National Neonatal Audit Programme (NNAP)

RCPCH Audits

Annual report

2018 annual report on 2017 data

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National Neonatal Audit Programme (NNAP)

2018 annual report on 2017 data

The National Neonatal Audit Programme is commissioned by the Healthcare Quality Improvement Partnership (HQIP) as part of the National Clinical Audit and Patient Outcomes Programme (NCAPOP).

HQIP is led by a consortium of the Academy of Medical Royal Colleges, the Royal College of Nursing and National Voices. Its aim is to promote quality improvement in patient outcomes, and in particular, to increase the impact that clinical audit, outcome review programmes and registries have on healthcare quality in England and Wales.

HQIP holds the contract to commission, manage and develop the National Clinical Audit and Patient Outcomes Programme (NCAPOP), comprising around 40 projects covering care provided to people with a wide range of medical, surgical and mental health conditions.

The programme is funded by NHS England, the Welsh Government and, with some individual projects, other devolved administrations and crown dependencies.
www.hqip.org.uk/national-programmes

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We would also like to thank the people and organisations that work closely with the NNAP but are not represented on the Project Board or Methodology and Dataset Group, including the National Maternity and Perinatal Audit (NMPA), the Independent Advisory Group of the Healthcare Quality Improvement Partnership (HQIP), and the Neonatal Critical Care Clinical Reference Group at NHS England.

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Dr Chris Kissack, Consultant Neonatologist, Scottish Representative
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**Note that members of the NNAP Project Team also sit on the Project Board and Methodology and Dataset Group.*

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Forewords

I am pleased to introduce the 11th annual report of the National Neonatal Audit Programme, which has been run by the Royal College of Paediatrics and Child Health since its inception in 2006.

The audit celebrates some key achievements in neonatal care this year; more very preterm babies are being admitted to neonatal units with a normal temperature and rates of magnesium sulphate administration to mothers at risk of very preterm birth have increased notably (from 53% with 17% missing data, to 64% with 8% missing data).

Variation, however, continues to exist between neonatal units and neonatal networks. There are clear opportunities for units and networks to use their NNAP data as a driver for quality improvement activities.

The audit achieves excellent engagement from the neonatal community and the high levels of data completeness achieved in most audit measures mean that the audit continues to be a robust source of information, enabling the neonatal community to make best use of their results to drive change.

The NNAP reports for the first time this year on new measures of parental partnership in neonatal care. The development of these new measures is a credit to the NNAP parent representatives Ellen Hallsworth and Patrick Tully and Bliss representative Zoe Chivers. Ellen and Zoe step down this year after several years of providing highly valuable insight to the NNAP. I thank them for their contribution to the audit.

Thank you also to those involved in writing this report and developing its recommendations, including the NNAP Project Board, Methodology and Dataset Group, the Project Team and Clinical Lead Professor Sam Oddie. Finally, I would like to thank the neonatal and wider perinatal teams for providing their essential input into the audit.

Professor Anne Greenough, Vice President Science and Research
Chair of the NNAP Project Board
Royal College of Paediatrics and Child Health

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The NNAP expects, this year, to achieve full coverage of the 182 neonatal units in England, Wales and Scotland. Engagement in this national audit is accepted by many national bodies to be a key indicator of neonatal service quality.

The measures used include processes (clinical and organisational) and outcomes and continue to address many different dimensions of healthcare quality. Refreshingly, several new ideas have been introduced in this report including measures relating to parental partnership in care, and place of birth of babies born at less than 27 weeks gestational age, which are known to influence important clinical outcomes. There is acknowledgement of the importance of linking maternity and neonatal data in collaboration with the National Maternity and Perinatal Audit (NMPA). A start is made in systematic analysis of rates of change in measures with time and their variation between units and networks.

The publication of comparative data is not sufficient on its own to improve care and reduce variation in outcomes. This might partly explain the fact that, despite ongoing improvement in many longstanding measures, the pace of change has reduced for many with the persistence of marked regional variation. Approaches by the NNAP to improve access to comparative data through *NNAP Online* and encourage local quality improvement are to be welcomed. National initiatives in England and Scotland to train professionals in quality improvement methodology and to collaborate for improvement, if sustained, should add momentum.

The NNAP has become a very important part of the landscape of UK neonatal care. In the context of current work to transform neonatal services in England and Scotland it is important that priority is given to quality improvement informed by national audit and benchmarking. Closer coordination of the work of the many agencies interested in the quality of neonatal care would help accelerate improvement.

Dr Gopi Menon, President
British Association for Perinatal Medicine

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Executive summary

Around 750,000 babies are born each year in England, Scotland and Wales, and of these nearly 105,000 or around 1 in 7, will require specialist neonatal care. The National Neonatal Audit Programme (NNAP) uses routinely collected data to support quality improvement in neonatal units of all types.

Established in 2006, the NNAP is commissioned by the Healthcare Quality Improvement Partnership (HQIP), funded by NHS England, the Scottish Government and the Welsh Government, and is delivered by the RCPCH. It forms part of the HQIP National Clinical Audit and Patient Outcomes Programme (NCAPOP). The RCPCH is currently contracted to deliver the NNAP from April 2017 to March 2021. For most audit measures, this report looks at care provided to babies with a final discharge from neonatal care between 1 January and 31 December 2017.

In addition to our existing audit measures, in 2017 the NNAP reported on new measures focussed on parental partnership in care; looking at minimising separation of mother and baby, and the presence of parents on consultant ward rounds. We hope that these measures will support neonatal units to achieve a partnership with parents in providing care. This year we also describe how many of the least mature babies are delivered in units best suited to care for them. Our final new measure describes, for the first time, how many babies develop necrotising enterocolitis.

Selected key findings and recommendations

These key findings were selected by consensus at the NNAP key findings workshop by a multidisciplinary and multiagency group of NNAP stakeholder representatives. For a full list of the key findings and recommendations for these, and other measures, see the key findings and recommendations section of the full report.

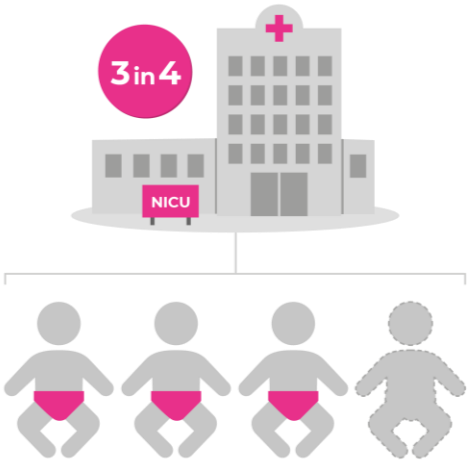
Antenatal magnesium sulphate

Giving magnesium sulphate to women who are at risk of delivering a preterm baby reduces the chance that their baby will develop cerebral palsy. The NNAP looks at whether mothers who delivered their baby at less than 30 weeks were given antenatal magnesium sulphate. Magnesium sulphate administration was much higher in 2017 than in 2016 (2017 – 64.1% of eligible mothers; 2016 – 53.3% of eligible mothers), reflecting rapid assimilation into practice of this aspect of NICE guidance, which is aimed at reducing cerebral palsy.

Selected recommendation:

To seek missed opportunities, and themes as to why magnesium was not given in line with NICE guidance, **neonatal and maternity care staff in units** with below average rates of administration should formally review records of babies born at less than 30 weeks where magnesium sulphate was not given to the mother.

Birth in a centre with a neonatal intensive care unit (NICU)

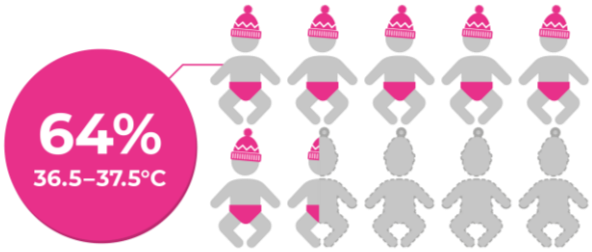


The NNAP looks at the proportion of babies born at less than 27 weeks gestational age who were born at a hospital with an on-site NICU. Babies who are born at less than 27 weeks gestational age are at high risk of death and serious illness. There is evidence that outcomes are improved if such immature babies are cared for in a NICU from birth. Three in four babies born less than 27 weeks gestational age were born at a hospital with an on-site NICU. Only two of 15 neonatal networks have more than 85% of these babies born within a hospital with an on-site NICU. Geographical size of network does not readily explain why more of some networks' babies are delivered in centres with a NICU.

Selected recommendation:

Neonatal networks, maternity networks and local maternity systems in England, and their equivalent bodies in Wales and Scotland, which do not achieve delivery of 85% of babies less than 27 weeks in a hospital with an onsite NICU should review whether they have realistic plans to achieve improvements in this area, and develop plans if required.

Promoting normal temperature on admission for very preterm babies

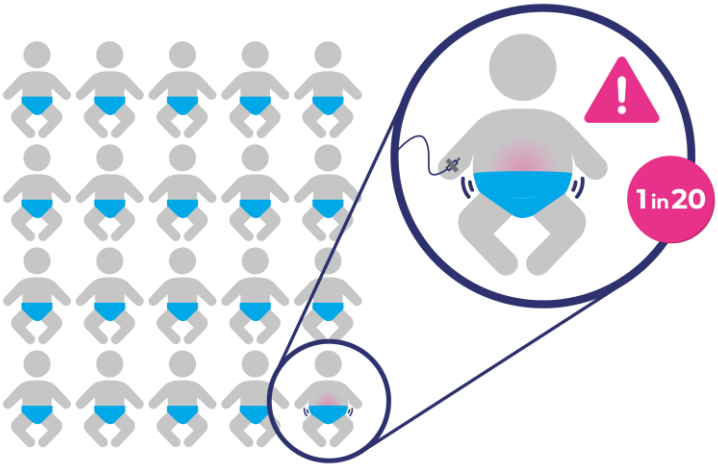


More very preterm babies in England, Scotland and Wales are admitted with a normal temperature than has been recorded for other nations in the international literature.[1,2,3] Sixty four percent of babies had a normal first temperature (36.5 to 37.5°C) measured within an hour of birth. This is an improvement in performance from recent years (2016 – 60.8%; 2015 – 58.1%) without an increase in hyperthermia – temperature above 37.5°C (2017 – 12.2%; 2016 – 12%). However there remains room for significant further improvement in the promotion of normothermia on admission to neonatal units for very preterm babies.

Selected recommendation:

Neonatal units should ensure that they have a care bundle in place, developed with multidisciplinary input, which mandates the use of evidence-based strategies to encourage admission normothermia of very preterm babies.

Necrotising enterocolitis

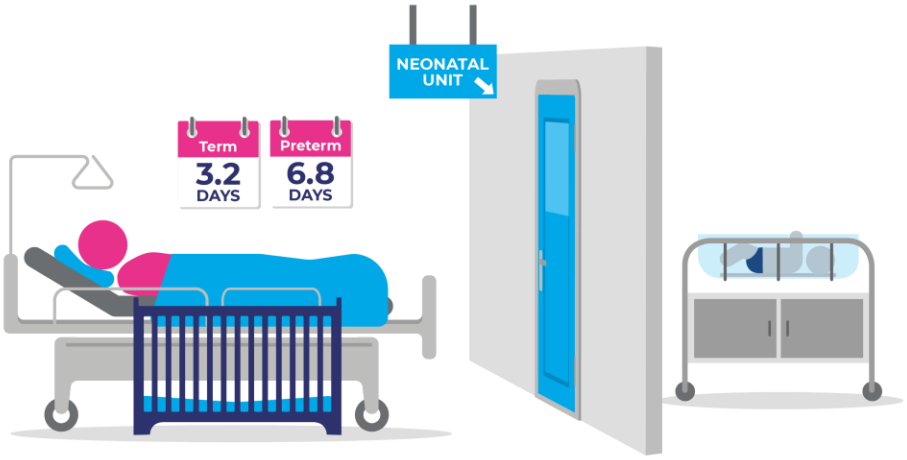


Necrotising enterocolitis (NEC) is a devastating illness which can follow preterm birth. One in twenty (5.6%; 428 of 8,228) babies born at less than 32 weeks gestational age developed necrotising enterocolitis (NEC). The NNAP uses a surveillance definition of NEC based on diagnosis at surgery, post-mortem or on the presence of clinical or radiographic signs.

Selected recommendation:

Neonatal units who validated their NEC data for 2017 should use NNAP Online to compare rates of NEC with other units, and use these comparisons to seek quality improvement opportunities.

Minimising separation of mothers and term and late preterm babies



The NNAP looks at the number of days that term and late preterm babies requiring low dependency care are separated from their mother. Variation exists in the average number of separation days between neonatal units and networks, for both term and late preterm babies. Findings for these two measures suggest that opportunities exist to reduce separation of mothers and term and late preterm babies by providing some neonatal care as transitional care.

Selected recommendation:

Neonatal units and trusts/health boards where transitional care cannot be delivered should work with their commissioners to develop the ability to deliver such care to minimise mother and baby separation, following the BAPM guidance A Framework for Neonatal Transitional Care.[11]

Full key findings by audit measure are available in chapter 2 of the main report.

Supporting quality improvement in neonatal care

The NNAP identifies areas for quality improvement in neonatal units in relation to the delivery and outcomes of care. The NNAP presents data to neonatal units and networks to facilitate quality improvement, alongside other initiatives in the following ways:

- **NNAP Online** is the audit's interactive reporting tool. It is available at http://nnap.rcpch.ac.uk and can be used to compare performance at a unit, network and national level; supporting neonatal units and networks to share best practice and stimulate quality improvement activities. The NNAP also shares examples of good practice by showcasing **case studies** in the annual report, online and at our annual NNAP and Neonatal Data Analysis Unit (NDAU) Collaborator's Meeting.

- **NNAP unit results posters** summarise a selection of the unit's NNAP results which are most relevant to parents and carers. Neonatal units display the posters in a public area, and complete a second poster, which explains the actions they are taking in response to their audit results. Designed to be used alongside ***Your baby's care*** (available at www.rcpch.ac.uk/nnap), our parents' guide to the NNAP, the posters help to communicate the meaning and relevance of the audit results not only to parents, but to the wider team involved in caring for the baby and mother.

- **NNAP quarterly reports** support neonatal units and networks to monitor data quality and completeness and their ongoing performance throughout the data collection year. Quarterly reports enable units to review their provisional results at the end of the year before inclusion in the NNAP annual report.

The NNAP works closely with **neonatal networks**, adapting its measures and reporting to be responsive to the needs of the networks. The NNAP works closely with other national bodies and participates in several national initiatives, including the National Clinical Audit Benchmarking project (NCAB, a collaboration between HQIP and CQC), the Neonatal Peer Review Visit programme, NHS Choices and MyNHS Clinical Outcomes Publication and the Transparency and Open Data initiative.

Future developments in the NNAP

For the 2018 data year, we expect to achieve participation from all 15 neonatal units in Scotland, giving full participation across England, Wales and Scotland and would like to achieve UK wide participation in the future.

A new measure of neonatal nurse staffing levels will be reported for the 2018 data year, focussing on the proportion of shifts staffed according to relevant standards, and the number of additional shifts that would be required to meet those standards.

In 2017 and 2018 the NNAP has been collecting data on mortality. For a very few preterm babies (those who die before 44 weeks post menstrual age, in a non NNAP unit) this will require additional data entry, but for most cases, this reporting will be based on existing data flows.

1. Introduction

This is the 11th annual report of the National Neonatal Audit Programme (NNAP) delivered by the Royal College of Paediatrics and Child Health (RCPCH).

The NNAP supports professionals, families and commissioners to improve care provided by neonatal services who look after babies born too early, with a low birth weight or who have a medical condition requiring specialist treatment.

Established in 2006, the NNAP is commissioned by the Healthcare Quality Improvement Partnership (HQIP), funded by NHS England, the Scottish Government and the Welsh Government, and is delivered by the RCPCH. It forms part of the HQIP National Clinical Audit and Patient Outcomes Programme (NCAPOP). The RCPCH is currently contracted to deliver the NNAP from April 2017 to March 2021.

Since its conception as an England only audit, the NNAP has expanded to include Welsh units in 2012, and Scottish units in 2015.

The data presented in this report relate to the care provided to 104,183 babies discharged from neonatal care during the calendar year 1 January 2017 to 31 December 2017 in the 179 participating neonatal units (of a total of 182) in England, Wales and Scotland.

1.1. Aims

The aims of the audit are:

- To assess whether babies admitted to neonatal units in England, Scotland and Wales receive consistent high-quality care in relation to the NNAP audit measures that are aligned to a set of professionally agreed guidelines and standards.
- To identify areas for quality improvement in neonatal units in relation to the delivery and outcomes of care.

1.2. Scope

In 2017, the NNAP focussed on the following areas of neonatal care:

- Administering antenatal steroids
- Administering antenatal magnesium sulphate
- Birth in a centre with a neonatal intensive care unit (NICU)
- Promoting normal temperature on admission for very preterm babies
- Speaking with parents within 24 hours of admission
- Involving parents in decision making through presence at consultant ward rounds
- Screening on time for retinopathy of prematurity (ROP)
- Measuring rates of infection
- Measuring rates of bronchopulmonary dysplasia
- Measuring rates of necrotising enterocolitis
- Minimising inappropriate separation of mother and baby (term and late to moderate preterm)
- Feeding breastmilk at discharge home
- Carrying out follow-up assessment at two years of age
- Measuring mortality rates

Full details of the 2017 audit measures are available in Chapter 5.

1.3. Future developments

The NNAP has responded to requests from stakeholders to include a measure of nurse staffing on neonatal units, and has introduced a three-part measure for 2018 data looking at; the proportion of nursing shifts numerically staffed according to guidelines and service specification, the proportion of shifts staffed according to guidelines and service specification for qualification in specialty, and the number of additional nursing shifts required to be worked to meet guidelines and service specification.

For the 2018 data year, we expect to achieve participation from all 15 neonatal units in Scotland, giving full participation across England, Wales and Scotland and would like to achieve UK wide participation in the future.

In 2017 and 2018 the NNAP has been collecting data on mortality in very preterm babies. For a very few preterm babies (those who die before 44 weeks post menstrual age, in a non NNAP unit) this will require additional data entry, but for most cases, this reporting will be based on existing data flows.

1.4. Quality improvement

The NNAP identifies areas for quality improvement in neonatal units in relation to the delivery and outcomes of care. The NNAP supports neonatal units and networks to achieve quality improvement in a number of ways, and collaborates with regional and national initiatives and groups.

NNAP quarterly reporting

Through the data year, the NNAP provide neonatal units and networks with summary reports of their cumulative results for each of the NNAP audit measures. These reports give units and networks the opportunity to identify areas for improvement in both data quality and performance as the audit year progresses and take early action if required.

Local action plans and case studies

Neonatal units and networks use their NNAP audit results to develop local action plans, focussing on one or several audit measures where they have identified opportunities for improvement. The NNAP shares case studies of quality improvement projects so that learning is shared across all units and networks.

See Chapter 4 for a selection of case studies from NNAP participant units. More case studies can be found on our web pages at: www.rcpch.ac.uk/nnap.

Collaborators meeting

The latest NNAP and NDAU Collaborators Meeting was held on 27 April 2018, and featured talks and presentations relating to the future direction of the NNAP, NICE guidance on developmental follow up of children and young people born preterm, and using audit data for quality improvement and local improvement case studies relating to NNAP measures.

Videos of the presentations can be accessed at: www.rcpch.ac.uk/resources/2018-nnapndau-collaborators-meeting-presentations

Working with neonatal networks, and relevant national bodies

Operational delivery networks (ODNs) are charged with supporting English health trusts to support delivery of care according to the service specification, to respond to relevant national priorities, and to work with commissioners to plan services that are responsive to local needs. Equivalent structures exist in Scotland and Wales. The NNAP considers and adapts its measures and reporting to be responsive to the needs of ODNs. This is achieved by presentation of findings to relevant meetings, and by representation of networks on NNAP committees. Other national bodies such as the NHS England clinical reference group, and the NHS Improvement ATAIN project are key partners to NNAP, and close contact is maintained with them, to ensure that measures and reporting are aligned and fit for purpose.

