East of England region (blue dots for data, green line for estimated trend from segmented regression) and the rest of the UKNC (red dots for data, yellow line for estimated trend from regression) by month of discharge.
Outcomes and findings

Daily use of parenteral nutrition

Comparison with the UKNC showed divergent patterns of PN use post-intervention. Data completeness has improved over the evaluation period therefore some caution is required in interpreting this analysis.

Figure 3 shows the percentage of care days each month where the baby received parenteral nutrition (PN) in the EoE and in the rest of the UK. In the EoE, there was an immediate statistically significant reduction in PN use when the care bundle was introduced (February 2011, marked by the red line).

Incidence of surgical NEC: EoE

After adjusting for gestational age, there was a significant reduction in NEC comparing 2010 with 2009, however this was prior to implementation of the bundle. There were no other significant time trends.

Figure 4 and the table below show that in 2009, when clinical concerns were raised, surgical NEC annual incidence in the EoE approached 20% among babies less than 26 weeks gestation.

After adjusting for gestational age, there was a significant reduction in NEC.
Outcomes and findings

Conclusions from the NDAU analysis

Over the four year evaluation period a significant improvement in feeding with mother’s own milk at discharge, both exclusively and partially, was observed in the EoE region.

However, exclusive feeding with mother’s own milk at discharge, the most stringent marker of success, increased faster in the EoE when compared to the rest of the UKNC where the care bundle was not implemented.
Part 2: Implementing the NEC care bundle in your own unit
The NHS Change Model was developed with hundreds of NHS staff at all levels who wanted to build energy for change across the NHS by using an approach to improving patient care that everyone agreed on and one based on solid research.

NHS England uses it as a framework for making change happen in the NHS, so everyone working for us is required to have a basic understanding of it. There are eight component parts – they have to be used together in equal measure to make change successful. You can use the framework on any change that matters to you, no matter how big or small.

We have mapped the NEC care bundle against the NHS Change Model to help you understand how each of the eight domains supports our proven practice change. The teams involved have shared their stories and experience through reflections and ‘tips’ to help make implementation more streamlined as you consider implementation in your unit.

Our shared purpose

Having a shared purpose has often been cited as the most important component of the model.

Our shared purpose is fundamental to any change and is the place to start – it holds all the other parts of the NHS Change Model together.

All the people involved in, or affected by, the change need to help us to define what needs to be achieved and how it relates to the things we really care about.

It is important to keep revisiting our shared purpose – to ensure that it continues to connect us with our vision for improving people’s lives.

Our experience

It was the ‘shared concern’ of clinicians about an increase in NEC rates which prompted a regional response to trying to tackle NEC as a collective across the entire network, using the multidisciplinary team.

The purpose of the NEC bundle was primarily to reduce the incidence of NEC and improve outcomes.

This was achieved through the promotion and use of mother’s own milk in conjunction with a standardised enteral feeding guideline when feeding preterm infants. We aimed to maintain this throughout the neonatal stay up to discharge.

Improving outcomes through reduced infection rates, improved developmental outcomes and increased parent satisfaction, through secondary outcomes were seen to be measurable outcomes as a result of the interventions.
Julia’s story
The midwifery team and BFI champions more than played their part. And we’re strong, strong enough to carry on and use this model for future changes.
Julia Green, NEC champion, Harlow

Jackie’s story
There were mixed responses initially to the planned care bundle implementation. It was thought to be a positive contribution to care in order to aim to reduce the incidence of NEC as well as having standardised care across the region and being able to monitor/audit the effectiveness of such regimes.
Jackie Kane, NEC champion, Broomfield

Jennifer’s story
If staff can clearly see that a change results in improved quality of care of the baby, then they will be more committed to it.
Dr Jennifer Birch, Neonatologist, Luton and Dunstable Hospital NNU

Tamboona’s story
It is so nice to sing from the same hymn sheet!
Tamboona, Staff nurse, Lister Hospital

Hints and tips
• Reinforce the shared vision as it is essential to maintain the focus on what you are trying to achieve.
• Don’t become distracted on the smaller aspects of the project, moving away from what you are essentially trying to deliver.
• Regularly reinforce the key message. Use ‘branding’ materials to support the message.
• Publish a monthly newsletter to give updates and feedback on progress. The newsletter can be used to reinforce the key messages and outputs required to deliver ‘our’ vision.
• The use of posters and the strapline ‘Reducing NEC and improving outcomes’ featured in all correspondence regarding the work and reinforced what was being worked towards.
• Including the entire team in the feedback and not focusing on one particular team is important for everyone to feel involved.
• Keep reminding the team that the outcome of improving breast milk supplies is dependent on both teams working together all the way.
Leadership for change

The evidence suggests that the leadership style and philosophy that is most likely to deliver large scale change is one that generates a commitment to a shared purpose through collaboration. You can build commitment to a shared purpose from wherever you sit in the hierarchy – we all have a leadership role in delivering change.

Our experience

Our leadership model consisted on leadership at two levels – those of the project leads and those leading the change locally, our Champions. As project leads we found the process challenging at times: implementation of standardised practice across a network is possible, it can take time, patience and clear steering to achieve this!

There is usually a willingness within individual units to accept, embrace and contribute positively to changes in practice. Where these have been identified by clinicians and local teams, the change process is made considerably easier.

However, to be successful, there has to be recognition that network projects need to be led by individuals with dedicated time. They have to be thoroughly planned, include appropriate representation and be carried out within realistic timeframes. Where appropriate, professional contact groups for key disciplines should be established, to harness the specific approaches they offer a project, adding depth to the work.

Communication and ongoing engagement are crucial aspects of project management with particular attention being given to keeping staff informed of progress and developments without a communication overload.

The Distributed Leadership model, using local champions to disseminate information, directly influenced the success of the project in their own unit by embracing and leading on the proposed change strategies.

Change brought about by local individuals who understood the culture of their teams and worked within that offered a powerful understanding of changes in culture and how to address local barriers in conjunction with broader regionally applied strategies.

Opportunities for career development for such leaders, allowing individuals to receive recognition locally for their successes as well as opportunities for units to benchmark themselves against each other and share good practice were unanticipated wins. Adequate resources, planning for sustainability and open, frequent communication is the key to long term project success.

By creating a deeper meaning for the change, leaders are role models of effective behaviours, skills and attributes and set a high ambition for performance; empowering others to commit to action.

By doing these things they ensure that the scale and pace of improvement is maximised.
Our story

We found that communication was vital and including the feeding specialist in education about the care bundle helped because she was able to disseminate the information to Midwives.