The National Clinical Audit Benchmarking (NCAB) project

The HQIP/CQC led NCAB project provides a visual snapshot of individual trust audit data set against individual national benchmarks. NCAB is a collaboration between HQIP and CQC, which aims to enhance the way inspectors, medical directors, local clinical audit teams and others engage, interact with and share clinical audit data.

NNAP participated in this project for the first time with 2016 data from units in England and Wales for a selected number of audit measures, and is participating again this year.

For more information about this project, please see: https://www.hqip.org.uk/national-programmes/clinical-audit-benchmarking/

Neonatal Peer Review Visit Programme in England

Through late 2017 and early 2018, the Quality Surveillance Team at NHS England have been running the Neonatal Peer Review Visit programme. The programme has used NNAP data to inform visits.

NHS Choices and MyNHS: Clinical Outcomes Publication

Clinical Outcomes Publication (COP) is an NHS England initiative, managed by HQIP, to publish quality measures at the level of individual consultant, team and unit level using national clinical audit and administrative data. The initiative relates to England only.

The NNAP participated in this initiative for the first time in 2016 by submitting data for six of the NNAP audit measures. The NNAP is participating again this year, with unit level data expected to be published on NHS Choices and MyNHS in December 2018.

For more information about this initiative, please see:
https://www.hqip.org.uk/national-programmes/clinical-outcomes-publication/

Open data

The NNAP publishes data annually on data.gov.uk following publication of the annual report. Data are published at neonatal unit level for all hospitals participating in the audit in England, Scotland and Wales. These are the same data available on NNAP Online.

Data accessed via data.gov.uk should be interpreted alongside this annual report and NNAP Online.

1.5. Impact and engagement

Information for parents and families

Your baby's care is a parent and carer's guide to the NNAP and the audit results. Available in English and Welsh, it tells families what the audit is, what it aims to achieve, explains the results for key audit measures, and what families can do in response to the results. We ask units to make the booklet available to parents and carers in their unit.

Your baby's care is available here: www.rcpch.ac.uk/nnap

The NNAP fair processing and parent information leaflet *Your baby's information*, is available here: www.nnap.ac.uk/nnap.

NNAP unit results posters

Following a successful pilot scheme for 2015 data, and a UK-wide roll out for 2016 data, the NNAP continues to produce its NNAP unit results posters. The results poster, designed in collaboration with our parent, nurse and Bliss representatives, summarises a selection of the unit's NNAP results which are most relevant to parents and cares. Neonatal units display the posters in a public area, and complete a second poster, which explains the actions they are taking in response to their audit results. Designed to be used alongside *Your baby's care*, the posters help to communicate the meaning and relevance of the audit results not only to parents, but to the wider team involved in caring for the baby and mother.

NNAP unit results posters can be downloaded from NNAP Online http://nnap.rcpch.ac.uk.

User feedback and improving the audit

The NNAP works closely with participating units and networks to make sure the audit is fit for purpose and continues to be as useful as possible to support improvements in care. We gather ad hoc feedback about audit measures and outputs directly from unit and network staff, through representatives at our Project Board and Methodology and Dataset Group, and at our Collaborators Meeting. Annually we run a survey seeking feedback from audit stakeholders. We ask for feedback on how units are using the audit data, quarterly reporting, NNAP Online, the national annual report, the unit posters and *Your baby's care*. We use the feedback to make improvements to the audit and the outputs we produce.

Collaboration with the National Maternity and Perinatal Audit

The National Maternity and Perinatal Audit (NMPA), commissioned by the Healthcare Quality Improvement Partnership in July 2016, is a national audit of NHS maternity services in England, Scotland and Wales. The NMPA is led by the Royal College of Obstetricians and Gynaecologists (RCOG), in partnership with the Royal College of Midwives (RCM), Royal College of Paediatrics and Child Health (RCPCH) and the London School of Hygiene and Tropical Medicine.

The RCPCH is represented on the NMPA Project Board by Professor Anne Greenough, and the NNAP is represented on the NMPA Clinical Reference Group by Dr Sam Oddie.

The first clinical report of the NMPA was published in November 2017. The findings and recommendations in the report are wide reaching and of relevance to the neonatal community. In a whole system approach, measures included in the NMPA should be considered alongside the NNAP measures of neonatal care, and perinatal mortality reporting through Mothers and Babies: Reducing Risk through Audits and Confidential Enquiries across the UK (MBRRACE-UK).

The NNAP team has been supporting the NMPA in the development of their latest project, a feasibility study aiming to link maternity and neonatal care records. We look forward to ongoing collaboration with the NMPA team in years to come.

You can find out more about the NMPA here: http://www.maternityaudit.org.uk.

1.6. NNAP Online

NNAP Online is the audit's interactive reporting tool. It is available at http://nnap.rcpch.ac.uk. NNAP Online provides unrestricted access to all NNAP results at an individual unit level and for each measure.

NNAP Online can be used to compare performance at a unit, network and national level. It enables units to compare themselves against other units of the same designation and enables units and networks to share best practice and stimulate quality improvement activities.

NNAP Online includes:

- Neonatal unit and neonatal network annual summary reports
- Graphical outputs for units and networks
- Interactive outlier caterpillar plots
- Posters of unit-level results
- Encephalopathy results (at trust or health board level)

2. Key findings and recommendations

The NNAP brings together a multidisciplinary group of representatives identify key findings and to translate the key findings and results of the audit into a set of recommendations that can be acted upon to improve neonatal care. The recommendations are made to support the existing goals and priorities of neonatal and perinatal services, and are targeted to the audience with the ability to action the recommendation.

Recommendations are designed to be specific to each audit measure, however there are a number of recommendations for neonatal units relating to quality improvement activities across all NNAP measures:

1. **Neonatal units** should display their NNAP results poster and the accompanying poster describing the ongoing relevant quality improvement activities that the unit is making, in public and professional facing areas of the neonatal unit.

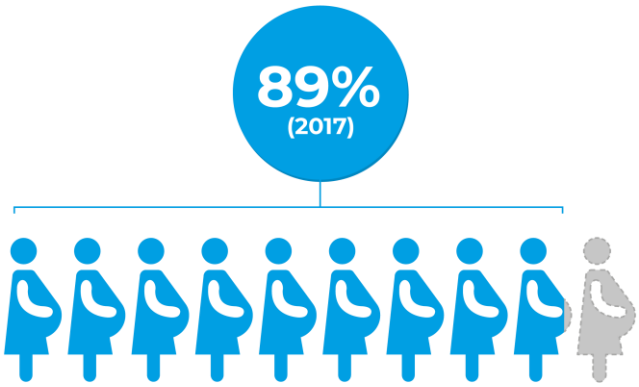
2. **Neonatal units** should use NNAP Online to identify quality improvement opportunities relevant to them, and to identify partner units with results they wish to emulate.

3. **Neonatal units** should ensure they have adequate processes for the timely capture of information for quality improvement, and build in regular review processes to measure their improvement progress.

Full recommendations can be found by audit measure in this chapter, and by audience in *Appendix B: Recommendations by audience* in the full report.

2.1. Antenatal steroids

Babies born at less than 35 weeks gestational age sometimes have breathing difficulties in the first few days after they are born. Antenatal steroids are a powerful health intervention, given to mothers by obstetricians and midwives before delivery of a preterm baby to help reduce breathing difficulties (respiratory distress syndrome) and make other serious complications such as bleeding into the brain less likely.



Key findings

- All neonatal networks and 84.9% (152 of 179) of units are meeting the NNAP standard of 85% of eligible mothers receiving at least one dose of antenatal steroids *(Table 5.1.2., page 74 and NNAP Online).*
- 88.6% of women who delivered a baby between 24 and 34 weeks' gestational age received at least one dose of antenatal steroids, 1.5% more than in 2016. Units vary in their recorded use of antenatal steroids, with rates from 64.3% to 100%. One unit (Queens Hospital, Romford) had significantly lower use of antenatal steroids than other units in 2017; this unit was also a low outlier in 2016 data *(NNAP Online).*
- Two units (St Mary's Hospital, Manchester and Birmingham Heartlands Hospital) improved their antenatal steroids coverage exceptionally over the period 2015 to 2017, from 73.4% to 90.3% and from 79.6% to 94.0% respectively *(NNAP Online).*
- Two units (Gloucestershire Royal Hospital and John Radcliffe Hospital, Oxford) demonstrated an exceptional decline in use of antenatal steroids from 2015 to 2017 (95.8% to 86.5% and 91.9% to 85.3% respectively) whilst remaining above the NNAP standard of 85%. This suggests that high performing units may need to retain focus on timely use of antenatal steroids in very preterm babies *(NNAP Online).*

Recommendations

4. **Perinatal services** (maternity and neonatal staff) should regard their rates of antenatal steroid administration as a key measure of the achievements of their clinical care. To identify quality improvement opportunities, neonatal and maternity care staff should formally review records of babies born at less than 35 weeks admitted for neonatal care where antenatal steroids were not given to the mother as part of their assurance with respect to NICE guidance.[18]

5. **Neonatal networks** should review administration rates of antenatal steroids in their units on a quarterly basis, identify any quality improvement opportunities and support units to achieve the best possible neonatal outcomes.

6. The **NNAP** and the **National Maternity and Perinatal Audit** should consider whether antenatal steroid administration could be more appropriately audited as part of the National Maternity and Perinatal audit from 2019 onwards.

7. Those responsible for defining **national maternity datasets** (NHS Digital in England) should ensure that antenatal steroid administration is captured as part of routine maternity data.

Full 2017 results for Antenatal steroids and a description of the measure are found on page 71.

2.2. Antenatal magnesium sulphate

Giving magnesium sulphate to women who are at risk of delivering a preterm baby reduces by 32% the chance that their baby will develop cerebral palsy.[4] The NICE quality standard *Preterm Labour and Birth* recommends that all women that may deliver their baby at less than 30 weeks gestational age are offered magnesium sulphate where possible.[18]

Key findings

- Magnesium sulphate administration was much higher in 2017 than in 2016 (2017 – 64.1% of eligible mothers; 2016 – 53.3% of eligible mothers), reflecting rapid assimilation into practice of this aspect of NICE guidance, which is aimed at reducing cerebral palsy.[18] Twenty-two units had administration rates of 80% or more of eligible women *(Table 5.1.3, page 75 and NNAP Online).*

- Marked variation is evident at network level, with the best performing network having a rate of administration more than one and a half times (78.8%) that of the lowest performing network (49.0%) *(Table 5.2.2, page 79).*

- The performance of three networks (Thames Valley and Wessex, South West, North West) is significantly better than average, and that of three networks (Staffordshire, Shropshire and Black Country, Midlands South West, Yorkshire and Humber) is significantly lower than average. Some networks (e.g. North West 2016 – 48%; 2017 – 70.3%) have made very rapid improvements to their performance *(NNAP Online).*

- John Radcliffe Hospital, Oxford reports exceptionally high rates of administration (91.2% of 102 women; national rate 64.1%), demonstrating that high rates of administration are achievable. Elsewhere, administration rates varied greatly

between units (from 0% to 100%) suggesting that uptake of this important treatment to prevent cerebral palsy is not yet optimal *(NNAP Online)*.

Recommendations

8. **Neonatal units** with below average rates of magnesium sulphate administration should identify comparable units to their own, that have higher rates of antenatal magnesium sulphate administration using NNAP Online. Working collaboratively with maternity staff, they should use quality improvement methodology and programmes to improve rates of administration in their hospitals.
9. To seek missed opportunities, and themes as to why magnesium was not given in line with NICE guidance,[18] **neonatal and maternity care staff in units** with below average rates of administration should formally review records of babies born at less than 30 weeks where magnesium sulphate was not given to the mother.
10. **Neonatal units** with significant levels of missing data should take steps to address this in collaboration with maternity care staff.
11. **Neonatal networks, maternity networks and local maternity systems** with below average rates of administration, or low rates of improvement review administration rates of magnesium sulphate in their units on a quarterly basis, identify any quality improvement opportunities and support units to achieve the best possible neonatal outcomes.
12. The **NNAP** and **NMPA** should explore the feasibility of reporting antenatal magnesium administration in NMPA.

Full 2017 results for Antenatal magnesium sulphate and a description of the measure are found on page 76.

Improving antenatal magnesium sulphate administration: a case study

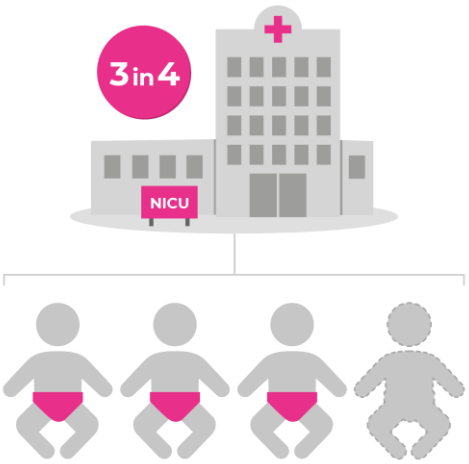
The neonatal unit at Watford General Hospital took a multidisciplinary approach to increase their rates of magnesium sulphate administration. Their top tips are:

- *Identify an appropriate maternity-neonatal forum to share NNAP $MgSO_4$ data*
- *Engage stakeholders and frontline champions in maternity and neonates*
- *Use live NNAP dashboard on BadgerNet to generate live run charts*
- *Partner with parents for improvement*

Find the full case study in chapter 4.1 and online at: www.rcpch.ac.uk/nnap

2.3. Birth in a centre with a neonatal intensive care unit (NICU)

Babies who are born at less than 27 weeks gestational age are at high risk of death and serious illness. National recommendations in England[5] state that neonatal networks should aim to configure and deliver services to increase the proportion of babies at this gestational age that are delivered in a hospital with a neonatal intensive care unit (NICU) on site. This is because there is evidence that outcomes are improved if such immature babies are cared for in a NICU from birth.



Key findings

- Only two of 15 neonatal networks have more than 85% of babies born at less than 27 weeks gestational age within a hospital with an on-site NICU. Geographical size of network does not readily explain why more of some networks' babies are delivered in centres with a NICU *(Table 5.3.1, page 82)*.
- Networks varied by important margins in how they performed on this measure. One neonatal network, East of England ODN, has a low rate of delivery of babies born at less than 27 weeks gestational age in a hospital with an on-site NICU making it a low outlier at more than three standard deviations (SD) from the national rate (East of England ODN – 46.4%, national rate - 73.9%). Three other neonatal networks had rates that were more than two standard deviations above the national rate *(NNAP Online)*.

Recommendations

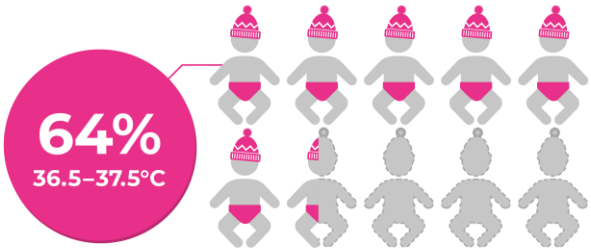
13. **Neonatal networks** should facilitate local and network review of all cases where babies of less than 27 weeks gestational age deliver in a hospital without a NICU with the aim of identifying and sharing opportunities to increase the rate of delivery in hospitals with an onsite NICU.

14. **Neonatal networks, maternity networks and local maternity systems** in England, and their equivalent bodies in Wales and Scotland, which do not achieve delivery of 85% of babies less than 27 weeks in a hospital with an onsite NICU should review whether they have realistic plans to achieve improvements in this area, and develop plans if required.

Full 2017 results for Birth in a centre with a NICU and a description of the measure are found on page 81.

2.4. Promoting normal temperature on admission for very preterm babies

Low admission temperature has been associated with an increased risk of illness and death in preterm babies. Low temperature (or hypothermia) is a preventable condition in vulnerable newborn babies. Staff on the neonatal unit need to know if a baby is too cold so they can take appropriate action. This NNAP measure looks at how successful neonatal units are at achieving a normal first temperature (36.5°C to 37.5°C inclusive) within an hour of birth in very preterm babies (less than 32 weeks gestational age).



Key findings

- More very preterm babies in England, Scotland and Wales are admitted with a normal temperature than has been recorded for other nations in the international literature.[2, 3,6] Sixty-four percent of babies had a normal first temperature (36.5 to 37.5°C) measured within an hour of birth. This is an improvement in performance from recent years (2016 – 61%; 2015 – 58%) without an increase in hyperthermia – temperature above 37.5°C (2017 – 12.2%; 2016 – 12%). However there remains room for significant further improvement in the promotion of normothermia on admission to neonatal units for very preterm babies *(Table 5.4.1, page 85, Table 5.4.3, page 90).*

- Temperature was measured and recorded in 99.7% (7,997 of 8,019) of babies *(Table 5.4.1, page 85).*

- Seven units (Bradford Royal Infirmary, Leeds Neonatal Service, John Radcliffe Hospital, Oxford, Princess Anne Hospital, Southampton, Rosie Maternity Hospital, Cambridge, The Royal London Hospital, and Queen Alexandra Hospital, Portsmouth) were positive outliers and achieved rates of documented within range temperatures of 71.1% to 87.5% *(NNAP Online).*

- Some units (Royal Victoria Infirmary, Newcastle, The Royal London Hospital) have increased their performance by 30% or more in two years, against a national average improvement of 5.4% over the same time *(NNAP Online)*.
- While all networks have improved their performance between 2015 and 2017, some had a lower rate of improvement, e.g. Midlands South West (2017 – 50.6%; 2016 – 48%; 2015 – 42%) *(NNAP Online)*.
- Just over one in 20 (5.6%) babies born before 32 weeks gestational age was markedly hypothermic (temperature less than 36.0°C) on admission to the neonatal unit. In 2015, 1 in 12 babies (8.3%) were markedly hypothermic *(Table 5.4.3, page 90)*.

Recommendations

15. **Neonatal units** should report all cases where the admission temperature of a very preterm baby is below 36.0°C using local risk reporting mechanisms, and consider a policy of reporting all babies with admission temperature below 36.5°C.
16. **Neonatal units** should ensure that they have a care bundle in place, developed with multidisciplinary input, which mandates the use of evidence-based strategies to encourage admission normothermia of very preterm babies.

Full 2017 results for Promoting normal temperature on admission for very preterm babies and a description of the measure are found on page 84.

Improving admission temperature: a case study

Sheffield Teaching Hospitals NHS Foundation Trust put in place a care bundle for thermal care at delivery. The approach included:

- *Education and awareness raising through induction and huddles*
- *Monthly admission temperature tracking*
- *Exception reporting of admission temperatures below 36.0°C*

Find the full case study online at: https://www.rcpch.ac.uk/resources/2018-nnapndau-collaborators-meeting-presentations

2.5. Parental consultation within 24 hours of admission

This measure of care looks at whether parents have been spoken to by a senior member of the neonatal team within the first 24 hours of their baby being admitted. It applies for all babies who require care on a neonatal unit. It is important that families understand and are involved in the care of their baby. This first consultation provides an opportunity for the senior staff member to meet the parents, listen to their concerns, explain how their baby is being cared for and respond to any questions.

Key findings

- Rates of parental consultation are stable, with 40% units (72 of 179) having performance of over 98%, and 29 units having a senior member of the neonatal team speaking to all parents within 24 hours of admission. The national rate was 94.6% (2016 - 94%; 2015 - 91.9%) *(Table 5.5.3, page 94, NNAP Online).*
- Nineteen units had performance that was low outlying. However low outlying units performed better than in 2016 – for example just three units (James Paget Hospital, Nevill Hall Hospital and St Michael's Hospital) had consultation rates of below 80% (2016 - 26 units) *(NNAP Online).*
- Most (12/15) networks improved their performance from 2015 to 2017. The worst performing network in 2015 (Midlands South West) was the most improved network between 2015 and 2017 (2015 - 70%; 2017 – 91%) *(NNAP Online).*

Recommendations

17. **Neonatal units** should regularly review the reasons why timely parental consultations did not occur. They should look for themes among the reasons, provide regular feedback to neonatal staff, and put processes in place to strengthen their support of parental partnership in care.

18. **Neonatal units** should ensure that parents are aware of the standard, for example as part of a welcome pack or signage in the neonatal unit.