Peterborough neonatal team

Hints and tips

- Change does not have to be led by the most senior staff. Junior staff may be better placed to lead some aspects of the change.
- Sustained, effective change is when everyone affected by the changes is involved and the changes are not led by one individual alone. Consider the roles of everyone in the MDT.
- Leading can be done by staff at all tiers, however, those leading changes must have the authority to act on findings or escalate them appropriately.
- As a leader, always celebrate success with your teams.
- Don’t shy away from poor results or from people who may present barriers. Use these people to help you understand any weaknesses in your change and overcome them. They often become your greatest allies.
- Remember that change takes time.
- As a leader, it is often the commitment and energy of your teams which in turn motivates and energises you to work even harder to ensure your team’s efforts are rewarded and recognised.
- Leading others who work together to bring real and sustainable change is one of the most humbling experiences for any leader.

Jennifer’s story

Any new project requires a significant degree of time commitment... to spread learning relating to the project to the team, to audit progress and success of the changes implemented and to keep pushing to maintain focus on the project and embed it as part of standard practice.

Dr Jennifer Birch, Neonatologist, Luton and Dunstable Hospital NNU

Kathy’s story

The challenge for the individual champion is to discover what works and what doesn’t, and to try to devise a method of presenting the change in such a way that it becomes successfully embedded in practice as a natural part of the routine.

Kathy May, West Suffolk Hospital
Engagement to mobilise

Understanding who is involved in and affected by our change means more than just holding a list of names of people involved in or affected by the change.

We need to understand what motivates them to support the change, so we need to ask questions to help us connect with their values – and find out what values we share. Our engagement efforts must fit with other parts of the NHS Change Model: we must be rigorous in managing the delivery of our change without demotivating people.

Our experience

Although this was a project focused on neonatal outcomes, it was essential that our midwifery teams were engaged early on. We needed their support to ensure that early expressing was facilitated within six hours of delivery. During the development phase of the bundle, midwives and feeding coordinators as well as lactation specialists had joined the group.

Some of the units which enjoyed the most success in establishing early expressing practices did so because they formed a small group of local, midwifery-based champions in each department. Collectively they were able to facilitate more change than a single member of staff, with limited time.

A core component of the care bundle was the enteral feeding guideline. We needed engagement from surgeons and medical colleagues to buy into this component. We undertook face-to-face outreach teaching which was pivotal in engaging clinicians – being able to discuss evidence and other issues which might arise locally and overcome these prior to implementation.

Our story

Information sessions provided by the project leads were extremely useful as they explained the theory behind the care bundle emphasising its importance. They also enabled any issues to be addressed prior to implementation.

Peterborough neonatal team

Hints and tips

• Those involved should understand the rationale for changes.
• Use the right language to convey the rationale and messages – medical teams are often engaged by evidence-based facts for the change or data on outcomes of related changes. Nursing teams are often engaged by changes involving improvements in quality.
• Regular feedback is essential. Even if the results are disappointing, framing these so that there is a focus on a measured improvement, can maintain engagement.
• Encourage others in the team to audit and measure. Involving the wider team leads to an improved understanding of the changes and can promote engagement using a bottom up approach.
• Involve as wide a team as possible – look for junior members of the team who can help to mobilise change in their own areas.
• Be aware of your teams’ energies and what motivates them to succeed. Use this knowledge to support and drive the changes.

Luisa’s story

Initially I did have concerns about how a change in practice would be adopted, on top of ever increasing demands on staff and ever decreasing budgets.

However, the simplicity of the idea, to give more mothers’ milk to more at-risk babies, is easy to believe in.

Luisa Lyons, Norfolk and Norwich

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Luisa Lyons, Norfolk and Norwich
Improvement methodology

An evidence-based improvement methodology ensures that our change will be delivered in a planned way that follows tried and tested methods for assuring success.

The improvement methodology is the game plan – but large scale change across systems will demand different approaches to small scale process improvements.

Different methodologies are available to support different kinds of change. A carefully chosen improvement methodology provides a solid platform for rigorous delivery of the change. It will also support the adoption and systematic spread of change.

Our experience

It is important to have an improvement process to work through, using proven tools and techniques, when carrying out any project, but especially one which involves so many teams and changes. There are many different types of improvement tools available but some of the ones we used in our project included process mapping, project scoping and Plan-Do-Study-Act (PDSA) cycles of change.

Improvement methodology will include aspects of change management which overlap some of the other components of the Change Model (e.g. PDSA also falls under transparent measurement). This is why it is so important to use the entire model as a whole.

A number of methodologies were used in the delivery of the NEC care bundle. Some of these may be useful for you to undertake before you start thinking about implementation in your own unit. This will enable you to plan for the changes you may need to make.

Project Planning: We started out by identifying and inviting a regional working group with representation from each of the units. We needed to make sure we had the right people involved from the start so as to understand what practices were in place across the region in a number of different topic areas.

We scoped: the aims of the project, stakeholders, resources required and where they would be found, meeting times and frequency, timelines. This is essential as part of understanding what you will need and how you will work through the project. It is also valuable to those who are funding the project so they can see that progress is being made and resources adequately planned for and used.

We mapped the current situation: we scoped practices in every unit to understand the ways clinicians were managing NEC, feeding practices, milk kitchen resources and milk preparation practices and levels of dietetic expertise.

This gave us a starting point in understanding the level of variation and what we needed to do to make sure what we eventually implemented was feasible for all units.

Identifying the measures: primary and secondary project aims (measures) were agreed based on the interventions. Our primary aim was to reduce the incidence of NEC although we knew this would be challenging given the very small numbers of cases involved. Nonetheless it was this that drove us to develop and implement the changes.

It was important to measure both clinical outcomes as well as adherence to the changes. We measured adherence on a monthly basis and used PDSA cycles to identify areas for improvement. Results from each unit were published monthly so we could see regionally where our common challenges lay.

Process mapping and mapping the patient journey: helped us understand optimal points to discuss feeding options, encourage early initiation of expressing and when and where to hand out information.

Sustain and share: Sustainability had an 18 month focus through:

- Development of roles relating to the care bundle in maternity and neonatal areas
- Encouraging a wider group of staff to champion the changes
- Incorporating the care bundle into mandatory training for nurses
- Incorporating the care bundle into induction training for junior medical staff
- Redesign and publication of the four elements into a single document.
Improvement methodology

**Hints and tips**

- There are many easily available and free to use project improvement guides. Consider using the NHSIQ quality and service handbook to see which ones best suit your project.
- Feedback, feedback, feedback! For us, feedback on how each unit was doing with compliance against each element and as a whole bundle – and using PDSA feedback and using PDSA cycles – were essential components to facilitating changes. Staff thereby knew what they needed to do to improve and were also able to benchmark themselves against other units.
- Think about changing what it is you feed back over time. You may want to send a message relating to audit results regularly but specific feedback on things that have shared learning for others are a boost to the unit that thought of them and are useful for all units to consider. Often what works well in one unit, will work in another.
- Always be positive and give staff something tangible to work towards.

Jennifer’s story

I organised a **breakfast teaching session** and also taught on a number of **nurse training days** to capture some of the band 5 nursing staff.

Posters were put up in the coffee room and the nutrition pathway, along with examples of the care bundle documentation, were placed in the communication folders and emailed to all the junior doctors, senior nurse team and consultant colleagues.

Consultant and senior nursing colleagues had been kept updated regularly throughout the project at **weekly unit meetings** prior to implementation.

At the time of the launch of the care bundle it was highlighted in our **safety briefings** at **shift handovers**. Our nursing champions with the help of our Practice Development team supported education around the launch of the project with the production of colourful **displays for the staff room**.

*Dr Jennifer Birch, Neonatologist, Luton and Dunstable Hospital NNU*
Rigorous delivery

Project management (or portfolio programming) is fundamental for delivering a change successfully. It involves identifying planned benefits that are of strategic importance, monitoring progress towards planned objectives, clarifying roles and responsibilities and controlling finances and quality.

Having shared and clear accountabilities will enhance the scale and pace of change.

A rigorous approach requires discipline and focus and is not optional – without rigorous delivery other elements of the change model will fail. Rigorous delivery should reinforce activities undertaken with other parts of the NHS Change Model.

Our experience

We planned for two way communication to ensure clinical engagement and that everyone understood what we wanted them to do. We gave everyone the opportunity to question the proposed changes so that they made sense regardless of their role within the team. We did this through face-to-face teaching in every unit, carried out by the project leads and thereafter supported by local champions.

We enabled audit through designing charts and care plans to serve as a prompt for practice, a means of documentation and an information/training tool as well.

We needed to manage the identified risk of the potential limitation of local resources for sterile milk preparation using a stainless steel surface. We had to think creatively about how to mitigate against this restriction; the ideal being that every unit prepared the feeds in a separate milk kitchen with restricted access and as sterile an environment as possible. The reality was that not all units had a milk kitchen. The standard became that all feeds, regardless of resources, were made up on a stainless steel surface – for some that became a trolley which was specifically allocated for just that use.

We needed to think carefully about and plan for stakeholder management, particularly senior leadership, and really needed our Heads of Midwifery to be involved so that they could support the changes around early expressing.

We wrote to all Heads of Midwifery, as well as Medical Directors and Chief Executives informing them about the project, outlining project aims and improvements and asking for their support.

Further stakeholder management aspects included producing brightly coloured and specially branded, generic information folders for easy dissemination of information. A minimum of three were produced for each unit and were placed in antenatal, postnatal and neonatal areas as a resource throughout the life of the project. This was an effective and inexpensive way of having all the information in one folder and easily accessible to all staff. Make sure you keep one in all areas (antenatal, delivery unit, postnatal, recovery and neonatal). The more staff see them, the more inclined they will be to pick them up and have a read.

In addition newsletters were sent out monthly following implementation and carried updates and information on the project. Feeding back results through the newsletters on such a regular basis gave the necessary momentum to the project which was needed in the early stages to ensure the changes took place. Once the changes were embedded we moved to a bimonthly publication and then a quarterly publication.

A formal launch of the project was held in the first two weeks of implementation and benefited from key note speakers and a review of the journey made up to that point.

Involvement from industry allowed this to be a free event and gave exhibitors the opportunity to outline loan equipment schemes, such as breast pumps and milk collecting bottles etc which helped to support the changes.

Hints and tips

- Plan carefully for all stages of the project and mitigate against risks.
- Ensure you have adequate resources in place.
- Ensure everyone involved is clear as to their role in the change – those leading as well as those implementing.
- Communicate all the way.

Julia’s story

A Monday ward round was the start and to facilitate a smooth beginning all the information had been copied, laminated and stuck to the ‘notes trolley’ – all information was to hand!

As well as information being available on the ward round, standardised feeding regimes and category of risk criteria were put up on the walls of the clinic rooms attached to each nursery for ease of reference.

ANTT guides were put up in the milk kitchen so that everyone was clear of the expectations.

Julia Cooper, Ipswich Hospital
Transparent measurement

In healthcare, we tend to measure for three reasons: to identify whether planned improvements are taking place, to judge people’s performance on the job, or to inform research evidence. Identifying and collecting the most appropriate data is often a bigger task than we anticipate it to be. It requires having a clearly defined shared purpose and this can take time to achieve.

Making data available to the public (e.g., comparative data) creates a lever for improvement, by increasing patient power and choice. Using appropriate measurement techniques ensures that success can be celebrated, remedial action can be taken to mitigate risk and the unforeseen consequences can be dealt with promptly. At the start of any change it is important to plan for expected benefits and return on investment.

Our experience

We undertook monthly auditing of compliance against the four elements to ensure the changes were taking place.

Each element was comprised of a number of interventions, all had to have been completed to achieve compliance in that element. Full compliance with the care bundle meant that all interventions in all four elements had to have been fully achieved. A tall order!

To encourage engagement and maintain motivation, compliance results were presented separately so it was easily seen where the areas for action lay but the overall scores were included and named separately as ‘All or None’.

Our teams were truly transparent in the way they wanted their audit results presented: openly and to be named so that units could benchmark themselves against each other. This was and still is seen as a positive motivator.

Success was celebrated through the awarding of gold, silver and bronze medals. Once gold medals had been achieved for two consecutive months, units moved to quarterly auditing as it was considered that the changes had been embedded.

Hints and tips

• If you don’t measure you won’t know whether you are improving.
• Ensure your measures are realistic.
• Ensure your findings are honest and transparent – even if they aren’t what you hoped they would be.
• Remember that measurement can be used to stimulate a competitive culture of improvement.
• Present your measures in different forums to gain widespread recognition of improvements.
• Have a regular place to show progress – ‘how we are doing board’.

Luisa’s story

Robust audit is the way forward as well as celebrating results with the staff for any small improvements. We now celebrate that staff routinely get mothers expressing 4–6 hours after birth, something which was just not done very often only two years ago.

Luisa Lyons, Infant feeding lead, Norfolk and Norwich

Julia’s story

What really worked were the regular updates with audit results identified in medal status and communicated throughout the team ensuring challenges were met as they were identified – with praises given to boost moral – if a team does well tell them – and feed them cake!

Julia Cooper, Ipswich Hospital

Amanda’s story

The implementation was slow but sure and each month we can see improvements.

Amanda Blake, NEC champion, Bedford Hospital

Julia’s story

High point: Initial success. Low point: Complacency led to dip in audit results.