19. **Neonatal units** with poorer data completeness should review and improve their documentation process. For example, by use of a dedicated notes sheet or a document in electronic records to record parental consultations.

Full 2017 results for Parental consultation within 24 hours of admission and a description of the measure are found on page 91.

Improving consultation with parents: a case study

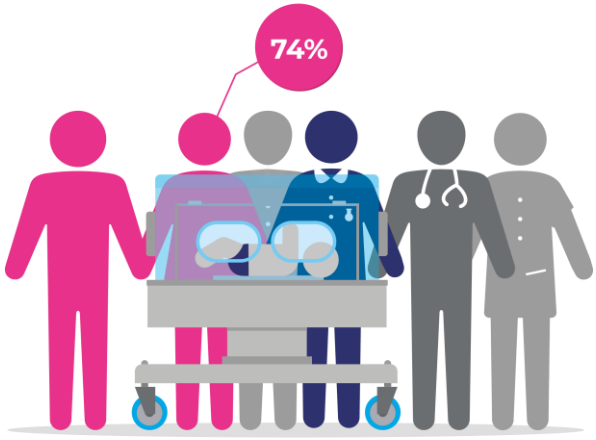
The Royal Oldham Hospital sparked the competitive spirit of their neonatal consultants to improve their rates of consultation with parents within 24 hours of admission.

A weekly run chart presented at communications meetings has resulted in a change in practice and sustained improvement.

Find the full case study in chapter 4.2 and online at: www.rcpch.ac.uk/nnap

2.6. Parental presence at consultant ward rounds

Neonatal intensive care is very stressful for babies and parents. Professionals, parents' advocates, and parents agree that parental partnership in care is supported by including parents in consultant ward rounds, which will occur regularly on neonatal units. For 2017 this measure seeks to identify the proportion of admissions where parents were present on a consultant ward round on at least one occasion during a baby's stay.



Key findings

- For 74.3% of neonatal stays parents were documented as having attended a consultant ward round at least once. This figure was 87.5% for neonatal admissions longer than 28 days, but the percentage of missing data was considerably higher for shorter stays (16% for stays of more than 7 days, less than 1% for stays longer than 28 days) *(Table 5.6.1, page 97).*
- In 10.6% of admissions, the reason given for parents not attending a consultant ward round was that no consultant ward round occurred. This is a new data measure for 2017 and it may be that differing interpretations are being applied to the term "consultant ward round" *(Table 5.6.1, page 97).*
- Although the validity of the findings may be affected by data completeness, the results suggest variation between neonatal networks in how frequently parents attend ward rounds, and can be involved in planning care. Attendance at any consultant ward round for stays longer than 28 days ranged from 76-98%, indicating that the model of parental partnership in care may yet be differentially adopted in UK neonatal care *(Table 5.6.2, page 98).*

Recommendations

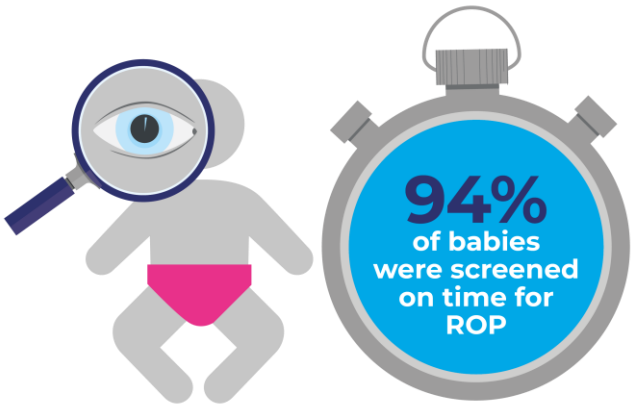
20. **Neonatal units** with poorer data completeness should review and improve their documentation process to ensure that all instances of parental presence on the ward round are recorded.

21. **Neonatal units** should work with local parent representatives to look at ways to improve the attendance of parents on the ward round and parental involvement in decision making. Neonatal units should refer to the BAPM Neonatal Service Quality Indicators[7] and the Bliss Baby Charter[8] for guidance.

Full 2017 results for Parental presence on consultant ward rounds and a description of the measure are found on page 95.

2.7. On-time screening for retinopathy of prematurity

Babies born very early or with a very low birth weight are at risk of retinopathy of prematurity (ROP). This condition affects the development of the blood vessels in the back of the eye. ROP can lead to loss of vision, but this is usually prevented by timely treatment. Therefore, screening babies for ROP at the right time is important to help babies have the best vision in the future. A national guideline indicates when screening should be done, and this measure reports on how successful neonatal services are in achieving 'on time' screening.[29]



Key findings

- 94.4% of babies had on-time ROP screening (2016 data 94.2%), which means that the pace of improvement in this area is slowing *(Table 5.7.1, page 104).*
- 98.1% of eligible babies had ROP screening reported at any time (2016 data 98.4%).
- Most babies who were not screened had birthweights or gestational age just below the relevant criteria for screening – for example mature growth restricted babies, or larger immature babies. However, 13 babies with gestational age less than 30 weeks appear not have been screened at any time.
- As in previous years, more than one in eight babies had their first ROP screen after discharge, reflecting increased early discharge home of preterm and growth restricted babies since the national guidelines were written.[29]
- Forty-seven units (26.3%) reported screening all their eligible babies on time, including 13 large (more than 50 eligible babies) units. Eighty-one units (45.3%) screened less than 95% of eligible babies on time.

- Nine units were identified as low outliers – of whom three were also identified as low outliers in the 2016 data (James Cook University Hospital, Middlesbrough, Newham General Hospital, Birmingham Women's Hospital) *(NNAP Online)*.

- Network level performance varies considerably, suggesting it may be possible for networks to improve their practice by comparing organisational and clinical arrangements to, and basing improvements on, networks with good performance. One network (North West) is identified for its excellent performance (97.4% on time screening of 1046 babies) *(Table 5.7.2, page 105)*.

- Three networks - Wales, Scotland, Trent Perinatal and Central Newborn Neonatal ODN - showed the most improvement between 2015 and 2017. Only the Northern Neonatal network did not show improvement – in 2017 it screened less than 9 out of 10 of its babies on time (86% on time screening of 342 babies), and in 2017 is a low outlier *(NNAP Online)*.

- At unit level, some units can be identified as having exceptional improvements in their performance between 2015-2017 (Royal Victoria Infirmary, Newcastle, Queens Hospital, Romford, Walsall Manor Hospital). Two other units have declining rates of ROP screening between 2015-2017 that make them outliers (Whipps Cross University Hospital, Rosie Maternity Hospital, Cambridge) *(NNAP Online)*.

Recommendations

22. **Neonatal units and ophthalmologists** should target quality improvement in their organisational, administrative and clinical processes at those babies whose birthweights and gestations are just inside the criteria for screening, because these babies constitute the majority of those not screened.

23. **Neonatal units** with low outlier status, and especially those who have been recurrently identified as such, should urgently review their clinical, administrative and organisational arrangements, and keep them under detailed regular review to optimise retinopathy screening and treatment outcomes.

24. **Neonatal units** should, as part of a formal local risk incident investigation, formally review their clinical, organisational and administrative pathways in discussion with their ophthalmology colleagues when cases are screened late, or not at all.

25. **Neonatal units** should clearly describe to parents, prior to the opening of the screening window, but after the first week of life, the need for ROP screening using an individualised written resource which sets out for the parents the anticipated date of first screening for their baby. If their baby is due to be screened after being discharged from the unit, neonatal staff should ensure that parents are aware of the importance of attending the appointment.

26. **Neonatal networks** with higher rates of failure to screen on time (for example over 2.5%) should seek to understand the reasons for this failure and address this with any units concerned.

27. **Guideline developers** should take the successful deployment of on time post discharge screening into account when describing appropriate clinical practice for ROP screening.

Full 2017 results for On-time screening for ROP and a description of the measure are found on page 102.

2.8. Encephalopathy

Encephalopathy is a brain illness. Encephalopathic babies have impaired consciousness and often have seizures. Encephalopathy in newborn babies has a variety of causes. Encephalopathy most commonly occurs in babies who are born at or near term and who appear to have got into difficulty during labour or delivery. It is important that hospitals gain understanding of their rates of encephalopathy in newborn babies to identify opportunities to improve midwifery and obstetric practice.

Key findings

- NNAP present rates of encephalopathy by trust or health board for the years 2014-2016 inclusive, using number of live births as a denominator. The rates of encephalopathy presented are not risk adjusted according to maternal or obstetric characteristics, and so cannot be seen as indicative of the quality of antenatal or intrapartum care *(NNAP Online)*.

Recommendations

28. **Neonatal units** should ensure that all cases of encephalopathy identified by the criteria used by the NNAP have been reviewed by a suitable multidisciplinary group to look for modifiable factors, in accordance with the approach taken in the Royal College of Obstetricians and Gynaecologists' "Each Baby Counts" programme.[9]

Full 2017 results for Encephalopathy and a description of the measure are found on page 107.

2.9. Measuring rates of infection

Sick and premature babies are prone to infection with germs including some that are normally harmless to healthy people. Infections can lengthen the stay in the neonatal unit and may worsen the long term developmental outlook for babies.[10] Neonatal unit staff and parents can reduce the risk of infection by following good infection prevention and control practice.

The NNAP focusses on reporting measures of bloodstream infection. To look for infection in babies, neonatal staff usually take blood cultures to check whether bacteria are present in the blood. They may also take a sample of cerebrospinal fluid (CSF). For 2017 data NNAP reports rates of blood cultures positive for bacteria, fungi or yeasts, and two different measures of bloodstream infection that occurs on the same day as a central line is present.

Key findings

Bloodstream infection

- 74 (41% of 179) neonatal units have provided assurance that 100% of positive blood cultures reported in their units have been submitted to the audit. This compares favourably to 2016 when 25 units could provide this assurance. This means that some inter-unit comparisons of infections can be made, for measures that do not depend on definitions of infection that depend on so called “symptoms and signs”. For units that have not offered this assurance the unknown number of unreported positive cultures renders inter-unit comparisons unreliable.
- For babies born at less than 28 weeks gestational age, confirmed infection rates appear high. 2563 babies had 521 growths of a pathogen, confirming the clinical importance of infection in this patient group (*Table 5.9.2, page 111).*

Full 2017 results for Bloodstream infection and a description of the measure are found on page 109.

Quality improvement surveillance definition (QISD): Central line associated bloodstream infection

- 74 (41% of 179) NNAP units have reported complete data entry of all positive blood cultures, making their own infection rates suitable for comparison to other neonatal units with complete data entry (see NNAP Online). In 2016 just 25 units reported complete data entry.
- In the 74 units with complete data entry, central line associated bloodstream infection occurred in 8.17 babies of less than 32 weeks gestational age per 1000 line days and in 2.84 babies of greater than or equal to 32 weeks gestational age per 1000 line days. This is more than that reported in units without complete data entry (5.85 per 1000 line days for babies less than 32 weeks gestational age, 2.15 per 1000 line days for babies greater than or equal to 32 weeks gestational age). The likely explanation is incomplete data entry in the units without known complete data entry *(Table 5.10.1, page 114).*

Full 2017 results for QISD: Central line associated bloodstream infection and a description of the measure are found on page 113.

Recommendations

29. **Neonatal units** should enter every blood culture result that is positive for any bacterial or fungal growth (including potential contaminants) and use a regular communication channel with their laboratory services to assure themselves and other NNAP audit users that their data entry is complete.

30. **Neonatal units** with complete entry of positive blood cultures and above average rates of bloodstream infection with a known pathogen in babies of less than 32 weeks gestational age should consider identifying suitable partner units from NNAP Online with lower rates of infection and comparing their infection reduction strategies to seek quality improvement opportunities.

31. **Neonatal units** with complete entry of positive blood cultures and above average rates of bloodstream infection with central line use as measured by the CRG / NNAP quality improvement surveillance definition of central line associated bloodstream infection (QISD CLABSI) should consider identifying suitable partner units from NNAP Online, and comparing their infection reduction strategies to seek quality improvement opportunities.

32. The **NNAP** should continue to seek to achieve linkage between other infection surveillance systems and the National Neonatal Research Database (NNRD) to report meaningful data about bloodstream infection.

Measuring infection: a case study

The Jessop Wing NICU, Sheffield Teaching Hospitals NHS Foundation Trust, implemented a three-step approach to recording their central line associated bloodstream infection rates:

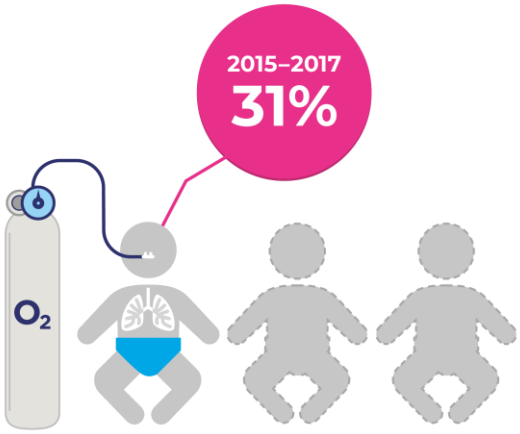
1. *Monthly e-mail from microbiology to named neonatal consultant with all positive blood culture results (between 2 and 8 per month).*
2. *Named consultant ensures results are recorded within the BadgerNet system.*
3. *Data team use BadgerNet tools to check any drug/line discrepancies to minimise line day errors.*

Find the full case study online at: https://www.rcpch.ac.uk/resources/2018-nnapndau-collaborators-meeting-presentations

2.10. Bronchopulmonary dysplasia (BPD)

Babies born preterm often don't have fully developed lungs and may require support with their breathing from a ventilator or other device. Simply being born early can cause some ongoing breathing difficulty. Being on a ventilator can cause damage to the lungs, exacerbate breathing problems later in life and put babies at risk of chest infections. This condition is known as bronchopulmonary dysplasia (BPD), also called chronic lung disease. NNAP reports on the proportion of babies born very early who are still receiving help with their breathing or extra oxygen four weeks before their due date.

Variations in rates of BPD might reflect different management or could reflect the way that neonatal units use oxygen in most mature babies.



Key findings

- Thirty one percent of admitted babies born at less than 32 weeks met the surveillance definition for bronchopulmonary dysplasia (receiving respiratory support and/or supplemental oxygen at 36 weeks' postmenstrual age) in the period 2015-2017 *(Table 5.12.1, page 119).*
- Marked variation exists at unit level in reported rates of both BPD alone and the composite measure of death or BPD. Among NICUs reported rates of BPD alone vary from below 25% to above 50% (mean 37.1%). Case mix characteristics explain much of, but not all, the variation in rates of BPD or death *(NNAP Online).*
- Important variation also exists between neonatal networks in their rates of both BPD and the combined outcome of death or BPD. These differences in rate are not wholly explained by differences in baseline characteristics of the cases. Rates of BPD or death are lower in three networks (East of England, South East Coast, Thames Valley and Wessex), and higher in two networks (Scotland and North West) than would be

expected if the babies cared for in these networks in 2015-2017 had been cared for in other units. A description of the novel matching approach used to compare networks and units is explained on page 58 and in Appendix E: Matching method of comparing outcomes for BPD.

Recommendations

33. **Neonatal units** with a positive treatment effect should consider examining the practice of neonatal units with a negative treatment effect to identify potential modifiable factors in their neonatal care which might influence rates of BPD.

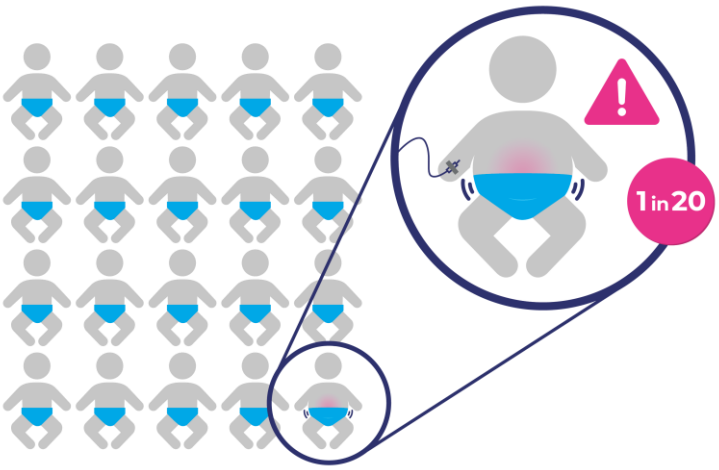
34. **Neonatal networks** with a positive treatment effect should consider examining the practice of networks with a negative treatment effect to identify potential modifiable factors in their neonatal care which might influence rates of BPD.

35. When the NICE guidance on specialist neonatal respiratory care for babies born preterm is published, **neonatal networks and neonatal units** should review their policies to ensure that saturation targets are in line with best practice recommendations.

Full 2017 results for Bronchopulmonary dysplasia and a description of the measure are found on page 117.

2.11. Necrotising enterocolitis

Necrotising enterocolitis (NEC) is a devastating illness which can follow preterm birth. Bowel inflammation prevents milk feeding, surgery may be needed and babies who develop NEC typically stay in hospital for a long time. Rates of mortality in babies with NEC are high, at over 20%. Babies who survive NEC can have developmental problems when they are older.



Key findings

- One in twenty (5.6%; 428 of 8,228) babies born at less than 32 weeks gestational age developed necrotising enterocolitis (NEC). The NNAP uses a surveillance definition of NEC based on diagnosis at surgery, post-mortem or on the presence of clinical or radiographic signs (*Table 5.13.1, page 125).*
- 84 units (of which 18 cared for 30 or more babies, accounting for 1438 of 8228 eligible babies) reported no cases of NEC at all, which may be an unexpected finding *(NNAP Online)*.
- Rates of NEC in the 78 units who had validated their NEC data for 2017 were 0.5% lower than rates in units who had not formally confirmed the local validation of their data.
- Most (5469 of 8228) of the very preterm (less than 32 weeks gestational age) babies eligible for this measure were in NICUs by 48 hours of age, but 2542 babies were nursed in Local Neonatal Units. Of the eligible babies in Local Neonatal Units, 3% (68) developed NEC which represents 1 in 6 of all babies who developed NEC. This emphasises the importance of delivering quality improvement opportunities at units of all levels caring for babies who are at risk of developing NEC *(Table 5.13.1, page 125).*

Reported levels of NEC by neonatal network appeared to vary threefold (South West 3.2% – South London 10.5%) *(Table 5.13.2, page 126).*

- Data was known to be missing for 7.3% (600 of 8228) of eligible babies. Of these 110 of a total of 393 deaths had no data on the occurrence of NEC (*Table 5.13.1, page 125).*

Recommendations

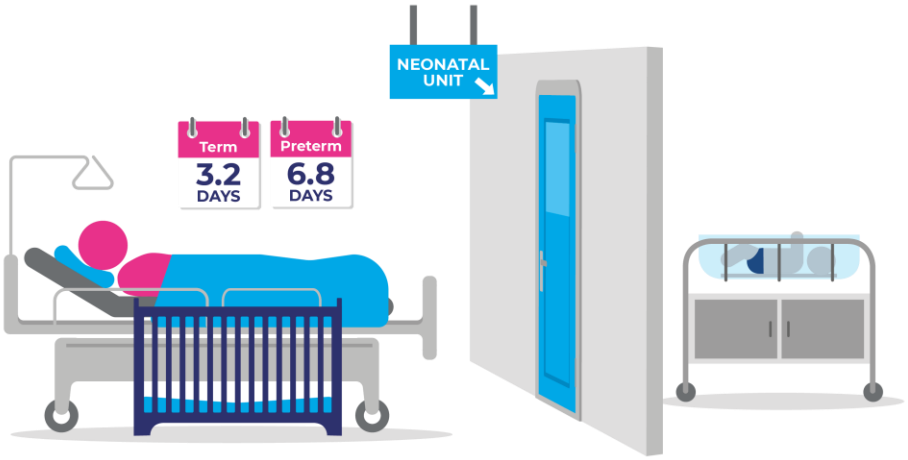
36. **Neonatal units** who validated their NEC data for 2017 should use NNAP Online to compare rates of NEC with other units, and use these comparisons to seek quality improvement opportunities.
37. **Neonatal units** should ensure that they will be able to validate their NEC data entry for the 2018 data year.
38. **Neonatal networks** should support neonatal units providing all levels of care to undertake quality improvement activities relating to NEC.
39. The **NNAP** should consider increasing the time period for reporting NEC, to a rolling period of three years to maximise the discriminatory power of this measure.
40. The **NNAP** should consider reporting a combined outcome of NEC or death from the 2019 data year, and should consider applying a matching approach to facilitate comparisons of rates between different networks and units.