Julia Green, Harlow

Luisa’s story

Robust audit is the way forward as well as celebrating results with the staff for any small improvements. We now celebrate that staff routinely get mothers expressing 4–6 hours after birth, something which was just not done very often only two years ago.

Luisa Lyons, Infant feeding lead, Norfolk and Norwich
System drivers

Conditions need to be in our favour if the change we want to see is going to work and be sustained. Sometimes they aren’t: for instance our payment systems incentivise activity in acute hospitals whilst our policy drivers push for care closer to home.

System drivers create the broad conditions for change – we need to consider what they are in relation to our change initiative – and whether they can be lined up to support what we are trying to do.

System drivers might take the form of incentives for change, or specific standards to be achieved if penalties are to be avoided.

In designing system drivers, we need to ensure that they are to be able to evolve and respond and change appropriately.

Our experience

Our main system driver was clinicians’ own concern about the incidence of NEC in their own units. They were therefore behind the project from the start. Other drivers which might help drive these changes in your unit could be:

- the national CQUIN to improve breastfeeding rates at discharge
- clinical knowledge that breastmilk is advantageous for many systems.

Units trying to gain accreditation for other national initiatives:

- UNICEF Baby Friendly Initiative (BFI)
- Bliss – Baby Charter
- Best Beginnings and the Small Wonders programme.

By implementing one of these initiatives you are automatically meeting the criteria of other aspects of these projects so you could be ticking several boxes by undertaking one task and receiving accreditation, recognition and improved quality of care by doing so.

Luisa’s story

Because we are going for UNICEF BFI at the same time and so much of the NEC care bundle echoes what we are trying to achieve with BFI, we’ve found both projects have complimented each other.

Luisa Lyons, Infant Feeding Lead, Norfolk and Norwich

Hints and tips

- Consider whether the changes are linked to any of your unit or Trust values, help to meet a CQUIN target or are linked to another work stream. Having outside influences to help drive your change can be powerful.
- If you are working towards accreditation for BFI or a Bliss or Best Beginnings work programme, “highlight” these to the team as multiple wins for the unit by undertaking one action for several outcomes.
- Use these outside drivers and collaborate to add strength to the change.

Lindsey’s story

The NEC pathway has supported the unit in its assessment for BFI level 3.

Lindsey Harding Payne, champion, Colchester Hospital

Jessie’s story

We aim to continue this work for the foreseeable future seeing as it has an enormous impact on our very own Trust’s vision as well as our own local goal in putting patients first and constantly striving for improvement in our services.

Our breastfeeding rate although improving remains one of our main challenges and we take this very seriously. Consequently we hired a new nursery nurse to support mothers with breastfeeding and are advertising a post for a band 7 breastfeeding coordinator whose job mostly would be to support parents on breastfeeding.

Jessie Mertalla, champion, Lister Hospital
Spread of innovation

The NHS has a unique opportunity to spread and adopt good practice between and within its teams and organisations. We need to accelerate the spread of innovative solutions to deliver the cost savings required while improving the quality of care. This means all of us sharing, learning about and adopting successful innovations from within and outside the NHS. Evidence shows that there are certain factors that help or hinder the spread and adoption of innovation in healthcare.

There is a wealth of knowledge, tools and approaches that will help us rigorously deliver the spread of innovation and measure our success. Successful spread and adoption links directly with all other NHS Change Model components.

Our experience

The NEC project has had calls for dissemination since early findings were presented at national forums. Documents and information on the work have been shared on request via email and this document has been prepared for exactly that purpose. Mapping the care bundle against the Change Model is aimed at allowing independent implementation as far as possible using an evidence-based model.

We are sharing our innovation through poster presentations and oral presentations at many national and international conferences. We have also published the work in medical and nursing journals and successfully submitted our outcomes in a major medical journal.

A national launch event was held where those who had expressed interest in adopting the work were invited. This not only showcased the work, but provided a forum for others to learn from us. The use of social media plays an important part here too: the use of Twitter and online forums.

Opportunities have been seized to disseminate the work by prompt responses to requests for information, telephone calls to explain some of the more complex aspects and working with industry as partners to spread ethically.

Submitting innovations for awards can bring other broader opportunities for national recognition and dissemination. These take time to complete but the recognition and kudos which comes from this recognition can serve as a significant motivator to teams.

Hints and tips

• When planning your improvement or change, consider the implications for dissemination and plan for this from the start.
• Network where possible to get others to recognise your improvement.
• Submit your change and measures for an Innovation award. This can help to gain regional, national or even international recognition which will support dissemination.
• Make use of social media to keep others updated on progress and outcomes.
• Consider working alongside industry to help promote your work but make sure your partnerships are ethical and mutually supportive.

Kathy’s story

Communication by poster display on staff room notice boards and in a communication diary has helped to maintain the profile of the project in the neonatal unit and in midwifery areas. Regular printed newsletters from the Project Leads have been displayed in staff areas, which also help not only to maintain the profile and encourage compliance, but also disseminate information and share good ideas and good practice.

Kathy May, champion, West Suffolk Hospital

Jackie’s story

Over the first year our figures improved greatly meaning we could then undertake quarterly audits, and the last two quarters we achieved 100%.

Almost two years on since implementation the NEC care bundle seems to be well understood in our unit and integrated in the day-to-day care of all neonates. All breast feeding/expressing mothers receive a breast feeding pack and are regularly reviewed re milk supply and/or any concerns. We have links with breast feeding link midwives as well as having our own unit link nurses for breast feeding support.

Jackie Kane, champion, Broomfield
Energy for change

Change requires energy, both from those leading and those delivering change. Change needs to take consideration of and involve the five energies:

- Psychological energy
- Physical energy
- Social energy
- Spiritual energy
- Intellectual energy

Some of the tools on the ‘Building energy for change’ website may be helpful in helping you plan for dealing with your teams’ energy and your own before you start planning your project.