Full 2017 results for Necrotising enterocolitis and a description of the measure are found on page 124.

2.12. Minimising separation of mother and baby (term and late preterm)

Some babies admitted to neonatal units may be separated from their mothers for longer than necessary. It may be possible to care for some babies in transitional care, a setting which takes an interdisciplinary approach of both midwives and neonatal staff to deliver high-quality care to both mothers and babies and avoid their separation.[11] This measure seeks to describe the number of babies admitted to neonatal units for low dependency care and to compare the number of days that babies were separated from their mothers.

The measure describes the number of "separation days" for each admission to a neonatal unit. Separation days are defined as days of low dependency care where breathing support was not needed. For some babies, separation from their mother may be able to be avoided altogether, with all their neonatal care delivered in a transitional care setting. For other babies where a neonatal unit admission is unavoidable, there may still be opportunities to reduce separation care days during admission, particularly where separation days are high.



Key findings

- Term babies admitted to neonatal units were separated from their mothers on average for 3.2 days on days when they received either “special care” without oxygen, or “normal care”. Networks varied in the average number of normal and special care days resulting in separation, and there is even greater variation between individual units (range 1 to 6 days) (*Table 5.14.1, page 129, Table 5.14.2 page 130 and NNAP Online*).

- The average number of term baby separation days is not higher for units providing higher levels of care (mean separation days at Special care units - 3.3 days; Local neonatal units - 3.2; Neonatal intensive care units - 3.1) *(Table 5.14.1, page 129)*.
- Late preterm babies admitted to neonatal units had an average of 6.8 separation days ("special care" days where oxygen was not given, or "normal care" days) (*Table 5.15.1, page 132).*
- Networks vary in the average number of late preterm separation days (range 5.1 to 8 days), and there is even greater variation between individual units (range 1.3 to 12.5 days) *(Table 5.15.2, page 133).*
- The difference between units' average late preterm separation days is not all explained by unit level, although variation does exist on average by unit level (mean separation days at special care units – 7.6 days; local neonatal units – 6.9 days; neonatal intensive care units – 6.3 days) *(Table 5.15.1, page 132).*
- Data completeness is good in the first year of this new measure as the relevant data are already routinely captured as part of care delivery.
- These findings suggest that opportunities exist to reduce separation of mothers and term and late preterm babies by providing some neonatal care as transitional care. Quality improvement activities based on this measure would be facilitated by presentation of the number of births at term in each hospital, data which is not yet available for England and Wales.

Recommendations

41. **Neonatal units and trusts/health boards** where transitional care cannot be delivered should work with their commissioners to develop the ability to deliver such care to minimise mother and baby separation, following the BAPM guidance A Framework for Neonatal Transitional Care.[11]
42. **Neonatal units** with above average numbers of separation days for term, or late preterm babies should consider if revision of their admission or discharge criteria and processes could reduce the number of mother and baby separation days.
43. **Neonatal units** should implement the BAPM guidance on the management of neonatal hypoglycaemia in term babies unless local circumstances make this inappropriate. Hypoglycaemia is a leading cause of term admission; some admissions for the management of hypoglycaemia could be avoided with the use of BAPM guidance.[12]

44. **Neonatal units** should be aware of their rates of admission for term babies, and use the themes emerging from ATAIN project reviews in England of term admissions to inform possible targeted review of their admission and discharge processes.

45. **Neonatal networks** should work collaboratively with local maternity system and maternity and neonatal safety collaborative colleagues (or their equivalents in Scotland and Wales) to understand the themes emerging from the ATAIN project and to assist their units in reducing unnecessary separation of the mother and her term baby.

46. **The NNAP** should seek to present the number of admissions and separation days alongside the number of births in each gestational age category.

Full 2017 results for Minimising inappropriate separation of mother and baby and a description of the measure are found on pages 127 and 131.

2.13. Breastmilk feeding at discharge home

Premature babies are vulnerable to infection, and their own mother's milk provides an important line of defence through the protective antibodies that it provides. These significant health benefits include a reduction in infection and bowel problems, as well as improved longer-term health and neurodevelopmental outcomes.

Key findings

- Only half (6,418, 57%) of the 11,282 babies born at less than 33 weeks gestational age cared for in NNAP units were analysed for this audit measure. Most excluded babies were transferred away from their unit of birth.
- Six out of 10 (60.5%) babies were getting some breast milk at discharge but the rate of breastmilk feeding at discharge has improved only marginally over time (2016 – 59%, 2015 – 58%) *(Table 5.16.3, page 137)*.
- At unit level there is marked variation in breast milk feeding rates at discharge for the most preterm babies, with NICUs ranging from 32.6% to 89.7% (NNAP Online).
- There is also marked network variation (48.6% to 87.8%), with networks in the north and west of the country generally having lower rates of breast milk feeding at discharge *(Table 5.16.2, page 136)*. This is broadly in keeping with feeding practices for more mature babies not admitted to neonatal units.[13]

Recommendations

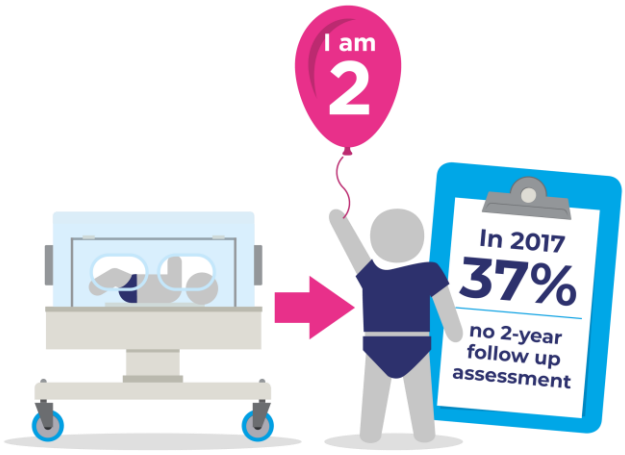
47. **Neonatal units** should use these data, alongside available data concerning breastfeeding practices in non-admitted babies in their local area, to inform local quality improvement activity aiming to improve rates of breastmilk feeding. Neonatal units can use The Baby Friendly Initiative (UNICEF)[14] and the Bliss Baby Charter[8] to support this activity.

48. **The NNAP** should develop a measure of early breastmilk feeding.

Full 2017 results for Breastmilk feeding at discharge home and a description of the measure are found on page 134.

2.14. Follow-up at two years of age

It is important that the development of very preterm babies is monitored by a paediatrician or neonatologist after the baby is discharged from the neonatal unit. This measure looks at whether there is a documented follow up consultation at two years of age for babies born at less than 30 weeks gestational age between July 2014 and June 2015 who survived and were discharged home from the neonatal unit. The follow up consultation assesses whether there are any significant problems with movement, the senses, and whether there are delays in development or other health problems. Babies born very early encounter these problems more often than those born at full term and it is important for those involved in the care of babies to know how the babies are developing as they get older so that they can arrange appropriate treatment.



Key findings

- Almost two in five (37.4%) of 4,043 babies born at less than 30 weeks gestational age between July 2014 and June 2015 were not recorded as having been seen for a follow up assessment at two years of age, despite the service specification and longstanding concern about practice in this area *(Table 5.17.1, page 140).*
- The proportion of babies documented as having been followed up at two years has increased only marginally since 2015 (2013 – 44.8%; 2014 – 54.5%; 2015 – 60%; 2016 – 60.9%; 2017 – 62.6%) *(Table 5.17.3, page 141).*
- Some units achieved good levels of follow up: 23 out of 45 units with more than 30 babies to follow up saw 70% or more of their babies. No network saw more than

three quarters of their babies, but one network saw fewer than half its babies *(NNAP Online and Table 5.17.2, page 140).*

- Six units achieved follow up of 100% of babies attributed to their units – three of these units had more than 10 babies to follow up. Forty-two units achieved follow up of 80% or more of the babies attributed to their units. Of these 35 had more than 10 babies to follow up *(NNAP Online).*

Recommendations

49. **Neonatal units and networks** should adopt the NICE guideline on Developmental follow-up of children and young people born preterm,[33] and make progress with the implementation of pathways across organisational structures (e.g. Sustainability and transformation plan footprints in England). This requires a multidisciplinary, whole health economy approach.

50. **Neonatal units** with incomplete data capture should ensure that they have the processes in place to document follow up at two years of age.

51. **Neonatal units** should discuss arrangements for two-year follow up with families prior to discharge home of their baby, supported by written communication which includes the expected timeframe for the follow up consultation.

Full 2017 results for Follow-up at two years of age and a description of the measure are found on page 138.

3. Methods

3.1. Audit measures and measure development

The NNAP is responsive to changes in guidance and standards and to the needs of its stakeholders. It has an established process for developing new audit measures and reviewing and revising existing measures where necessary.

New measures are developed in the NNAP in response to a need identified by audit users, attendees at the annual NNAP/NDAU Collaborators Meeting, professional organisations, parent support organisations, neonatal networks, national initiatives or members of the NNAP Methodology and Dataset Group and Project Board.

As part of the development process, the proposal is reviewed to ensure that it aligns with existing activities and initiatives in neonatology, and with any relevant standards or guidelines. The measure is then developed by the NNAP Project Team and Methodology and Dataset Group in consultation with key stakeholders, before a final review and approval by the NNAP Project Board. Participating units are notified of any new or amended measures ahead of the start of the data collection period in which they will be used for the first time.

In July 2017, the Methodology and Dataset Group conducted a review of measures against current standards and guidelines and against potential for quality improvement. After this review, some measures were clarified or adjusted in line with the current evidence base, before inclusion in the set of measures for 2018 data. A review of measures to be included in the audit for the 2019 data year is currently underway.

3.2. Case ascertainment

Data for the NNAP analyses are extracted from the National Neonatal Research Database (NNRD) held at the Neonatal Data Analysis Unit (NDAU). The NNRD contains a predefined set of variables (the National Neonatal Dataset) obtained from the electronic neonatal patient records of each participating NHS Trust. Data are downloaded from the BadgerNet patient record system used in neonatal units and transferred to NDAU with health board and trust Caldicott Guardian approval. For Scotland a separate approval was received from the Public Benefit and Privacy Panel for health and social care.

In usual practice, every baby admitted to a participating neonatal unit entered on the BadgerNet patient record system, and is eligible for inclusion in NNAP; the audit therefore achieves 100% case ascertainment in the participating organisations. Babies receiving special care in transitional care areas or postnatal wards can also be entered, but it is known that some units do not enter data for such babies and for this reason measures do not concentrate on care outside neonatal units.

For most audit measures in this report, the cohort comprises all babies with a final discharge from neonatal care from 1 January to 31 December 2017. There are some exceptions to this; Encephalopathy and Minimising inappropriate separation of mother and baby (term and late preterm) measures use birth year, and Follow-up at two years of age comprises babies born between July 2014 and June 2015.

3.3. Data quality and completeness

For the 2017 data, quarterly reports were produced by the NNAP project team and disseminated to all neonatal unit NNAP clinical leads to provide regular updates on their data completeness and adherence to the NNAP standards. All neonatal units were provided with a summary report of their 2017 data in January 2018 after which they were given a final six-week window of opportunity to review and amend their 2017 data on the BadgerNet system. The final 2017 data download for this report was extracted from BadgerNet after the reviewing process had closed at the end of March 2018.

In the 2017 data report, we report outlier analysis and main report measures using a “no imputation” approach. By this we mean that rates of adherence to standards, or rates of clinical outcomes are described for the babies where the outcome is known. Numbers of patients with an outcome are included under “with outcome” in results tables. Missing data are also presented in results tables alongside clinical data.

3.4. Babies included in the 2017 dataset

The 2017 download included data on care provided for 104,183 babies with final discharge from neonatal care in 2017. The number of babies eligible for each audit question varies depending on the gestational age covered by the audit measure and the episode of care under consideration.

In addition, numerators may differ from the figures extracted locally; for example, in the analysis of the audit measure Consultation with parents some babies born, first admitted and discharged in 2017 do not appear in the analysis if they had a subsequent episode that continued into 2018.

Similarly, babies with episodes spanning years 2016 and 2017 were included in the data for year 2017. The NDAU conducts NNAP analyses using the age of the baby in minutes from birth, as opposed to calendar days to enhance patient anonymity. This can result in minor variations in the numerators for age critical fields, such as the timing of ROP screening.

A data cleaning and validation process is applied to the raw dataset before creation of the NNAP dataset that is used to produce the data included in this report. That process includes:

- Checking the providers included in the dataset against a master list to identify new providers.
- Removal of episodes which are complete duplicates or do not have birth year and gestation at birth or admission times entered.
- Only babies who were finally discharged in the NNAP reporting year of interest are kept in the NNAP dataset. The exception to this dataset is the cohort used for the Encephalopathy measure, this dataset is based on those babies with a birth year in the NNAP reporting year of interest.

3.5. Denominator data: live births

To support the analysis and interpretation of some of the audit measures, the NNAP has sought to use data on the number of live births at each hospital in England, Wales and Scotland. These data are not available at hospital level in England and Wales, and are not yet available at trust level for the calendar year 2017. Although these data are available for Scotland, we use 2016 data aggregated to trust or health board as a denominator for the Encephalopathy measure. These data from MBRRACE-UK for England and Wales, and from the Scottish Birth Record (managed by the Information Services Division) for Scotland. Next year, live birth data will be used to support the interpretation of the Minimising separation of mother and baby measures.

3.6. Outlier methodology and identification process

The NNAP selects measures for outlier analysis when data collection is mature and where identifying variation is likely to be useful for quality improvement purposes. Benchmarking is typically applied to new measures and where is a lack of a nationally agreed guideline or standard.

The NNAP manages outlier status in line with the RCPCH policy for the *Detection and Management of Outlier Status for Clinical Indicators.*[15] The RCPCH has agreed analytical models for identifying outliers as part of the statistical and analytical plan for each audit, but as a general principle the College bases the actions regarding outliers upon the HQIP 2017 guidance for management of outliers, *Detection and management of outliers for National Clinical Audits*.[16]

For more information about the methodology used for the detection of outliers, refer to the NNAP Statistical Analysis Plan for 2017 data: www.rcpch.ac.uk/nnap.

3.7. Longitudinal analysis

This year, for the first time, NNAP is assessing the difference in performance on a range of audit measures over time. The change between two years is measured by the difference of the rates of compliance. Outliers among these changes, either exceptional reductions or improvements, are identified by the established methods and can be identified on NNAP Online. In the audit of 2017 data, comparisons are made for pairs of years 2016-2017 and 2015-2017.

For more information about the methodology used for longitudinal outlier analysis, refer to the NNAP Statistical Analysis Plan for 2017 data: www.rcpch.ac.uk/nnap.

3.8. Risk adjustment for bronchopulmonary dysplasia (BPD) or death

Risk adjustment for the combined outcome of BPD or death was conducted by comparing the prevalence of BPD or death in each unit and network with the prevalence of BPD in a set of babies with very similar background characteristics that were treated in the whole domain of the NNAP. The matching was conducted for an extensive set of background variables extracted from the NNRD.

The output of the matching method is a “treatment effect”. Treatment effect is the difference between the rate of BPD or death in babies cared for in a neonatal network compared to the observed rate for a matched group of babies with very similar case mix, cared for in all neonatal units. A positive treatment effect indicates that the rate of BPD or death is higher in the network of interest than for a comparable group of babies cared for in all neonatal units.

For more information about the methodology used for the matching method of BPD analysis, refer to Appendix E: Matching method of comparing outcomes for BPD and the NNAP Statistical Analysis Plan for 2017 data: www.rcpch.ac.uk/nnap.

3.9. Mortality reporting: Mortality to discharge in very preterm babies

Beginning in 2017, NNAP has been collecting data on mortality in very preterm babies. We will report mortality in babies born at 24-31 weeks gestational age with the first full three year rolling period being 2017-2019. Units are asked to report deaths in the usual way, but in addition deaths occurring before discharge home in babies of less than 44 weeks gestationally corrected age should be reported via BadgerNet, even if they occur in a non NNAP unit, or occur in a palliative care environment. Mortality will be reported only by network of birth.

For the full definition of this measure, please refer to the NNAP 2018 measures guide: https://www.rcpch.ac.uk/work-we-do/quality-improvement-patient-safety/national-neonatal-audit-programme-nnap/about.

3.10. Neonatal unit designations

We use the *Toolkit for High Quality Neonatal Services* (Department of Health, 2009) to define different levels of neonatal unit as follows:

Special care units (SCUs) provide special care for their own local population. Depending on arrangements within their neonatal network, they may also provide some high dependency services. In addition, SCUs provide a stabilisation facility for babies who need to be transferred to a neonatal intensive care unit (NICU) for intensive or high dependency care, and they also receive transfers from other network units for continuing special care.

Local neonatal units (LNUs) provide neonatal care for their own catchment population, except for the sickest babies. They provide all categories of neonatal care, but they transfer babies who require complex or longer-term intensive care to a NICU, as they are not staffed to provide longer-term intensive care. Most babies over 27 weeks gestational age will usually receive their full care, including short periods of intensive care, within their LNU. Some networks have agreed variations on this policy, due to local requirements. Some LNUs provide high dependency care and short periods of intensive care for their network population. LNUs may receive transfers from other neonatal services in the network, if these fall within their agreed work pattern.

Neonatal intensive care units (NICUs) are sited alongside specialist obstetric and feto-maternal medicine services, and provide the whole range of medical neonatal care for their local population, along with additional care for babies and their families referred from the neonatal network. Many NICUs are co-located with neonatal surgery services and other specialised services. Medical staff in a NICU should have no clinical responsibilities outside the neonatal and maternity services.

3.11. Neonatal network designations

Neonatal networks are designed to support the delivery of high quality neonatal care in their region for all their population. They ensure that mothers and babies are treated in a hospital appropriate to their needs.

In this report, we present data by neonatal Operational Delivery Network (ODN) in England. The Wales Neonatal Network comprises all neonatal units in Wales. In Scotland, there are currently three Managed Clinical Networks (MCN); West of Scotland, South East and Tayside, and North of Scotland. In line with recommendations made in *The Best Start: A Five-Year Forward Plan for Maternity and Neonatal Care in Scotland,*[17] Scotland will shortly be moving to a single neonatal network; pending this, and in agreement with the three existing networks, the NNAP reports Scottish unit data as a single network.

Where there is a change in network configuration, unit name or unit level, the NNAP will apply the status as at the end of the data reporting year. For example, if the configuration of a network changes on 1 April 2018, 2018 data will be presented as per the network configuration on 31 December 2018.

4. Case studies: how NNAP supports local quality improvement

4.1. Think magnesium! A multidisciplinary approach to improve magnesium sulphate uptake

Presented by

Dr Sankara Narayanan (Consultant Neonatologist & NNAP lead)[1],
Dr Anastasia Katana (Locum Consultant Neonatologist)[1],
Ms Nanda Shetty (Consultant Obstetrician)[2],
Ms Marcellina Coker (Consultant Obstetrician)[2]

Neonatal[1] & Obstetrics[2] Department, Watford General Hospital, West Hertfordshire NHS Trust

Background

Research has shown that magnesium sulphate ($MgSO_4$), given antenatally in threatened preterm labour, is neuroprotective and reduces cerebral palsy. Watford General Hospital was an outlier for this audit measure in the 2017 NNAP report (2016 data). In this case study, we demonstrate how we have used NNAP antenatal $MgSO_4$ data to guide our quality improvement in $MgSO_4$ uptake.

Our improvement plan

Our improvement journey started in 2016, when we became aware that our neonatal service was an outlier for antenatal magnesium sulphate ($MgSO_4$) administration with an uptake approximately 20%, which was far below the national average (43%).

Strategy for change:

Using the Institute of Healthcare Improvement (IHI) model we aimed to increase the uptake of $MgSO_4$ in eligible preterm deliveries. Improvement was defined as an increase in the uptake of $MgSO_4$ from 15% in 2016 to 40%, hence reaching the then national average.

Primary, secondary drivers were identified which informed change ideas. These changes were tested in iterative plan, do, study, act (PDSA) cycles.

What we did:

Figure 4.1.1: Driver Diagram

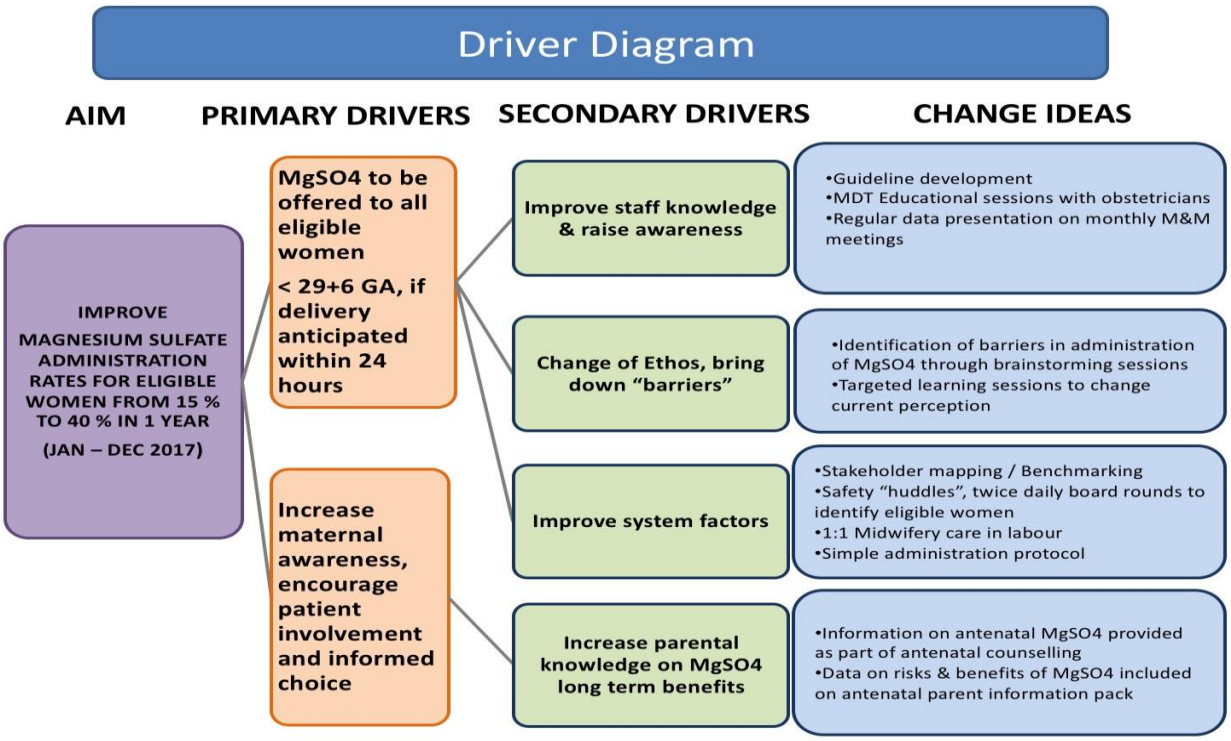
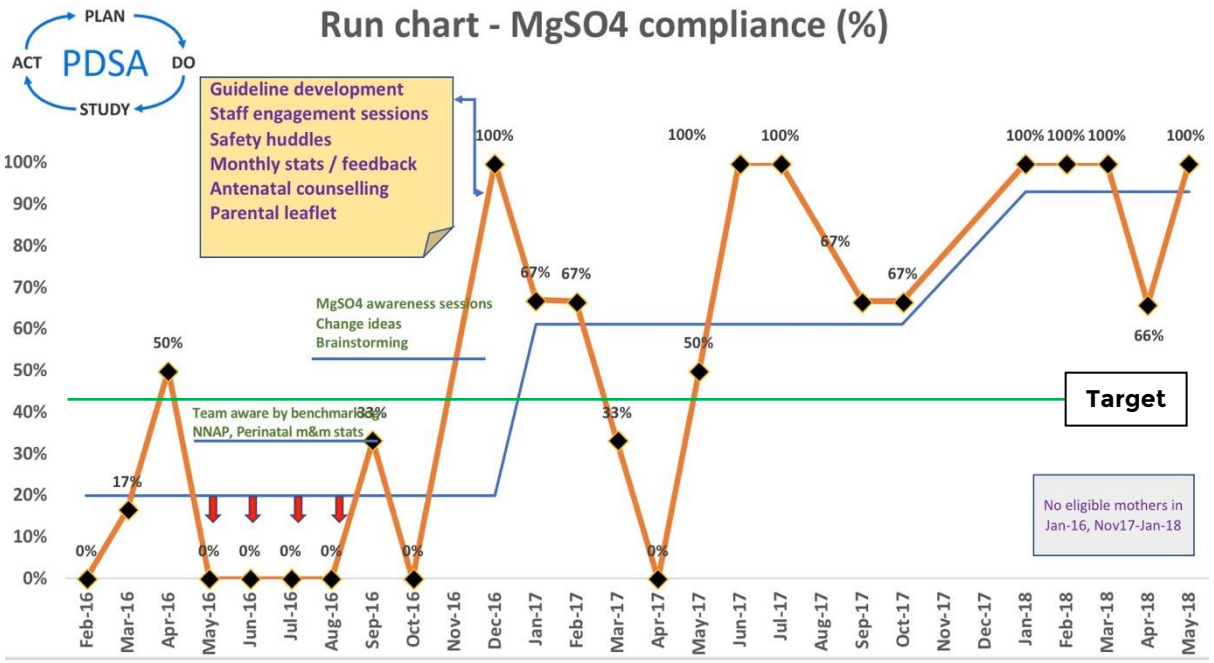


Figure 4.1.2: Compliance to Magnesium Sulphate Administration – Run chart



Change package:

We have increased awareness amongst the neonatal, obstetric and midwifery teams by presenting run chart data (Figure 2) in monthly Perinatal Mortality and Morbidity meetings. We commenced frequent bitesize $MgSO_4$ awareness and engagement sessions with all the stakeholders. A new and simple guideline for $MgSO_4$ administration was developed and implemented and we encouraged 1:1 midwifery care in labour. Safety "huddles", twice daily board rounds, were introduced to identify all eligible women. Additionally, we involved the service users, by providing them with a parental information leaflet with the antenatal counselling pack and $MgSO_4$ information were included in the antenatal counselling conversations and golden hour care checklist.

Challenges:

The main challenge was to change staff's ethos and perceptions, bring down the "barriers" and move away from the culture "this is how we do it for years and it works for our patients". We achieved this by enhancing communication and knowledge sharing through safety huddles, identifying clinical champions to support the team, presentations in joint multidisciplinary team forums and empowering ward level leadership. Encouraging parent involvement raised further awareness of this important neuroprotective treatment.

Outcomes

Table 4.1.1: Antenatal $MgSO_4$ administration annual uptake

Level 2 Neonatal Unit			
Year	**Eligible mothers**	**$MgSO_4$ given**	**$MgSO_4$ not given**
2016	20	3 (15%)	17 (85%)
2017	18	10 (55%)	8 (44%)
Jan-May 2018	6	5 (83%)	1 (17 %)

According to the NNAP 2016 report only 15% of eligible women received antenatal $MgSO_4$ at Watford General Hospital, compared to a national average of 43%. Table 1 and Figure 2 shows steady improvement from 2016 to 2018 with the implementation of change ideas. The 2017 data show that we met and surpassed our improvement target achieving a compliance of 55%, well above the national average. The 2018 NNAP data shows further improvement and a sustainable change. This sustainable improvement has a direct impact on the long-term neurodevelopmental outcomes and by extension to the quality of life of preterm babies born at less than 30 weeks of gestation.

Top tips for implementation

- Identify an appropriate maternity-neonatal forum to share NNAP $MgSO_4$ data
- Identify and engage stakeholders and frontline champions within maternity and neonates
- Use live NNAP dashboard on BadgerNet to generate live run charts
- Partner with parents for improvement

Acknowledgements

Justine Chung, Matron, Delivery Suite, Bhavani Sivakumar, BadgerNet Data Analyst.

4.2. Improving Parental consultation within 24 hours of admission

Presented by

Dr Natasha Maddock, Consultant Neonatologist, The Royal Oldham Hospital

Mrs Beverley Scholes, NICU Data Quality Clerk, The Royal Oldham Hospital

Background

Communicating to families about their baby's progress is very important. When the services at The Royal Oldham Hospital were first developed into a level 3 NICU we made a big improvement increasing the percentage of parents spoken to from less than 50% to 86%; a level that was comparable with our peers and other level 3 units within the Network.

However, despite regular communication and reminders we had been unable to improve on the number of parents who were seen by a senior member of staff within 24 hours of admission. In 2014 we spoke to 84% and in 2015 86%. Whilst reviewing the 2016 data in February 2017 it became apparent that this had not improved despite there being a general improvement across the UK and I suspected we would be an outlier (which we were) so I put a plan in place to try and improve our documented communication.

Measures

We measured the percentage of parents spoken to for all patients that were admitted to the neonatal unit, not just those that fulfilled the NNAP criteria, and put them in a run chart.

Our improvement plan

In March 2017 I worked with our data quality clerk to devise a run chart that looked at the percentage of parents that were spoken to on a weekly basis. The clerk would check the BadgerNet data quality of all the babies admitted in the past week, and complete the spreadsheet. She would then print off the chart each week and display on the staff notice board.

For the first few months the results were mentioned at the communication meeting. Whilst this was officially anonymous, consultants could identify themselves as we attend the unit for a week.

My consultant colleagues agreed that we needed to improve and were happy to trial this. Once in place they requested that if a consultant spoke to 100% of parents that they would receive a gold star.

Outcomes

- Our 2017 results have improved to 94%.
- My consultant colleagues were very enthusiastic about this and worked hard to make sure it was successful. In fact they became very competitive and the gold star was their idea.
- Within a few months there was a definite attitude change with medical staff always including first consultation as part of the presentation of an admission.
- Despite less frequent updates, this improvement appears to have been sustained, although there is still room for improvement, particularly for those patients who remain on the unit for a short period of time or for an intervention.

Top tips for implementation

- You need a dedicated member of staff who can check the data and update the graph weekly.
- Consultants are amazingly competitive.

Acknowledgements

I thank the Clinical Lead at Arrowe Park, Dr Oliver Rackham, for sharing his project.

If you would like a copy of the spreadsheet used by The Royal Oldham Hospital to devise their run chart, please contact nnap@rcpch.ac.uk.

4.3. Data collection of antenatal steroids given

Presented by

Hazel Williams, NNEB, BadgerNet System Data Officer at Calderdale & Huddersfield Foundation Trust.

Background

- My main aim was to improve our rates of administration of antenatal steroids.
- Looking at our NNAP data for 2016, our rate for administration had dropped to 81% (from 93% in 2015). I wanted to see what had caused this change.

Measures

I planned to measure the improvement by comparing our 2017 data.

Our improvement plan

Firstly, I questioned what changes could have had an impact on our practice. The main change in our trust was that our maternity system had moved from our old PAS system to Athena (run by K2), and the maternity team had gone paperless.

We requested and established an interface between Athena and BadgerNet to pull the maternity details through for the baby admission when Athena replaced our old system. This has been working well, but the Athena system did not have a set place to record when steroids had been given. Information was being missed as it was being documented in various places not always obvious to neonatal staff.

Once this was realised, working with the maternity electronic patient record (EPR) midwives, we added a separate tab in Athena to capture that steroids had been given, the courses and the dates and times.

The next issue was to re-educate staff to document in the designated tab. Documentation was reviewed on a weekly basis and staff were notified by email of any errors relating to missing details.

At the same time, we notified the obstetric team of babies who did not have steroids documented so they could review why.

Outcomes

Our expected NNAP results indicate that we are up to 94.5% antenatal steroid administration for 2017, which is an excellent achievement. Our next project is to develop a tab within Athena to record administration of magnesium sulphate neuro protection, again this will also be beneficial for the maternity team.

Top tips for implementation

- Meet with maternity staff to discuss how they work with their EPR systems
- Keep in touch with the maternity team, things change for them too in practice and EPR.
- Find a "named" person in your IT department to work with who understands what you want to achieve.

Acknowledgements

- K2 and Clevermed, who were very helpful in assisting us with interfacing and testing of the system. The IT department at Calderdale.
- Emma Hardwidge and Carol Gregson, Maternity EPR Midwifes at Calderdale, who have assisted throughout.

5. Full NNAP results

In this section, we present the full results, attributed by unit level and by network, for each of the NNAP measures.

For each measure, we include:

- NNAP audit measure
- Change to audit measure for the 2017 data year
- NNAP standard and source of standard
- Whether outlier analysis will be conducted
- Inclusion criteria
- Results

For individual unit-level results, please go to NNAP Online.

Data completeness

Data completeness within the NNAP is good. Missing data are negligible for the measures Temperature, Bronchopulmonary dysplasia and Breastmilk feeding at discharge home. For Antenatal steroids, missing data are small at 1.5%, but have increased from 1.1% in 2016. Missing data for first consultation has also improved in the past year, but remains non-trivial at 2.7% (2016 - 3.6%).

Average rates of missing data by unit are given in Appendix A: Data completeness and unit level of participating units. Thirty-six units (20.1%) have average rates of missing data above 10%, and five units (2.8%) have rates above 20%. Aggregate rates of missing data are dominated by missing data for the Magnesium sulphate measure (2017 – 7.7%; 2016 – 18.8%).

5.1. Antenatal steroids

Babies born at less than 35 weeks gestational age sometimes have breathing difficulties in the first few days after they are born. Antenatal steroids are a powerful health intervention, given to mothers by obstetricians and midwives before delivery of a preterm baby to help reduce breathing difficulties (respiratory distress syndrome) and make other serious complications such as bleeding into the brain less likely.

The key findings and recommendations for this audit measure are found on page 24.

NNAP audit measure

Is a mother who delivers a baby between 24 and 34 weeks gestational age inclusive given at least one dose of antenatal steroids?

Change to the audit measure for the 2017 data year: None.

From the 2018 data year, in line with NICE guidance, the NNAP measure will be amended to include babies at 23 weeks gestational age and exclude babies at 34 weeks gestational age.[18],[19],[20],[21]

As noted in the Key findings and recommendations section, the NNAP will work with NMPA to consider whether antenatal steroid administration might best be audited within the NMPA in order that the administration of antenatal steroids to women who do not go on to deliver preterm can ultimately form part of the audit, and because the NMPA may have higher visibility among maternity caregivers. For this to function optimally, data on antenatal steroid administration should be collected as part of routine maternity data.

NNAP standard

Eighty-five percent (85%) of mothers should receive at least one dose of antenatal steroids.

Source of standard: NNAP Project Board

Outlier analysis: Yes

Inclusion criteria

Mothers of babies who meet the following criteria will be included in the analysis:

- Admitted for neonatal care
- Experienced their final neonatal discharge in the calendar year of analysis
- Had care provided by an NNAP unit
- Gestational age at birth between 24 and 34 weeks inclusive
- Only data from the first known episode of care will be considered for analysis
- For multiple births, only one baby will be included so that each mother is only counted once per delivery

Results

18,965 eligible mothers were identified from data submitted for **21,661** babies by **179** neonatal units in England, Scotland and Wales and **33** places of birth not allied with an NNAP participating unit. Records for **67** babies were excluded from analysis because their data lacked sufficient detail to identify their mother.

At least one dose of antenatal steroids was administered to **88.6%** of eligible mothers and no dose was administered to **11.4%** of these mothers.

If the mother delivered at home, in transit, in an unknown location or in a maternity unit not allied to a NNAP participating unit, these results are not shown in Table 5.1.1. These cases are included in the network level Table 5.1.2. under 'Other' ODN.

There is **1.5%** missing data and only four hospitals have missing data of over 10%. The number of eligible mothers in these four hospitals ranged from 12 to 63.

Table 5.1.1: Administration of antenatal steroids, by neonatal unit level.

Mothers with babies in neonatal units participating in NNAP; deliveries at the gestational age of between 24 and 34 weeks, inclusive.

NNU level	NNU	Mothers	With outcome	Administration of antenatal steroids		*Missing data (%)*
				Yes (%)	No (%)	
SCU	37	1,736	1,690	1,489 (88.1%)	201 (11.9%)	46 (2.6%)
LNU	88	7,998	7,902	7,043 (89.1%)	859 (10.9%)	96 (1.2%)
NICU	54	8,912	8,782	7,873 (89.6%)	909 (10.4%)	130 (1.5%)
Total	**179**	**18,646**	**18,374**	**16,405 (89.3%)**	**1,969 (10.7%)**	***272 (1.5%)***

Figure 5.1.1: Caterpillar plot of the rates of administration of antenatal steroids; neonatal units.

Rates of administration of antenatal steroids are presented by dots, and 95% confidence intervals by vertical bars. The units are presented in the ascending order of the rates. The units can be identified in NNAP Online.

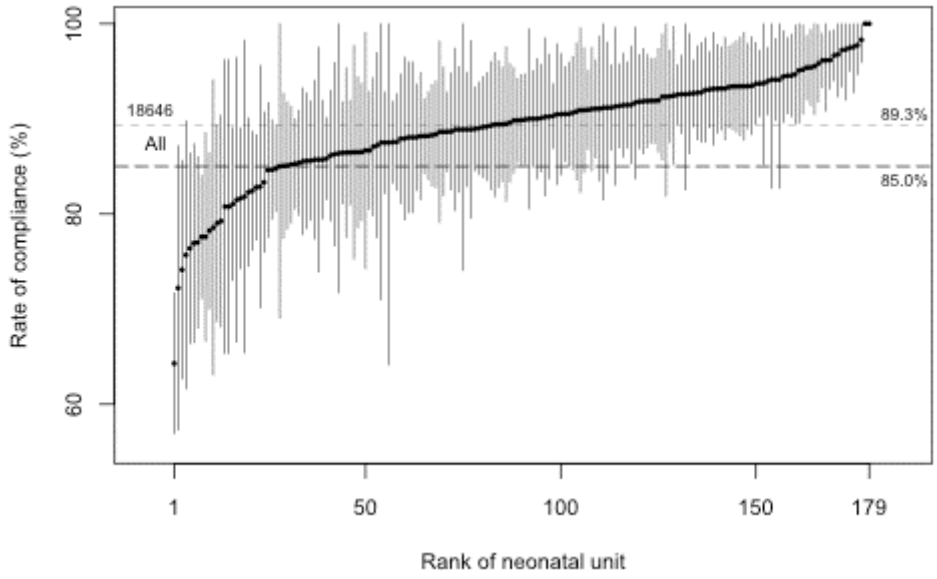


Table 5.1.2: Administration of antenatal steroids, by neonatal network.

Mothers with babies in neonatal units participating in NNAP; deliveries at the gestational age of between 24 and 34 weeks, inclusive.

Network	Mothers	With outcome	Administration of antenatal steroids		*Missing data (%)*
			Yes (%)	No (%)	
East of England Neonatal ODN	1,664	1,639	1,463 (89.3%)	176 (10.7%)	*25 (1.5%)*
Midlands South West Newborn Neonatal ODN	845	818	711 (86.9%)	107 (13.1%)	*27 (3.2%)*
North Central & North East London Neonatal ODN	1,320	1,294	1,150 (88.9%)	144 (11.1%)	*26 (2%)*
North West London Neonatal ODN	770	768	719 (93.6%)	49 (6.4%)	*2 (0.3%)*
North West Neonatal ODN	2,323	2,278	2,068 (90.8%)	210 (9.2%)	*45 (1.9%)*
Northern Neonatal ODN	747	734	642 (87.5%)	92 (12.5%)	*13 (1.7%)*
Scotland	1,203	1,188	1,098 (92.4%)	90 (7.6%)	*15 (1.2%)*
South East Coast Neonatal ODN	1,354	1,343	1,195 (89%)	148 (11%)	*11 (0.8%)*
South London Neonatal ODN	1,053	1,021	871 (85.3%)	150 (14.7%)	*32 (3%)*
South West Neonatal ODN	1,189	1,174	1,020 (86.9%)	154 (13.1%)	*15 (1.3%)*
Staffordshire, Shropshire and Black Country Neonatal ODN	668	663	596 (89.9%)	67 (10.1%)	*5 (0.7%)*
Thames Valley & Wessex ODN	1,396	1,391	1,249 (89.8%)	142 (10.2%)	*5 (0.4%)*
Trent Perinatal & Central Newborn Neonatal ODN	1,517	1,489	1,320 (88.7%)	169 (11.3%)	*28 (1.8%)*
Wales	760	748	688 (92%)	60 (8%)	*12 (1.6%)*
Yorkshire & Humber Neonatal ODN	1,819	1,808	1,599 (88.4%)	209 (11.6%)	*11 (0.6%)*
Isle of Man	18	18	16 (88.9%)	2 (11.1%)	*0 (0%)*
Other	319	299	145 (48.5%)	154 (51.5%)	*20 (6.3%)*
Total	**18,965**	**18,673**	**16,550 (88.6%)**	**2,123 (11.4%)**	***292 (1.5%)***

Figure 5.1.2: Caterpillar plot of the rates of administration of antenatal steroids; neonatal networks.