<table>
<thead>
<tr>
<th>Energy</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Psychological</td>
<td>Energy of courage, trust and feeling safe to do things differently. It involves feeling supported to make a change as well as belief in self and the team, organisation or system, and trust in leadership and direction.</td>
</tr>
<tr>
<td>Physical</td>
<td>Energy of action, getting things done and making progress. It is the flexible, responsive drive to make things happen, with vitality and kinetic force (motion).</td>
</tr>
<tr>
<td>Social</td>
<td>Energy of personal engagement, relationships and connections between people. It reflects a ‘sense of us’ and is therefore a collective concept that captures a situation where people are drawn into an improvement or change because they feel a connection to it as part of the collective group.</td>
</tr>
<tr>
<td>Spiritual</td>
<td>Energy of commitment to a common vision for the future, driven by shared values and a higher purpose. It involves giving people the confidence to move towards a different future that is more compelling than the status quo, by finding the deep meaning in what they do.</td>
</tr>
<tr>
<td>Intellectual</td>
<td>Energy of curiosity, analysis, thinking and cognition. It involves gaining insight, a thirst for new knowledge as well as planning and supporting processes, evaluation, and arguing a case on the basis of logic and evidence.</td>
</tr>
</tbody>
</table>

http://www.institute.nhs.uk/tools/energy_for_change/energy_for_change_.html
Energy for change (continued)

Jessie’s story
When the bundle was finally implemented in 2011 there were ambivalent reactions towards its effectiveness and sustainability. We would hear comments such as ‘seriously I do not think it will work’, or ‘oh not again, yet another piece of paper work’ or ‘Oh please, another bundle to contend with?’ Nonetheless we rallied on and once trained, staff appreciated its purpose and goals and even the sceptics were converted! It was like a ‘eureka moment’! Gradually, the NEC care bundle seemed to have found its way into the hearts and minds of the whole unit and we can proudly say that it is now fully embedded in our unit and became part of our continual documentation. Just like that!

Jessie Mertalla, champion, Lister Hospital, Stevenage

Mr Minocha’s story
I could clearly see that there is a need to adopt a regional policy on management of babies who are at a high risk of developing NEC. I could also see that most units are doing things differently; probably all of them have some rationale. But due to smaller numbers in each unit and lack of uniformity, we were unable to understand where things were working well, and where they could be improved.
The bigger challenge was to understand the care pathways of different units and then to follow through when the baby gets moved between the unit.

Mr Minocha, Paediatric Surgeon, Norfolk and Norwich

Kathy’s story
Pre-implementation presentations in our own unit by the Project Leaders ensured that all medical, nursing and dietetic staff were aware of the care bundle and of the responsibility of being part of a very large Regional project.
It was apparent that the success of the project across the region would depend on individual staff in each unit complying with the care bundle.

Kathy May, champion, West Suffolk

Julia’s story
First reactions to the NEC Care bundle were of excitement to be involved in the initiation of the project. On learning the aims and size of the project the task rapidly became daunting.

Julia Cooper, champion, Ipswich Hospital
Part 3: Tools to support implementation of the NEC care bundle
Implementation tools

Part 3 has been created to share some of the tools which we found helpful when we implemented the care bundle in the East of England.

Julia’s story

The positives of the care bundle clinically commented on by staff include the higher rate of early feeding and the ease of the standardisation of the feeding regime along with the clarity of the increased rate of feeding.

The care pathway has proved to be a useful tool in teaching both new staff and parents in the importance of the rate increase and the reasons behind that.

Benefits also include a higher rate of breastfeeding at discharge empowering mothers to choose how to feed their baby.

Julia Cooper, NEC champion, Ipswich Hospital
Supporting early expressing

- Top Tips for expressing and breastfeeding
- Checklist of actions (page 4 of Nutrition Pathway)
- Breastfeeding leaflet
- Breast massage and hand expressing poster
- Expressing log
- Best Beginnings Small Wonders DVD
- Bliss booklet – Breastfeeding your premature baby
- Bliss leaflet – Comfort holding and Kangaroo Care
- Information on pump hire
- Kangaroo Care stickers (Bliss and Best Beginnings website)

Our story

We still occasionally have some difficulty in achieving early expressing, but the midwives are more aware of the NEC care bundle than when we first implemented it and are usually happy to help mums hand express as soon as possible after delivery. In practice it can be seen that when the midwives have assisted the mums with first hand expressing yielding colostrum – the mums are often more inclined to persist with their expressing.

Sister, Broomfield NNU

Julie’s story

We had a 26 week baby whose mum had no intention of breastfeeding. Once expressing and its reasoning was explained to her she began expressing within four hours and now has enough milk stored for a long long time! And on discussion with her yesterday is now considering breast feeding in the future! ... I have to say I am totally convinced the ‘early’ expressing definitely equals a good supply, and lots of my work colleagues agree from what we have seen.

Julie Mulhern, NEC champion, Peterborough
Supporting long term expressing

• Top Tips for expressing and breastfeeding
• Expressing log
• Best Beginnings Small Wonders DVD
• Bliss booklet – Breastfeeding your premature baby
• Bliss leaflet – Comfort holding and Kangaroo Care
• Information on pump hire

My story
I found it very helpful on the night he was born that the midwife did the hand expressing for me to get the colostrum. This was frozen and in the couple of days after he was born and I was having problems getting anything from my breasts, I always knew there was something in storage.
Mum, Broomfield NNU

Beverley’s story
It wasn’t until I was asked to go through the nursing care plan in the NEC care bundle with a new Mother that I realised a problem that had always been there was just about to be addressed. I was well aware of the benefits of breast milk for the premature or sick baby but although mothers were encouraged to express it was often seen as a delicate subject to discuss with traumatised new mothers and failure became the normal outcome.

The NEC care bundle encourages collaborative working across the multidisciplinary team and helps to link the clinical ‘need’ for breast milk with the role and responsibilities of the NICU nurse to support mothers to succeed. Providing breast milk helps mothers regain some control and fulfil a role that no one else can.
Beverley Doel, Return to Nursing Student, Cambridge

1. Checklist of actions (page 4 of Nutrition Pathway)
2. Expressing log
3. Bliss leaflet – Comfort holding and Kangaroo Care
4. Best Beginnings Small Wonders DVD
5. Bliss booklet – Breastfeeding your premature baby
Support for using the enteral feeding guideline

- Algorithm 1 and 2
- Enteral feeding guideline
- Nutrition Pathway

Dr Chiyende’s story
This new care pathway is really helpful, we don’t have to go over so many different sheets of papers.

Dr Chiyende, neonatal consultant, Lister Hospital

Jackie’s story
Prior to this implementation it was the doctors who directed the initiation and advancement of feeds for each individual baby rather than a standard protocol, therefore having set guidelines to follow seemed a positive input into care.

Jackie Kane, NEC champion, Broomfield Hospital

Amanda’s story
When we initially started talking within the unit about introducing a standardised feeding regime – there was an outcry from most of the staff. Concerns were raised about changing such an embedded practice as the way we introduced feeds. When the care bundle was launched it took a while for nurses to have the confidence that this fitted in with our own feeding regime – but it had a more structured approach so babies were being managed consistently.

Amanda Blake, NEC champion, Bedford Hospital

Nutrition Care Pathway
Algorithm 1: Initiating and advancing enteral feeds

- Commence feeding as close to birth as possible following individual clinical assessment
- Maintain trophic feeds in high risk infants as long as clinically indicated
- Infants can move between risk categories following individual clinical assessment

**Algorithm 1 is to be used in conjunction with Algorithm 2**

Caution should be taken initiating feeds in the following subgroups. The decision to manage as “high risk” is at the clinician’s discretion.