Rates of administration of antenatal steroids are presented by black dots and the 95% confidence intervals are indicated by vertical bars. The networks are presented in the ascending order of the rates.

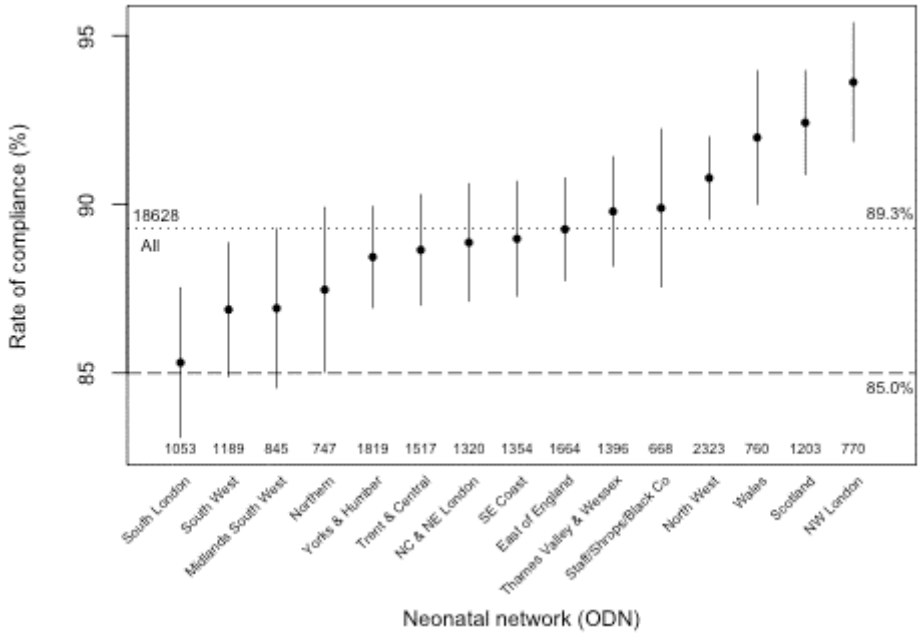


Table 5.1.3: Administration of antenatal steroids, by NNAP reporting year (2008 to 2017).

NNAP year	NNU	Mothers	With outcome	Administration of antenatal steroids		*Missing data (%)*
				Yes (%)	No (%)	
2008	129	9,066	6,391	5,744 (89.9%)	647 (10.1%)	*2,675 (29.5%)*
2009	167	16,031	14,861	11,228 (75.6%)	3,633 (24.4%)	*1,170 (7.3%)*
2010	173	17,199	16,577	12,911 (77.9%)	3,666 (22.1%)	*622 (3.6%)*
2011	164	15,716	15,201	12,009 (79%)	3,192 (21%)	*515 (3.3%)*
2012	173	16,538	16,193	13,285 (82%)	2,908 (18%)	*345 (2.1%)*
2013	176	16,992	16,776	14,142 (84.3%)	2,634 (15.7%)	*216 (1.3%)*
2014	173	17,170	17,025	14,517 (85.3%)	2,508 (14.7%)	*145 (0.8%)*
2015	179	18,687	18,550	15,910 (85.8%)	2,640 (14.2%)	*137 (0.7%)*
2016	181	18,947	18,735	16,317 (87.1%)	2,418 (12.9%)	*212 (1.1%)*
2017	179	18,965	18,673	16,550 (88.6%)	2,123 (11.4%)	*292 (1.5%)*

5.2. Antenatal magnesium sulphate

Giving magnesium sulphate to women who are at risk of delivering a preterm baby reduces by 32% the chance that their baby will develop cerebral palsy.[22] The NICE quality standard *Preterm Labour and Birth* recommends that all women that may deliver their baby at less than 30 weeks gestational age are offered magnesium sulphate where possible.[18]

The key findings and recommendations for this audit measure are found on page 26.

NNAP audit measure

Is a mother who delivers a baby below 30 weeks gestational age given magnesium sulphate in the 24 hours prior to delivery?

Change to the audit measure for the 2017 data year: None.

As noted in the Key findings and recommendations section, the NNAP will work with NMPA to consider whether antenatal magnesium sulphate administration might best be audited within the NMPA, in part because NMPA findings may have higher visibility among maternity caregivers. Inclusion of data collection about magnesium administration in routine datasets is therefore a key priority.

NNAP standard

Benchmarking

Inclusion criteria

Mothers of babies who met the following criteria were included for analysis:

- Final neonatal discharge in the calendar year of analysis
- Had care provided by an NNAP unit
- Gestational age at birth less than 30 weeks
- Only the first known episode of care will be considered for analysis
- For multiple births, only one baby will be included so that each mother is only counted once per delivery.

Results

There were **4,276** eligible mothers identified from data submitted for **4,843** babies by **176** neonatal units in England, Scotland and Wales and **20** places of birth not allied with an NNAP participating unit. Records for **16** babies were excluded from analysis because their data lacked sufficient detail to identify their mother.

Magnesium sulphate was administered to **64.1%** of eligible mothers and no dose was administered to the remaining **35.9%**. **8.0%** of cases had missing or unknown magnesium sulphate data.

Almost half of units had no missing data for this measure, but 24 units have more than 25% missing data, and 8 units had more than 50% missing data. Missing data has markedly decreased since 2016 (2016 17.4%; 2017 8%, 323 babies).

If the mother delivered at home, in transit, in an unknown location or in a maternity unit not allied to a NNAP participating unit, these results are not shown in Table 5.2.1. These cases are included in the network level Table 5.2.2 under 'Other' network.

Table 5.2.1: Administration of magnesium sulphate, by neonatal unit level.

Mothers with babies in neonatal units participating in NNAP; deliveries at the gestational age of less than 30 weeks.

NNU level	NNU	Mothers	With outcome	Administration of magnesium sulphate		Missing data (%)
				Yes (%)	No (%)	
SCU	34	160	135	51 (37.8%)	84 (62.2%)	25 (15.6%)
LNU	88	1317	1213	687 (56.6%)	526 (43.4%)	104 (7.9%)
NICU	54	2700	2506	1768 (70.6%)	738 (29.4%)	194 (7.2%)
Total	**176**	**4177**	**3854**	**2,506 (65%)**	**1,348 (35%)**	**323 (7.7%)**

Figure 5.2.1: Caterpillar plot of the rates of compliance for administration of magnesium sulphate; neonatal units.

Rates of administration of magnesium sulphate are presented by black dots and the 95% confidence intervals by vertical bars. The units are presented in the ascending order of the rates. The units can be identified in NNAP Online.

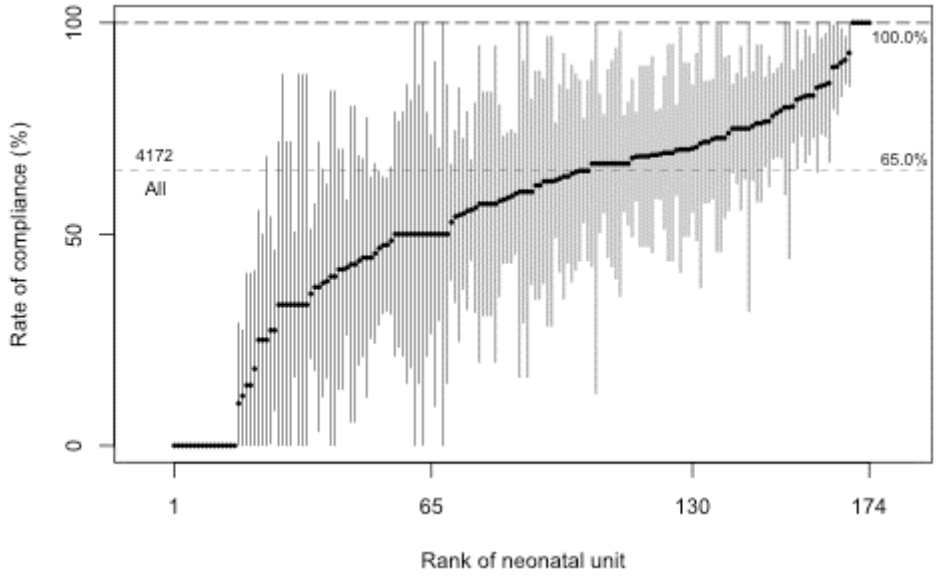


Table 5.2.2: Administration of magnesium sulphate, by neonatal network.

Mothers with babies in neonatal units participating in NNAP; deliveries at the gestational age of less than 30 weeks.

Network	Mothers	With outcome	Administration of magnesium sulphate		*Missing data (%)*
			Yes (%)	No (%)	
East of England Neonatal ODN	318	305	185 (60.7%)	120 (39.3%)	13 (4.1%)
Midlands South West Newborn Neonatal ODN	207	163	84 (51.5%)	79 (48.5%)	44 (21.3%)
North Central & North East London Neonatal ODN	289	262	169 (64.5%)	93 (35.5%)	27 (9.3%)
North West London Neonatal ODN	181	158	103 (65.2%)	55 (34.8%)	23 (12.7%)
North West Neonatal ODN	535	490	345 (70.4%)	145 (29.6%)	45 (8.4%)
Northern Neonatal ODN	145	116	74 (63.8%)	42 (36.2%)	29 (20%)
Scotland	234	220	142 (64.5%)	78 (35.3%)	14 (6.0%)
South East Coast Neonatal ODN	295	284	186 (65.5%)	98 (34.5%)	11 (3.7%)
South London Neonatal ODN	296	276	190 (68.8%)	86 (31.2%)	20 (6.8%)
South West Neonatal ODN	255	244	180 (73.8%)	64 (26.2%)	11 (4.3%)
Staffordshire, Shropshire and Black Country Neonatal ODN	161	151	74 (49%)	77 (51%)	10 (6.2%)
Thames Valley & Wessex ODN	366	354	279 (78.8%)	75 (21.2%)	12 (3.3%)
Trent Perinatal & Central Newborn Neonatal ODN	318	287	177 (61.7%)	110 (38.3%)	31 (9.7%)
Wales	172	155	93 (60%)	62 (40%)	17 (9.9%)
Yorkshire & Humber Neonatal ODN	411	395	229 (58%)	166 (42%)	16 (3.9%)
Isle of Man	1	1	0 (0%)	1 (100%)	*0 (0%)*
Other	92	74	12 (16.2%)	62 (83.8%)	*18 (19.6%)*
Total	**4276**	**3935**	**2,522 (64.1%)**	**1,413 (35.9%)**	***341 (8.0%)***

Figure 5.2.2: Caterpillar plot of the rates of compliance for administration of magnesium sulphate; neonatal networks.

Rates of administration of magnesium sulphate. The estimates are marked by black dots and the 95% confidence intervals are indicated by vertical bars. The networks are presented in the ascending order of the rates in 2017.

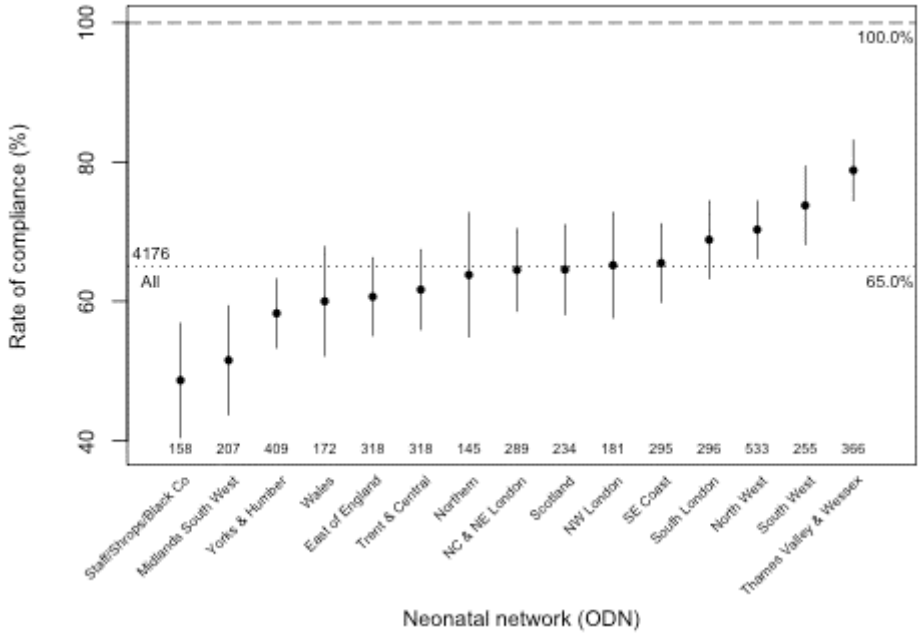


Table 5.2.3: Administration of antenatal magnesium sulphate, by NNAP reporting year (2016–2017)*.

NNAP Year	NNU	Mothers	With outcome	Administration of magnesium sulphate		Missing data (%)
				Yes (%)	No (%)	
2016	182	4,242	3,506	1,868 (53.3%)	1,638 (46.7%)	*736 (17.4%)*
2017	176	4,276	3,935	2,522 (64.1%)	1,413 (35.9%)	*341 (8%)*

*Results presented here for 2016 and 2017 are both calculated using the 2017 measure derivation method so that they are directly comparable.

5.3. Birth in a centre with a neonatal intensive care unit (NICU)

Babies who are born at less than 27 weeks gestational age are at high risk of death and serious illness. National recommendations in England state that neonatal networks should aim to configure and deliver services to increase the proportion of babies at this gestational age that are delivered in a hospital with a neonatal intensive care unit (NICU) on site.[23] This is because there is evidence that outcomes are improved if such immature babies are cared for in a NICU from birth.

The key findings and recommendations for this audit measure are found on page 28.

NNAP audit measure

Is an admitted baby born at less than 27 weeks gestational age delivered in a maternity service on the same site as a designated NICU?[24]

Change to the audit measure for the 2017 data year: New measure for 2017 data year.

NNAP standard

Benchmarking

Outlier analysis: Yes, at network level only.

Inclusion criteria

Babies were included for analysis if they meet the following criteria:

- Final neonatal discharge in the calendar year of analysis
- Had care provided by an NNAP unit
- Gestational age at birth of less than 27 weeks
- Only data from the first known episode of care will be considered for analysis
- For multiple births, only one baby will be included so that each mother is only counted once per delivery.

Results

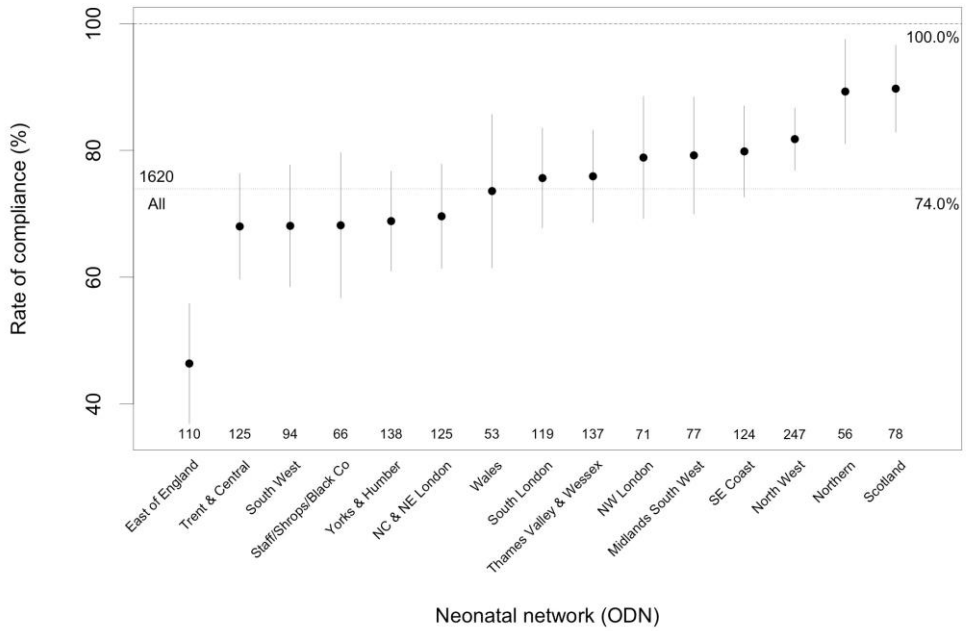
1,621 babies were born less than 27 weeks across units in England, Scotland and Wales. Of these **73.9%** were delivered appropriately in a hospital with a NICU on site.

There was no obvious correlation between workload of network and the proportion of babies delivered in a centre with a NICU *(Table 5.3.1)*.

Table 5.3.1: Delivery location of babies born at less than 27 weeks, by neonatal network

Network	Babies	Delivery location	
		Hospital with designated NICU (%)	Other (%)
East of England Neonatal ODN	110	51 (46.4%)	59 (53.6%)
Midlands South West Newborn Neonatal ODN	77	61 (79.2%)	16 (20.8%)
North Central & North East London Neonatal ODN	125	87 (69.6%)	38 (30.4%)
North West London Neonatal ODN	71	56 (78.9%)	15 (21.1%)
North West Neonatal ODN	247	202 (81.8%)	45 (18.2%)
Northern Neonatal ODN	56	50 (89.3%)	6 (10.7%)
Scotland	78	70 (89.7%)	8 (10.3%)
South East Coast Neonatal ODN	124	99 (79.8%)	25 (20.2%)
South London Neonatal ODN	119	90 (75.6%)	29 (2.4%)
South West Neonatal ODN	94	64 (68.1%)	30 (31.9%)
Staffordshire, Shropshire and Black Country Neonatal ODN	66	45 (68.2%)	21 (31.8%)
Thames Valley & Wessex ODN	137	104 (75.9%)	33 (24.1%)
Trent Perinatal & Central Newborn Neonatal ODN	125	85 (68%)	40 (32%)
Wales	53	39 (73.6%)	14 (26.4%)
Yorkshire & Humber Neonatal ODN	138	95 (68.8%)	43 (31.2%)
Isle of Man	1	0 (0%)	1 (100%)
Total	**1,621**	**1,198 (73.9%)**	**418.349 (26.1%)**

Figure 5.3.1: Caterpillar plot of the rates of compliance for Birth in a centre with a NICU; neonatal networks.



5.4. Promoting normal temperature on admission for very preterm babies

Low admission temperature has been associated with an increased risk of illness and death in preterm babies. Low temperature (or hypothermia) is a preventable condition in vulnerable newborn babies. Staff on the neonatal unit need to know if a baby is too cold so they can take appropriate action. This NNAP measure looks at how successful neonatal units are at achieving a normal first temperature (36.5°C to 37.5°C inclusive) within an hour of birth in very preterm babies (less than 32 weeks gestational age).

The key findings and recommendations for this audit measure are found on page 30.

NNAP audit measure

Does an admitted baby born at less than 32 weeks gestational age have its first measured temperature of 36.5–37.5°C within one hour of birth?

Change to the audit measure for the 2017 data year: Clarification that the standard relates to achievement of normal first temperature within an hour of birth.

NNAP standard

The temperature should be taken for at least 98% of babies. The composite measure of timeliness and normal temperature should be met for at least 90% of babies. It is recognised that this is an aspirational standard.