- Severe SGA infants (<10th percentile and >24 weeks gestation)
- Indomethacin or ibuprofen for PDA
- Complex congenital cardiac disease
- Decreased urine output
- Polyhydramnios infants

<table>
<thead>
<tr>
<th>High Risk</th>
<th>Moderate Risk</th>
<th>Standard Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;28 weeks gestation at birth</td>
<td>&lt;1000g at birth</td>
<td>&gt;28 weeks gestation</td>
</tr>
<tr>
<td>Unstable/hypotensive ventilated neonates</td>
<td>Preterm hypoxic-ischaemia with significant organ dysfunction</td>
<td>Normal infants</td>
</tr>
<tr>
<td>Preterm SGA infant (&lt;23rd centile) or &lt;36/40 gestation at birth</td>
<td>Preterm SGA infant (&lt;23rd centile) or &lt;36/40 gestation at birth</td>
<td>Preterm SGA infant (&gt;23rd centile) or &gt;36/40 gestation at birth</td>
</tr>
<tr>
<td>Abnormal reversed end-diastolic flow in infants born &lt;34/40</td>
<td>Abnormal reversed end-diastolic flow in infants born &lt;34/40</td>
<td>Normal infants</td>
</tr>
<tr>
<td>Re-establishment of feeds following NEC</td>
<td>Re-establishment of feeds following NEC</td>
<td>Normal infants</td>
</tr>
<tr>
<td>Serious congenital gut malformations (e.g. gastroschisis)</td>
<td>Serious congenital gut malformations (e.g. gastroschisis)</td>
<td>Normal infants</td>
</tr>
</tbody>
</table>

Page 1 of 4
Supporting asepsis when preparing milk feeds

- ANTT prompt
- Pictorial guide to ANTT
- ANTT audit tool

Ruth’s story
I thought we were going back in time, as this was how we used to work in the milk kitchen. I love it!
Ruth, nursery nurse, Lister

Lindsey’s story
The ANTT was quickly implemented into the milk kitchen and new practices adapted to.
Lindsey Harding Payne, NEC champion, Colchester

Kathy’s story
The ANTT for milk feeds element of the care bundle was the least challenging aspect to introduce and easily assimilated into practice.
Feeding charts were adapted to accommodate the extra boxes to be ticked to show compliance with ANTT, which was more convenient for the nurses than having a separate sheet to sign.
Kathy May, NEC champion, West Suffolk Hospital

Amanda’s story
Questions were raised as to why we had to make feeds up by ANTT and how this would be very time consuming. The ANTT once implemented and embedded into practice took no longer than the practice that was previously undertaken.
One of our Senior Nurses developed a pictorial advice sheet for the ANTT, which when discussed with the network was used across the whole network.
Amanda Blake, NEC champion, Bedford Hospital

East of England Perinatal Networks

Reducing the risks of infection associated with milk feed preparation

- The prompt must be used every time a milk feed is to be prepared.
- Once the milk feed has been prepared, please complete the compliance chart and audit form kept in the milk kitchen.
- EBM / DBM must be used within 24 hours from the start of the defrosting process.
- Fresh EBM can be used for 48 hours from being expressed.
- EBM / DBM must not be used after being out of the fridge longer than 4 hours.

Action required

<table>
<thead>
<tr>
<th>Action</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hand hygiene</td>
<td>Hands have been washed following correct hand hygiene technique.</td>
</tr>
<tr>
<td>Food preparation</td>
<td>Food and any additives have been prepared using aseptic non-touch technique.</td>
</tr>
<tr>
<td>Gloves</td>
<td>Non sterile gloves have been worn throughout the preparation of the feed.</td>
</tr>
<tr>
<td>Milk storage</td>
<td>A maximum of four hours worth of feed was prepared in each container. Up to 24 hours of feeds were prepared and stored in the refrigerator.</td>
</tr>
<tr>
<td>Patient’s milk</td>
<td>Each patient’s milk is stored in a separate container, marked with their details and the time of milk preparation.</td>
</tr>
<tr>
<td>Gloves / aprons / equipment</td>
<td>Gloves, aprons and equipment used for feed preparation have been discarded after use according to local policy.</td>
</tr>
<tr>
<td>Feed preparation</td>
<td>Following milk preparation hands have been washed following correct hand hygiene technique.</td>
</tr>
<tr>
<td>Compliance chart</td>
<td>Compliance chart and audit form have been completed.</td>
</tr>
</tbody>
</table>

A CARE BUNDLE TO REDUCE THE INCIDENCE OF NEC IN THE EAST OF ENGLAND

Element 4: Reducing the risks of infection associated with milk feed preparation.
A note on the expressing logs

Some of our staff felt that the expressing logs were an additional pressure for mothers. We expected staff to offer them to mothers but mothers were able to decline the use of the logs and use alternative methods, as they wished.

Regardless of whether mothers used the log or not, support for ensuring milk supplies were being established in mothers who aimed to express or breastfeed in the longer term were expected to be carried out.

The feedback below is what staff and mothers told us about the logs.

### Kathy's story
The expressing logs have been surprisingly popular – indeed when offering them, we find many mothers were already intending to keep a record of expressing in a notebook.

*Kathy May, West Suffolk Hospital*

### My story
In practice regarding the expressing logs, we have found some mums do use them but a lot admit they don’t, or use another method to record their expressions, such as mobile phones.

*Sister, Broomfield NNU*

### My story
I used the log as her feeding guide so I could keep track of when she had fed.

*Mum, Broomfield NNU*

### My story
I definitely found the expressing log beneficial. It helped me to keep track of my milk production – especially in the first few days after birth when colostrum supply/flow was very low. I always knew that I wanted to breastfeed my baby but being premature and via emergency section were hurdles I had to overcome – recovering myself and trying my best to provide what nature intended when my baby is not with me was the most physically demanding, so the log was a good way to see the improvements day-by-day of helping my baby as much as I could – it was for me a motivator to continue pushing myself because I could see personal achievements on an hourly and daily basis.

*Mum, Broomfield NNU*

### My story
I have never produced much milk but posters on the wall said ‘every drop counts’ – I read this every day and it kept me persevering.

*Mum, NNU, Broomfield*

### Julia’s story
The pack contained details on how to express, benefits of breast milk, the expressing log and two muslin squares to interchange from mum to baby (to encourage lactation and smell association to baby of mum).

Alongside the information, a pack of 2.5 and 5ml syringes with labels and end caps were given to each mum.

The reason behind the small syringe pack was to give the message to the mothers that only a small amount of colostrum was expected, this raised the mothers’ confidence and gave them a sense of worth in an otherwise often disheartening situation. By all the information being given by the neonatal team it helped to keep it consistent. All mothers were given the two packs – no matter what gestation their baby was, ensuring all babies got the same best practice start.

*Julia Cooper, NEC champion, Ipswich hospital*

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### Feedback on the information packs

#### My story
I have never produced much milk but posters on the wall said ‘every drop counts’ – I read this every day and it kept me persevering.

*Mum, NNU, Broomfield*
Issues you may encounter…

**Documentation issues**

**Julia’s story**

Initially the care plans were kept in a filing cabinet and it was reliant on the staff to fetch and fill in yet another piece of documentation.

As the first audits showed not all babies were getting a care plan a change was made that all new notes made up by the ward clerks would have the care plan included.

This had limited success as now all the babies had care plans – just not completed care plans! Another change in practice so that the care plans were kept with the daily documentation in the cot side notes meant they were more visible and the documentation improved.

Documentation improved again when the new style Pathway was introduced as all of the information is together in one place for each baby.

Documentation and communication go hand-in-hand and the biggest challenge has been communication between the neonatal and midwifery teams.

All of the documentation was kept with the baby and the project appeared to be perceived as a neonatal venture not midwifery project.

Explaining that the six hour expressing window is to help a mother achieve successful breastfeeding has been the way forward through regular audit updates and more recently a midwifery devised sticker put into the maternal notes.

The sticker records the time expressing has commenced.

This works two ways, it acts as a prompt to initiate expressing within the time frame, and records the information for future reference enabling all staff to help the mother to continue.

Having a dedicated Midwifery lead would be recommended to drive the care bundle from the midwifery side.

*Julia Cooper, NEC champion, Ipswich Hospital*

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**Helen’s story**

Recently we have had to bring the issue of documentation to the fore as it was starting to drop by the wayside a little. I did this by posting another small presentation in the staff room and mentioning it at the daily briefings.

*Helen Collins, Luton and Dunstable*
Issues you may encounter…

**Enteral feeding guideline issues**

**Note from the project leads:**
Remember that the algorithms and guidelines only apply to those babies who are 35 weeks and under.

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**Julia’s story**
Lessons learned and shared: Engage a bigger Core Team at the outset to put nutrition at the forefront of thinking on admission and push home on the ward round every day.

*Julia Green, Harlow*

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**Kathy’s story**
The most controversial aspect of introducing the guideline has been the change to earlier introduction of enteral feeds in situations where in the past we would have delayed introducing enteral feeds.

In particular, many nursing staff are uncomfortable about introducing formula milk while waiting for expressed breast milk to become available, though they understand the need for early priming of the gut.

*Kathy May, NEC champion, West Suffolk Hospital*

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**Jennifer’s story**
I realised we needed to think of another way to bring focus back to the project. One solution was to add the NEC care bundle to our weekly ‘short audits’, performed on the ward round. I also reinstigated my opportunistic ‘spot-checks’ of the paperwork to ensure it had been completed.

Helen worked with nursing colleagues to maintain awareness of the care bundle and to encourage everyone to remember to complete the documentation.

These initiatives were successful in improving compliance with all elements of the care bundle apart from the initiation of expressing within 6 hours of birth.

*Dr Jennifer Birch, Neonatologist, Luton and Dunstable Hospital NNU*

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**My story**
The algorithms laminated and hanging on the ward round trolley or on each baby’s cot makes them visible and easily accessible as a decision making tool.

*Neonatal Sister, Broomfield*
Issues you may encounter…

Supporting mothers to start expressing within six hours of delivery

Helen’s story
We were already encouraging expressing but were prompted by the pathway to encourage earlier expressing, within six hours, to comply with the pathway. This has been our biggest stumbling block to achieve. We have had meetings with the midwives and maternity care assistants to try to address the issue, but the audits are showing that we are not succeeding.

Unfortunately our workload prevents us from visiting the labour ward or the postnatal wards to assist these mothers, so we depend on our midwife colleagues for this. Some of our senior staff have monthly meetings with the midwives to update them on NICU issues, including the Nutrition Care Pathway.
We hope that the student midwives that come to our unit will take the message with them too!
Helen Collins, NEC champion, Luton and Dunstable

Our experience
There remains an ongoing battle with some of our colleagues to encourage first expression within the first six hours after delivery and the support for frequent expressing whilst in the postnatal ward.

Reasons why this was the case would be:
• Mother had caesarean section and is too ill to express
• Mother is tired and needs some rest
• We are so busy and we don’t have the time
• Mother does not want to express
• Mother is asleep at the moment.

and tips to overcome them

Note from the project leads:
As a result of feedback on the challenges of supporting mothers to begin expressing within six hours due to a shortage of staff, the working group have designed a pictorial guide to breast massage and hand expressing to help mothers.
This is available free of charge through Bliss.
Issues you may encounter and tips to overcome them

Our story
We negotiated with the midwifery team regarding the optimum time for expressing EBM after delivery. We strive to develop more teamwork with them through communication and education.

Watford NNU Team

My story
New mums to the unit could have ‘breast feeding buddies…’ To share their neonatal experiences and support each other.

Mum, Broomfield

My story
I really liked my baby’s picture on the expressing log, it motivated me a lot.

Mum, Broomfield

Changes in practice have led to these positive comments and suggestions

My story
I found the information in the breast feeding pack very helpful and got further with reading and looking at pictures than someone explaining as I am a visual learner.

The Start 4Life booklet hand expressing page is useful but could also have pictures of this on the expressing room wall.

I am very happy with the information I have been given by the information pack and nurses… good to have information for future reference.

Mum, Broomfield
Share some of our ‘Project Positive’ stories

Jessie’s story
Encouraging breastfeeding and particularly early expression is a paramount consideration during the admission process. Medical and midwifery teams are also increasingly proactive with regard to the implementation of the NEC care bundle. Mothers who hadn’t considered breastfeeding antenatally are now expressing and going home successfully breastfeeding their babies. Because of the NEC care bundle, we can proudly say that our milk kitchen is one of the best managed milk kitchens in the region if not the whole country. Our whole operational system in the milk kitchen was transformed. We ensure that there is a spare member of staff allocated to the milk kitchen solely for making up feeds for all the babies in the unit and for ensuring that the milk kitchen is running smoothly. Having somebody to work in the milk kitchen everyday also denotes that our nursing staff can spend more time caring for their patients and their families instead of leaving their patients by going in and out of the nursery to make up feeds in the milk kitchen.