Source of standard: NNAP Project Board

Outlier analysis: Yes

Inclusion criteria

Babies were included for analysis if they met the following criteria:

- Gestational age at birth of less than 32 weeks
- Admitted to a neonatal unit within an hour of birth
- Final neonatal discharge in the calendar year of analysis

- Had care provided by an NNAP unit
- Only the first known episode of care will be considered for analysis

Results

8,019 babies were born at a gestational age of less than 32 weeks in **178** NNAP units and **10** places of birth not associated with an NNAP participating unit. For **22** babies (**0.3%**) temperature data was missing. Of the **7,997** babies with recorded outcomes, the temperature was taken on time and within a normal range for **5147** babies (**64.4%**), late for **239** (**3.0%**), and was not taken in **15** cases (**0.2%**).

In the following tables responses are assigned "Other" if the mother delivered at home, in transit, in an unknown location or in a non-NNAP unit.

LNUs and NICUs achieve similar levels of thermoregulation (SCUs 59.9%; LNUs 64.9%; NICUs 65.1%).

Table 5.4.1: Timeliness and normothermia, by neonatal unit level.

Temperature taken within one hour of birth (on time and within a normal range).

NNU level	NNU	Babies	With outcome	Temperature measurement							*Missing data (%)*
				On time (%)					Late	Not taken	
				< 32°C	32°C-35.9°C	36°C-36.4°C	36.5°C-37.5°C	> 37.5°C			
SCU	36	419	416	0	26 (6.3%)	81 (19.5%)	249 (59.9%)	42	17	1	*3 (0.7%)*
LNU	88	2,863	2,857	0	168 (5.9%)	457 (16%)	1,854 (64.9%)	293	76	9	*6 (0.2%)*
NICU	54	4,657	4,645	1	215 (4.6%)	619 (13.3%)	3,023 (65.1%)	643	139	5	*12 (0.3%)*
Other	-	80	79	1	35 (44.3%)	14 (17.7%)	21 (26.6%)	1	7	0	*1 (1.3%)*
Total	**178**	**8,019**	**7,997**	**2**	**444 (5.6%)**	**1,171 (14.6%)**	**5,147 (64.4%)**	**979 (12.2%)**	**239 (3.0%)**	**15 (0.2%)**	***22 (0.3%)***

Figure 5.4.1: Caterpillar plot of the rates of compliance for temperature on admission; neonatal units.

Rates of compliance with the standard for temperature on admission (on time and within a normal range). The estimated rates of compliance with the standard are marked by black

dots and the 95% confidence intervals by vertical bars. The units are presented in the ascending order of the rates. The units can be identified in NNAP Online.

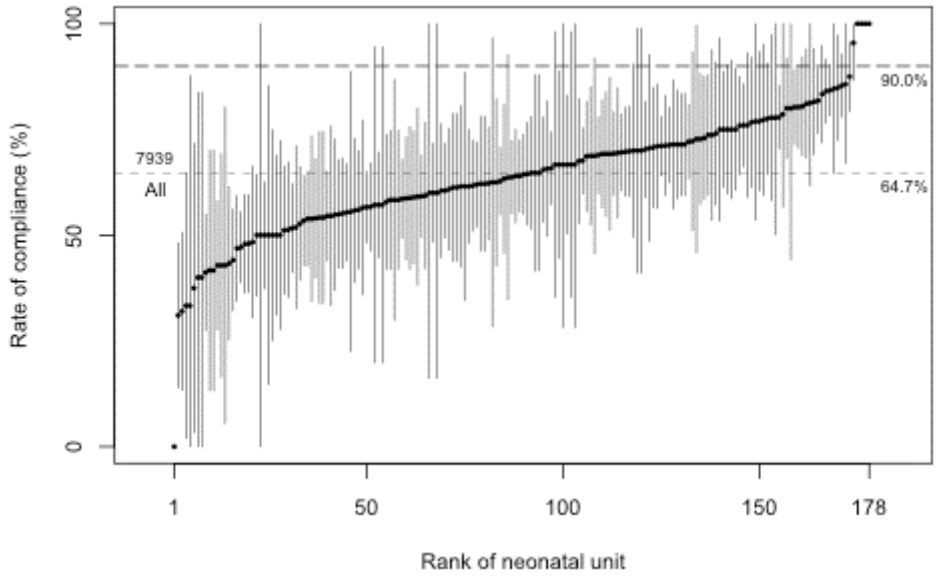


Table 5.4.2: Timeliness and normothermia, by neonatal network

Temperature taken within one hour of birth (on time and within a normal range).

Network	Babies	With outcome	Temperature measurement							*Missing data (%)*
			On time (%)					Late	Not taken	
			< 32°C	32°C-35.9°C	36°C-36.4°C	36.5°C-37.5°C (normothermia)	>37.5°C			
East of England Neonatal ODN	615	613	0	31	84 (13.7%)	425 (69.3%)	48 (7.8%)	23	2	2 (0.3%)
Midlands South West Newborn Neonatal ODN	357	356	0	38	57 (16%)	180 (50.6%)	56 (15.7%)	25	0	1 (0.3%)
North Central & North East London Neonatal ODN	554	552	0	50	111 (20.1%)	340 (61.6%)	37 (6.7%)	14	0	2 (0.4%)
North West London Neonatal ODN	341	339	0	10	38 (11.2%)	250 (73.7%)	31 (9.1%)	10	0	2 (0.6%)
North West Neonatal ODN	1,009	1,006	0	51	178 (17.7%)	604 (60%)	144 (14.3%)	25	4	3 (0.3%)
Northern Neonatal ODN	305	303	0	16	46 (15.2%)	198 (65.3%)	41 (13.5%)	2	0	2 (0.7%)
Scotland	460	459	0	26	52 (11.3%)	310 (67.5%)	57 (12.4%)	14	0	1 (0.2%)
South East Coast Neonatal ODN	576	575	1	36	86 (15%)	363 (63.1%)	83 (14.4%)	6	0	1 (0.2%)
South London Neonatal ODN	496	491	0	27	77 (15.7%)	302 (61.5%)	72 (14.7%)	11	2	5 (1%)
South West Neonatal ODN	505	505	0	26	0 (11.9%)	306 (60.6%)	78 (15.4%)	33	2	0 (0%)

Staffordshire, Shropshire and Black Country Neonatal ODN	279	279	0	19	49 (17.6%)	185 (66.3%)	23 (8.2%)	3	0	0 (0%)
Thames Valley & Wessex ODN	688	688	0	11	53 (7.7%)	510 (74.1%)	109 (15.8%)	4	1	0 (0%)
Trent Perinatal & Central Newborn Neonatal ODN	637	636	0	24	122 (19.2%)	392 (61.6%)	56 (8.8%)	40	2	1 (0.2%)
Wales	338	337	0	13	34 (10.1%)	239 (70.9%)	32 (9.5%)	18	1	1 (0.3%)
Yorkshire & Humber Neonatal ODN	776	776	0	31	110 (14.2%)	519 (66.9%)	111 (14.3%)	4	1	0 (0%)
Isle of Man	3	3	0	0	0 (0%)	3 (100%)	0 (0%)	0	0	0 (0%)
Other	80	79	1	35	14 (17.7%)	21 (26.6%)	1 (1.3%)	7	0	1 (1.3%)
Total	**8,019**	**7,997**	**2**	**444**	**1,171 (14.6%)**	**5,147 (64.4%)**	**979 (12.2%)**	**239**	**15**	**22 (0.3%)**

Figure 5.4.2: Caterpillar plot of the rates of compliance for temperature on admission; neonatal networks.

Rates of compliance with the standard for temperature on admission (on time and within a normal range). The estimated rates of compliance with the standard are marked by black dots and the 95% confidence intervals are indicated by vertical bars. The networks are presented in the ascending order of the rates in 2017.

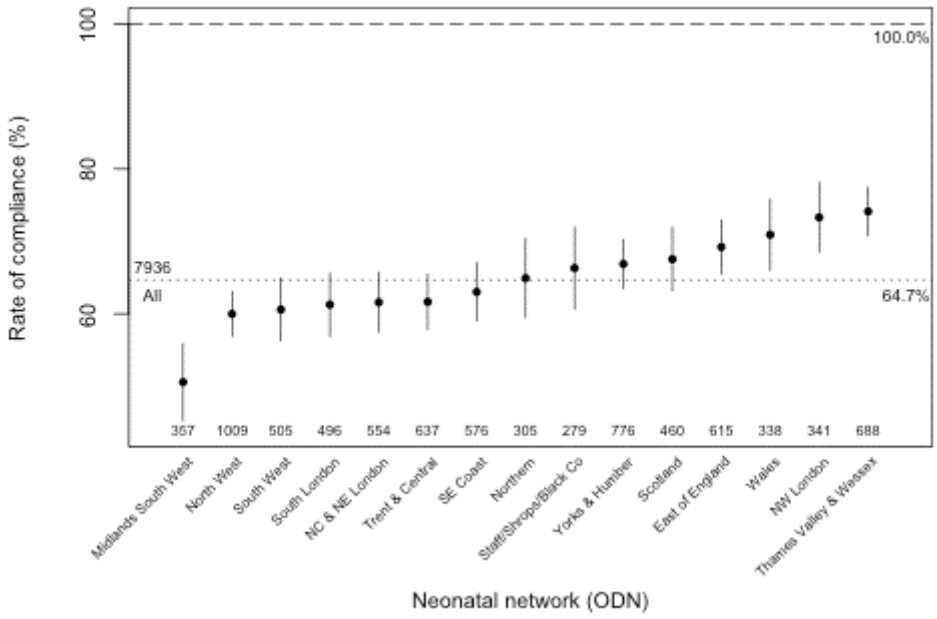


Table 5.4.3: Timeliness and normothermia, by NNAP reporting year (2013–2017).

NNAP year	NNU	Babies	With outcome	Temperature measurement							
				On time (%)					Late	Not taken	*Missing data (%)*
				< 32°C	32°C-35.9°C	36°C-36.4°C	36.5°C-37.5°C (normothermia)	>37.5°C			
2013	170	2,908	2,848	2	334	553 (19.4%)	1,485 (52.1%)	325 (11.4%)	133	16	*60 (2.1%)*
2014	167	3,109	3,074	4	361	611 (19.9%)	1,578 (51.3%)	380 (12.6%)	131	9	*35 (1.1%)*
2015*	177	7,864	7,807	3	648	1,403 (18%)	4,537 (58.1%)	760 (9.7%)	432	24	*57 (0.7%)*
2016*	181	8,044	8,006	3	559	1,368 (17.1%)	4,868 (60.8%)	960 (12%)	235	13	*38 (0.5%)*
2017*	178	8,019	7,997	2	444	1,171 (14.6%)	5,147 (64.4%)	979 (12.2%)	239	15	*22 (0.3%)*

*For 2015-2017 data babies born less than 32 weeks were included in the audit measure. In previous years, only babies less than 29 weeks were included.

5.5. Parental consultation within 24 hours of admission

This measure of care looks at whether parents have been spoken to by a senior member of the neonatal team within the first 24 hours of their baby being admitted. It applies for all babies who require care on a neonatal unit. It is important that families understand and are involved in the care of their baby. This first consultation provides an opportunity for the senior staff member to meet the parents, listen to their concerns, explain how their baby is being cared for and respond to any questions.

The key findings and recommendations for this audit measure are found on page 32.

NNAP audit measure

Is there a documented consultation with parents by a senior member of the neonatal team within 24 hours of a baby's first admission?[25],[26],[27]

Note: By senior member of the neonatal team, NNAP means a consultant or middle grade doctor, or a nurse practitioner acting in such a role.

Change to the audit measure for the 2017 data year: None.

Outlier analysis: Yes

NNAP standard

A consultation should take place within 24 hours of first admission for every baby.

Source of standard: NNAP Project Board

Inclusion criteria
Babies were included for analysis if they met the following criteria:

- Final neonatal discharge in the calendar year of analysis
- Had care provided by an NNAP unit
- Admitted to neonatal care for at least 12 hours in their first episode, receiving special care or a higher level of neonatal care
- Babies receiving neonatal care in non-neonatal unit locations (postnatal ward, transitional care etc.) were not included.

Results

There were **93,859** first episodes of care (lasting at least 12 hours) reported by **179** neonatal units considered for this question. Babies who did not receive HRG 1, 2 or 3 on a neonatal unit during their first day of care or whose admission was for less than 12 hours were excluded from the analysis; this left **59,655** first episodes eligible for the audit measure.

A senior member of the neonatal team consulted parents or carers within 24 hours of admission for **94.6%** of eligible episodes. Consultations that occurred before admission or more than 24 hours after admission were recorded in **3.3%** of eligible episodes.

No consultation occurred for **2.2%** of eligible episodes and data on consultations was either missing or 'unknown' for **2.7%** of eligible episodes.

Table 5.5.1: Time of first consultation, by neonatal unit level.

First consultation with a senior member of staff within 24 hours of first admission

NNU level	NNU	Babies	With outcome	Time of first consultation				*Missing data (%)*
				Within 24 hours of admission (%)	Before admission	After 24 hours	No consultation	
SCU	37	6,168	5,902	5,450 (92.3%)	184	106	162	*266 (4.3%)*
LNU	88	26,413	25,727	24,543 (95.4%)	425	334	425	*686 (2.6%)*
NICU	54	27,074	26,401	24,898 (94.3%)	350	487	666	*673 (2.5%)*
Total	**179**	**59,655**	**58,030**	**54,891 (94.6%)**	**959 (1.7%)**	**927 (1.6%)**	**1,253 (2.2%)**	***1625 (2.7%)***

Table 5.5.2: Time of first consultation, by neonatal network.

First consultation with a senior member of staff within 24 hours of first admission.

Network	Babies	With outcome	Time of first consultation				*Missing data (%)*
			Within 24 hours of admission (%)	Before admission	After 24 hours	No consultation	
East of England Neonatal ODN	6,637	6,389	6,003 (94%)	186	64	136	*248 (3.7%)*
Midlands South West Newborn Neonatal ODN	2,807	2,730	2,486 (91.1%)	71	77	96	*77 (2.7%)*
North Central & North East London Neonatal ODN	4,593	4,512	4,403 (97.6%)	36	45	28	*81 (1.8%)*
North West London Neonatal ODN	2,374	2,278	2,138 (93.9%)	39	56	45	*96 (4%)*
North West Neonatal ODN	7,060	6,914	6,493 (93.9%)	62	161	198	*146 (2.1%)*
Northern Neonatal ODN	2,155	2,108	2,010 (95.4%)	38	19	41	*47 (2.2%)*
Scotland	4,239	4,125	3,828 (92.8%)	105	57	135	*114 (2.7%)*
South East Coast Neonatal ODN	3,772	3,684	3,566 (96.8%)	34	44	40	*88 (2.3%)*
South London Neonatal ODN	3,723	3,539	3,384 (95.6%)	50	46	59	*184 (4.9%)*
South West Neonatal ODN	4,057	3,879	3,490 (90%)	103	144	142	*178 (4.4%)*
Staffordshire, Shropshire and Black Country Neonatal ODN	1,905	1,895	1,762 (93%)	30	32	71	*10 (0.5%)*
Thames Valley & Wessex ODN	4,666	4,646	4,616 (99.4%)	4	11	15	*20 (0.4%)*
Trent Perinatal & Central Newborn Neonatal ODN	4,421	4,258	3,983 (93.5%)	72	88	115	*163 (3.7%)*
Wales	2,416	2,324	2,176 (93.6%)	74	25	49	*92 (3.8%)*
Yorkshire & Humber Neonatal ODN	4,730	4,652	4,460 (95.9%)	52	57	83	*78 (1.6%)*
Isle of Man	100	97	93 (95.9%)	3	1	0	*3 (3%)*
Total	**59,655**	**58,030**	**54,891 (94.6%)**	**959 (1.7%)**	**927 (1.6%)**	**1,253 (2.2%)**	***1625 (2.7%)***

Figure 5.5.1: Caterpillar plot of the rates of compliance for first consultation within 24 hours of admission; neonatal networks.

Rates of compliance with the standard for first consultation within 24 hours of admission. The estimated rates of compliance with the standard are marked by black dots and the 95% confidence intervals are indicated by vertical bars. The networks are presented in the ascending order of the rates.

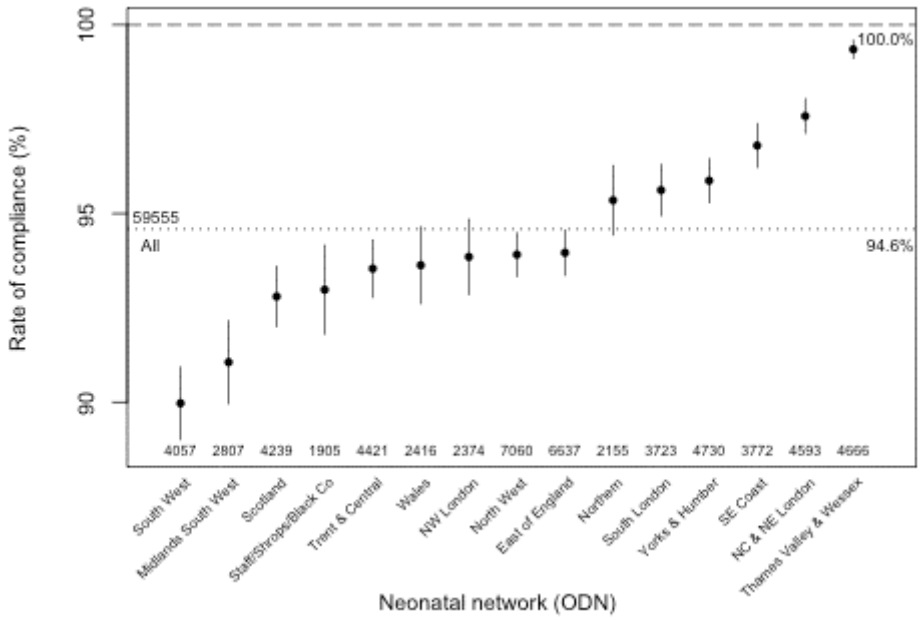


Table 5.5.3: Time of first consultation, by NNAP reporting year (2013–2017).

NNAP Year	NNU	First episodes	With outcome	Time of first consultation				*Missing data (%)*
				Within 24 hours (%)	After 24 hours	Before admission	No consultation	
2013	176	50,757	48,021	42,807 (89.1%)	1,386	2,273	1,555	*2,736 (5.4%)*
2014	174	52,372	50,668	46,485 (91.7%)	1,451	1,134	1,598	*1704 (3.3%)*
2015	179	58,077	55,840	51,300 (91.9%)	1,261	1,204	2,075	*2237 (3.9%)*
2016	181	60,148	57,926	54,422 (94%)	1,054	1,024	1,426	*2222 (3.7%)*
2017	179	59,655	58,030	54,891 (94.6%)	927	959	1,253	*1625 (2.7%)*

5.6. Parental presence at consultant ward rounds

Neonatal intensive care is very stressful for babies and parents. Professionals, parents' advocates, and parents agree that parental partnership in care is supported by including parents in consultant ward rounds, which will occur regularly on neonatal units. For 2017 this measure seeks to identify the proportion of admissions where parents were present on a consultant ward round on at least one occasion during a baby's stay.

The key findings and recommendations for this audit measure are found on page 34.

NNAP audit measure

For a baby admitted for more than 24 hours, did at least one parent attend a consultant ward round at any point during the baby's admission?[25,26,28]

Note: Consultant ward round refers to any ward round where a consultant is in attendance, reviewing the care of patients, at any time of the day.

Change to the audit measure for the 2017 data year: New measure for the 2017 data year.

The NNAP Project Board and Methodology and Dataset Group recommended that the NNAP should clarify that this measure is designed to address the inclusion of parents on a ward round where decisions are made rather than updating parents at another time.

NNAP standard

Benchmarking.

Inclusion criteria

Babies were included for analysis if they met the following criteria:

- Experienced their final neonatal discharge in the calendar year of analysis
- Had care provided by an NNAP unit
- At least 24 hours (≥ 1440 minutes) between the admission time and discharge time for the episode of care
- A baby may have several admissions; every eligible admission is included in the analysis
- Babies receiving all neonatal care in non-neonatal unit locations (postnatal ward, transitional care etc.) are not included.