Jessie Mertalla, Lister Hospital, Stevenage

Wilf’s story
Regardless of whether or not the bundle has lead to any differences in outcome I feel
1. It was and is a huge achievement to have an agreed feeding protocol across the whole network which all clinicians signed up to.
2. I am pleased that trainees have been involved in the work undertaken to introduce this care bundle.
3. This consistency helps parents when babies are transferred between units.
This consistency is helpful to all staff especially trainees who will see an agreed approach as they rotate through hospitals. Well done you can be very proud!

Dr Wilf Kelsall, Neonatologist, Rosie Hospital, Cambridge

Helen’s story
On a positive note, we now have nearly all of our mums expressing, even if they did not intend to breastfeed, which is excellent! On the downside (sort of!) our freezers are so full of expressed milk that we have trouble fitting it all in and parents are reporting that they’re buying freezers to accommodate their supply at home!

Helen Collins, Luton and Dunstable
Share some of our ‘Project Positive’ stories

Our story
standardisation of feeding guidelines helped us to move away from the use of hydrolysed formulas for feed initiation in preterm babies.
Preparation of feeds has changed: we now have a designated area in each nursery. Being able to make up enough specialist formula for 24 hours and storing it in the fridge is advantageous. We also monitor the fridge and freezer temperatures more carefully.
Watford neonatal team

Our experience
Things seem to be making a positive effect. There is now a uniformity of care in the region. We do not struggle to look through a dozen different care pathways and feeding regimes… all doctors and nursing staff in different units are speaking the same language (…and understanding each other!) and to me it feels than we are starting to see a reduction in the incidence and severity of NEC.
Only time will tell whether this will make a statistical difference to the overall incidence, morbidity and mortality but this would help us to look at where we are failing, with the hope that we could do some fine tuning in our care pathway in future to make a significant impact in defeating this monster called ‘NEC’.
With hope for a brighter and happier future for our ‘tiny tots’.

My story
I think the NEC care bundle has improved our breast feeding policy, especially with regards to the importance of expressing and giving breast milk to smaller at-risk babies.
Sister, Broomfield

Our story
We have found the NEC care bundle to be a positive influence on the care of our babies; kangaroo (skin-to-skin) care has increased as staff are more aware of its importance and using a standard feeding regime ensures consistency of care.
Sister, Broomfield
Conclusion
Celebrating all the good stuff

- Enteral Feeding Guideline selected for oral presentation at ‘Trouble up North’ conference in Wakefield – September 2011
- NEC care bundle presented at Imperial College London Preterm Lactation and Breastfeeding Conference – September 2011
- Enteral Feeding Guideline selected for poster presentation at the Paris 2012 Quality and Safety in Healthcare Conference
- Central Medical Supplies fund the publication of one year of Nutrition Pathways
- NEC care bundle presented at first Special Interest Group in NEC (SIGNEC) meeting – first large scale call for national dissemination June 2012
- Bliss offers support for national dissemination
- NEC project published in Infant, January 2013
- NEC care bundle presented at BUSS Family centred care study day in London – February 2013
- NEC care bundle presented at joint NNAP/NDAU collaborators’ meeting in London – February 2013
- NEC care bundle presented at ‘Achieving Improved Outcomes in Neonatology’ Conference in Cardiff – February 2013
- NEC care bundle presented to Paediatric Nutrition Group at the RCPCH – April 2013
- NEC care bundle presented at ‘Developing a nurturing environment in neonatal care’ study day in Bath – May 2013
- NEC care bundle presented at St. George’s ‘Neonatal Surgery: where is the Cutting Edge’ international conference – June 2013
- NEC care bundle presented at Medela company headquarters to all staff – June 2013
- NEC care bundle presented at N3 meeting in London
- NEC care bundle presented at SIGNEC 1st International Conference in London – 2013
- NEC care bundle presented at Introduction to Preterm Nutrition in London – September 2013
- NEC care bundle presented at UNICEF conference in Glasgow – October 2013
- NEC care bundle presented at Thames Regional Perinatal Group (TRPG) meeting – November 2013
- NEC care bundle presented at workshop on neonatal nutrition meeting in Edinburgh 2013
- NEC care bundle presented at Birmingham Women’s Unit – December 2013
- Northern Ireland Neonatal Network become the first network to consider adopting the care bundle outside of the East of England – January 2014
- NEC care bundle presented at SBK conference in Manchester – February 2014
- NEC care bundle presented as the Guest Lecture at the British Association of Perinatal Medicine (BAPM) conference in April 2014
- NEC care bundle presented at the Medela satellite symposium at the Perinatal Conference in Harrogate – June 2014
- NEC care bundle presented at the West Midlands Feeding and Nutrition study day – February 2015
Acknowledgements

The NEC care bundle Working Group

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Asnat Doza, Cheryl France and all the mothers who advised the project as it developed and was embedded.

Joanne Ferguson for her unwavering attempts to support wider dissemination and bring the NEC agenda to the forefront of research.

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Our partners from the industry sector who provided training, funding and opportunities for additional improvements along the way.

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Identified leads for implementation for my unit

<table>
<thead>
<tr>
<th>Role</th>
<th>Name</th>
<th>Phone</th>
<th>Bleep</th>
<th>Email</th>
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<tbody>
<tr>
<td>Project lead</td>
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<tr>
<td>Neonatal medical lead</td>
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<td>Neonatal nursing lead</td>
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<td>Dietitian</td>
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<td>Additional neonatal champions</td>
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<td>Neonatal surgical lead (as appropriate)</td>
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<tr>
<td>Midwifery lead</td>
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<td>Breastfeeding lead / lactation specialist: neonatal</td>
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| Maternity                             | Additional midwifery champions Maternity Support Workers |      |       |       |
|                                       | Name | Phone | Bleep | Email |
|                                       |      |       |       |       |
|                                       |      |       |       |       |

| Speech and language therapist         |      |       |       |       |
|                                       | Name | Phone | Bleep | Email |
|                                       |      |       |       |       |
|                                       |      |       |       |       |

| Audit lead                            |      |       |       |       |
|                                       | Name | Phone | Bleep | Email |
|                                       |      |       |       |       |
|                                       |      |       |       |       |

| Mechanism for feedback of results (newsletter / notice board / email) |      |       |       |       |
|                                                                      | Name | Phone | Bleep | Email |
|                                                                      |      |       |       |       |
|                                                                      |      |       |       |       |

| Parental involvement / peer support |      |       |       |       |
|                                     | Name | Phone | Bleep | Email |
|                                     |      |       |       |       |
|                                     |      |       |       |       |

| Other local teams/staff working in relation to this agenda |      |       |       |       |
|                                                          | Name | Phone | Bleep | Email |
|                                                          |      |       |       |       |
|                                                          |      |       |       |       |

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