Results

There were **71,622** admissions for babies admitted for more than 24 hours. Of these admissions, **18.8%** had missing data, leaving **58,163** eligible admissions. **74.3%** of these eligible admissions had the presence of at least one parent for one or more ward rounds recorded at any point during the admission.

Table 5.6.1: Parent present on one or more consultant ward rounds, by neonatal unit level.

NNU level	NNU	Length of stay (days)	Admissions	With outcome	Parental presence on consultant ward round			*Missing data (%)*
					Parent present (%)	Parent not present	No ward round	
SCU	37	≤ 7	4,621	3,470	2,332 (67.2%)	352	786	*1,151 (24.9%)*
		8-14	1,499	1,329	1,050 (79%)	102	177	*170 (11.3%)*
		15-21	836	769	628 (81.7%)	64	77	*67 (8%)*
		22-28	461	419	376 (89.7%)	25	18	*42 (9.1%)*
		>28	566	520	439 (84.4%)	44	37	*46 (8.1%)*
		Total	7,983	6,507	4,825 (74.2%)	587	1,095	*1,476 (18.5%)*
LNU	88	≤ 7	16,916	13,132	9,598 (73.1%)	2,137	1,397	*3,784 (22.4%)*
		8-14	5,685	5,154	4,206 (81.6%)	564	384	*531 (9.3%)*
		15-21	2,987	2,829	2,259 (79.9%)	322	248	*158 (5.3%)*
		22-28	1,592	1,519	1,268 (83.5%)	142	109	*73 (4.6%)*
		>28	3,672	3,569	3,139 (88%)	218	212	*103 (2.8%)*
		Total	30,852	26,203	20,470 (78.1%)	3,383	2,350	*4,649 (15.1%)*
NICU	54	≤ 7	16,836	10,866	6,532 (60.1%)	2,990	1,344	*5,970 (35.5%)*
		8-14	6,193	5,363	3,856 (71.9%)	917	590	*830 (13.4%)*
		15-21	3,083	2,835	2,129 (75.1%)	404	302	*248 (8%)*
		22-28	1,746	1,652	1,273 (77.1%)	214	165	*94 (5.4%)*
		>28	4,929	4,737	4,145 (87.5%)	277	315	*192 (3.9%)*
		Total	32,787	25,453	17,935 (70.5%)	4,802	2,716	*7334 (22.4%)*
Total	**179**	**Total**	**71,622**	**58,163**	**43,230 (74.3%)**	**8,772 (15.1%)**	**6,161 (10.6%)**	***13,459 (18.8%)***

Table 5.6.2: Parent present on one or more consultant ward rounds, by neonatal network.

Network	Length of stay (days)	Admissions	With outcome	Parental presence on consultant ward round			Missing data (%)
				Parent present (%)	Parent not present	No ward round	
East of England Neonatal ODN	≤ 7	4,910	3812	2,802 (73.5%)	565	445	*1,098 (22.4%)*
	8-14	1,459	1356	1,074 (79.2%)	193	89	*103 (7.1%)*
	15-21	617	607	483 (79.6%)	74	50	*10 (1.6%)*
	22-28	349	340	283 (83.2%)	34	23	*9 (2.6%)*
	>28	746	737	651 (88.3%)	45	41	*9 (1.2%)*
	Total	8,081	6852	5,293 (77.2%)	911	648	*1,229 (15.2%)*
Midlands South West Newborn Neonatal ODN	≤ 7	2,028	908	618 (68.1%)	192	98	*1,120 (55.2%)*
	8-14	640	465	315 (67.7%)	112	38	*175 (27.3%)*
	15-21	288	239	155 (64.9%)	71	13	*49 (17%)*
	22-28	176	162	118 (72.8%)	38	6	*14 (8%)*
	>28	411	393	302 (76.8%)	69	22	*18 (4.4%)*
	Total	3,543	2167	1,508 (69.6%)	482	177	*1,376 (38.8%)*
North Central & North East London Neonatal ODN	≤ 7	3,097	2001	1,641 (82%)	293	67	*1,096 (35.4%)*
	8-14	940	776	678 (87.4%)	88	10	*164 (17.4%)*
	15-21	511	430	367 (85.3%)	56	7	*81 (15.9%)*
	22-28	292	237	205 (86.5%)	27	5	*55 (18.8%)*
	>28	781	664	583 (87.8%)	70	11	*117 (15%)*
	Total	5,621	4108	3,474 (84.6%)	534	100	*1513 (26.9%)*
North West London Neonatal ODN	≤ 7	1,463	602	420 (69.8%)	153	29	*861 (58.9%)*
	8-14	500	319	232 (72.7%)	66	21	*181 (36.2%)*
	15-21	266	196	141 (71.9%)	47	8	*70 (26.3%)*
	22-28	173	127	92 (72.4%)	28	7	*46 (26.6%)*
	>28	401	342	274 (80.1%)	54	14	*59 (14.7%)*

	Total	2,803	1586	1,159 (73.1%)	348	79	*1,217 (43.4%)*
North West Neonatal ODN	≤ 7	3,965	2718	1,507 (55.4%)	774	437	*1,247 (31.5%)*
	8-14	1,694	1494	998 (66.8%)	288	208	*200 (11.8%)*
	15-21	942	892	582 (65.2%)	187	123	*50 (5.3%)*
	22-28	465	457	303 (66.3%)	81	73	*8 (1.7%)*
	>28	1,090	1082	881 (81.4%)	74	127	*8 (0.7%)*
	Total	8,156	6643	4,271 (64.3%)	1,404	968	*1,513 (18.6%)*
Northern Neonatal ODN	≤ 7	1,246	1025	707 (69%)	208	110	*221 (17.7%)*
	8-14	598	544	430 (79%)	57	57	*54 (9%)*
	15-21	290	267	225 (84.3%)	21	21	*23 (7.9%)*
	22-28	163	151	139 (92.1%)	6	6	*12 (7.4%)*
	>28	302	272	252 (92.6%)	10	10	*30 (9.9%)*
	Total	2,599	2259	1,753 (77.6%)	302	204	*340 (13.1%)*
Scotland	≤ 7	2,386	1781	1,005 (56.4%)	519	257	*605 (25.4%)*
	8-14	888	821	586 (71.4%)	111	124	*67 (7.5%)*
	15-21	501	468	348 (74.4%)	39	81	*33 (6.6%)*
	22-28	238	235	182 (77.4%)	22	31	*3 (1.3%)*
	>28	611	603	508 (84.2%)	24	71	*8 (1.3%)*
	Total	4,624	3908	2,629 (67.3%)	715	564	*716 (15.5%)*
South East Coast Neonatal ODN	≤ 7	2,710	2164	1,435 (66.3%)	388	341	*546 (20.1%)*
	8-14	933	855	667 (78%)	126	62	*78 (8.4%)*
	15-21	455	437	358 (81.9%)	54	25	*18 (4%)*
	22-28	246	242	210 (86.8%)	26	6	*4 (1.6%)*
	>28	591	584	518 (88.7%)	48	18	*7 (1.2%)*
	Total	4,935	4282	3,188 (74.5%)	642	452	*653 (13.2%)*
South London Neonatal ODN	≤ 7	2,364	1280	865 (67.6%)	273	142	*1,084 (45.9%)*
	8-14	838	607	406 (66.9%)	124	77	*231 (27.6%)*

	15-21	459	385	264 (68.6%)	72	49	*74 (16.1%)*
	22-28	235	196	146 (74.5%)	30	20	*39 (16.6%)*
	>28	599	544	461 (84.7%)	52	31	*55 (9.2%)*
	Total	4,495	3012	2,142 (71.1%)	551	319	*1,483 (33%)*
South West Neonatal ODN	≤ 7	2,900	2162	1,686 (78%)	307	169	*738 (25.4%)*
	8-14	911	839	747 (89%)	73	19	*72 (7.9%)*
	15-21	453	438	414 (94.5%)	15	9	*15 (3.3%)*
	22-28	268	262	251 (95.8%)	5	6	*6 (2.2%)*
	>28	590	584	571 (97.8%)	9	4	*6 (1%)*
	Total	5,122	4285	3,669 (85.6%)	409	207	*837 (16.3%)*
Staffordshire, Shropshire and Black Country Neonatal ODN	≤ 7	1,193	883	530 (60%)	179	174	*310 (26%)*
	8-14	424	401	278 (69.3%)	61	62	*23 (5.4%)*
	15-21	213	209	141 (67.5%)	35	33	*4 (1.9%)*
	22-28	100	99	76 (76.8%)	12	11	*1 (1%)*
	>28	316	315	285 (90.5%)	9	21	*1 (0.3%)*
	Total	2,246	1907	1,310 (68.7%)	296	301	*339 (15.1%)*
Thames Valley & Wessex ODN	≤ 7	2885	2680	2,049 (76.5%)	415	216	*205 (7.1%)*
	8-14	862	852	794 (93.2%)	29	29	*10 (1.2%)*
	15-21	472	471	442 (93.8%)	17	12	*1 (0.2%)*
	22-28	290	289	281 (97.2%)	3	5	*1 (0.3%)*
	>28	773	769	757 (98.4%)	9	3	*4 (0.5%)*
	Total	5,282	5061	4,323 (85.4%)	473	265	*221 (4.2%)*
Trent Perinatal & Central Newborn Neonatal ODN	≤ 7	2,971	2062	1,215 (58.9%)	471	376	*909 (30.6%)*
	8-14	880	832	658 (79.1%)	104	70	*48 (5.5%)*
	15-21	491	483	370 (76.6%)	46	67	*8 (1.6%)*
	22-28	276	273	219 (80.2%)	30	24	*3 (1.1%)*
	>28	659	653	581 (89%)	25	47	*6 (0.9%)*

	Total	5,277	4303	3,043 (70.7%)	676	584	*974 (18.5%)*
Wales	≤ 7	1,453	1199	658 (54.9%)	320	221	*254 (17.5%)*
	8-14	491	475	336 (70.7%)	69	70	*16 (3.3%)*
	15-21	278	269	209 (77.7%)	19	41	*9 (3.2%)*
	22-28	178	176	137 (77.8%)	18	21	*2 (1.1%)*
	>28	409	405	348 (85.9%)	17	40	*4 (1%)*
	Total	2,809	2524	1,688 (66.9%)	443	393	*285 (10.1%)*
Yorkshire & Humber Neonatal ODN	≤ 7	2,747	2150	1,296 (60.3%)	413	441	*597 (21.7%)*
	8-14	1,295	1188	901 (75.8%)	74	213	*107 (8.3%)*
	15-21	653	626	508 (81.2%)	33	85	*27 (4.1%)*
	22-28	349	343	274 (79.9%)	21	48	*6 (1.7%)*
	>28	878	870	743 (85.4%)	23	104	*8 (0.9%)*
	Total	5,922	5177	3,722 (71.9%)	564	891	*745 (12.6%)*
Isle of Man	≤ 7	55	41	28 (68.3%)	9	4	*14 (25.5%)*
	8-14	24	22	12 (54.5%)	8	2	*2 (8.3%)*
	15-21	17	16	9 (56.3%)	4	3	*1 (5.9%)*
	22-28	1	1	1 (100%)	0	0	*0 (0%)*
	>28	10	9	8 (88.9%)	1	0	*1 (10%)*
	Total	107	89	58 (65.2%)	22	9	*18 (16.8%)*
Total		**71,622**	**58,163**	**43,230 (74.3%)**	**8,772 (15.1%)**	**6,161 (10.6%)**	***13,459 (18.8%)***

5.7. On-time screening for retinopathy of prematurity

Babies born very early or with a very low birth weight are at risk of retinopathy of prematurity (ROP). This condition affects the development of the blood vessels in the back of the eye. ROP can lead to loss of vision, but this is usually prevented by timely treatment. Therefore, screening babies for ROP at the right time is important to help babies have the best vision in the future. A national guideline indicates when screening should be done, and this measure reports on how successful neonatal services are in achieving 'on time' screening.[26]

The key findings and recommendations for this audit measure are found on page 36.

NNAP audit measure

Does an admitted baby born weighing less than 1501g, or at gestational age of less than 32 weeks, undergo the first retinopathy of prematurity (ROP) screening in accordance with the NNAP interpretation of the current guideline recommendations?[29]

Change to the audit measure for the 2017 data year: None.

NNAP standard

100% of eligible babies should receive ROP screening within the time windows for first screening recommended in the guidelines.

Note: In interpreting the national standards for this NNAP analysis, the Project Board has decided that a baby will be seen as having had ROP screening "on-time" if:

- A baby who was discharged before the ROP screening window opened had their first screening conducted prior to discharge, or
- A ROP screen takes place within the ROP screening window, before or after discharge.

The NNAP Project Board has also agreed to allow an extra week either side of the ROP screening window.

Source of standard: National standard (RCPCH, RCOphth, BAPM and Bliss, *Guideline for the Screening and Treatment of Retinopathy of Prematurity*, 2008[29]).

Outlier analysis: Yes

Inclusion criteria

Babies were included for analysis if they met the following criteria:

- Final neonatal discharge in the calendar year of analysis
- Had care provided by an NNAP unit
- Alive at the beginning of the national guideline screening window

and

- The baby was born at less than 32 weeks gestational age and was admitted to a neonatal unit

or

- The baby's birth weight was less than 1501g.

Results

There were **9,681** babies born with a birth weight less than 1501g or with a gestational age at birth less than 32 weeks in a NNAP contributing neonatal unit. Of these babies, **17** were excluded because they did not have a recorded episode of care in a neonatal unit until after the closure of the ROP screening window. **22** babies were removed, as a responsible unit could not be assigned. A further **33** babies were excluded because they were transferred to non-neonatal units before, or during, the ROP screening window. Finally, **610** babies were excluded because they died before the closure of the screening window and had not been screened. This left **8,999** babies eligible for ROP screening from **179** neonatal units.

Including post-discharge screenings, **98.1%** of eligible babies had at least one screening for ROP recorded, while **94.4%** of babies were screened on-time in accordance with current NNAP criteria. Of the remaining babies, **3.1%** were first screened after the closure of the screening window, and less than **1%** were screened before the screening window opened. No screening data was available for **1.9%** of eligible babies.

Table 5.7.1: Timing of ROP screening, by neonatal unit level.

NNU Level	NNU	Babies	Any screen (%)	Screening time					No Screen (%)
				On time			Early (%)	Late (%)	
				During care	After discharge	On time total (%)			
SCU	37	740	718 (97%)	565	111	676 (91.4%)	11 (1.5%)	31 (4.2%)	22 (3%)
LNU	88	3,716	3,645 (98.1%)	2,983	521	3,504 (94.3%)	24 (0.6%)	117 (3.1%)	71 (1.9%)
NICU	54	4,543	4,465 (98.3%)	3,825	487	4,312 (94.9%)	22 (0.5%)	131 (2.9%)	78 (1.7%)
Total	**179**	**8,999**	**8,828 (98.1%)**	**7,373**	**1,119**	**8,492 (94.4%)**	**57 (0.6%)**	**279 (3.1%)**	**171 (1.9%)**

Figure 5.7.1: Caterpillar plot of the rates of compliance for on-time ROP screening; neonatal units.

Rates of compliance with the standard for on-time ROP screening. The 95% confidence intervals are indicated by vertical bars. The units can be identified in NNAP Online.

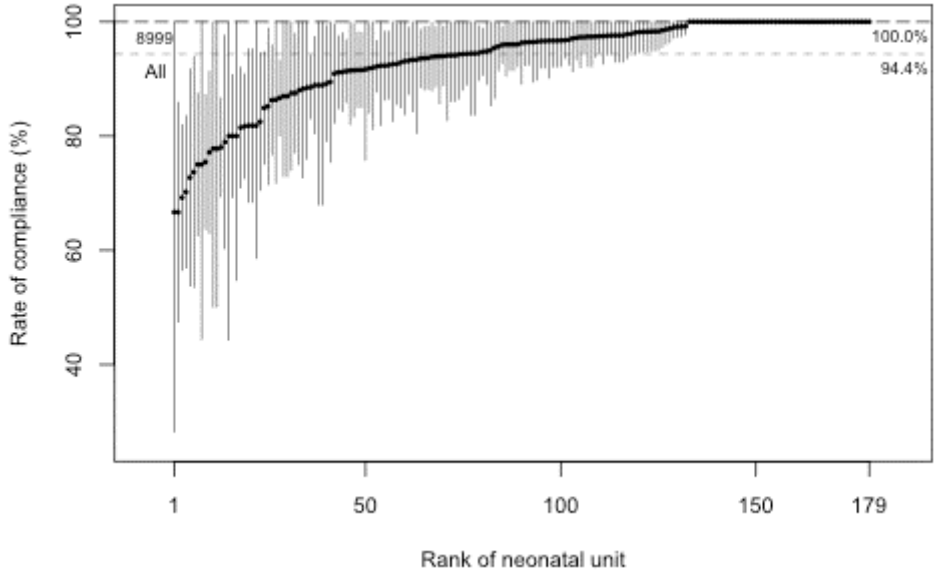


Table 5.7.2: Timing of ROP screening, by neonatal network.

Network	Babies	Any screen (%)	Screening time					No screen (%)
			On time			Early (%)	Late (%)	
			During care	After discharge	On time total (%)			
East of England Neonatal ODN	744	727 (97.7%)	615	76	691 (92.9%)	7 (0.9%)	29 (3.9%)	17 (2.3%)
Midlands South West Newborn Neonatal ODN	410	406 (99%)	335	50	385 (93.9%)	4 (1%)	17 (4.1%)	4 (1%)
North Central & North East London Neonatal ODN	683	657 (96.2%)	578	65	643 (94.1%)	0 (0%)	14 (2%)	26 (3.8%)
North West London Neonatal ODN	414	406 (98.1%)	306	80	386 (93.2%)	1 (0.2%)	19 (4.6%)	8 (1.9%)
North West Neonatal ODN	1046	1040 (99.4%)	859	160	1019 (97.4%)	3 (0.3%)	18 (1.7%)	6 (0.6%)
Northern Neonatal ODN	342	326 (95.3%)	247	47	294 (86%)	2 (0.6%)	30 (8.8%)	16 (4.7%)
Scotland	530	522 (98.5%)	443	53	496 (93.6%)	4 (0.8%)	22 (4.2%)	8 (1.5%)
South East Coast Neonatal ODN	631	623 (98.7%)	521	84	605 (95.9%)	2 (0.3%)	16 (2.5%)	8 (1.3%)
South London Neonatal ODN	568	562 (98.9%)	445	81	526 (92.6%)	6 (1.1%)	30 (5.3%)	6 (1.1%)
South West Neonatal ODN	551	546 (99.1%)	475	57	532 (96.6%)	1 (0.2%)	13 (2.4%)	5 (0.9%)
Staffordshire, Shropshire and Black Country Neonatal ODN	317	315 (99.4%)	279	32	311 (98.1%)	0 (0%)	4 (1.3%)	2 (0.6%)
Thames Valley & Wessex ODN	761	753 (98.9%)	634	95	729 (95.8%)	10 (1.3%)	14 (1.8%)	8 (1.1%)
Trent Perinatal & Central Newborn Neonatal ODN	734	698 (95.1%)	579	92	671 (91.4%)	9 (1.2%)	18 (2.5%)	36 (4.9%)
Wales	389	375 (96.4%)	325	30	355 (91.3%)	4 (1%)	16 (4.1%)	14 (3.6%)
Yorkshire & Humber Neonatal ODN	873	867 (99.3%)	728	117	845 (96.8%)	4 (0.5%)	18 (2.1%)	6 (0.7%)
Isle of Man	6	5 (83.3%)	4	0	4 (66.7%)	0 (0%)	1 (16.7%)	1 (16.7%)
Total	**8999**	**8828 (98.1%)**	**7373**	**1119**	**8492 (94.4%)**	**57 (0.6%)**	**279 (3.1%)**	**171 (1.9%)**

Figure 5.7.2: Caterpillar plot of the rates of compliance for on-time ROP screening; neonatal networks.

Rates of compliance with the standard for on-time ROP screening. The 95% confidence intervals are indicated by vertical bars. The networks are presented in the ascending order of the rates in 2017.

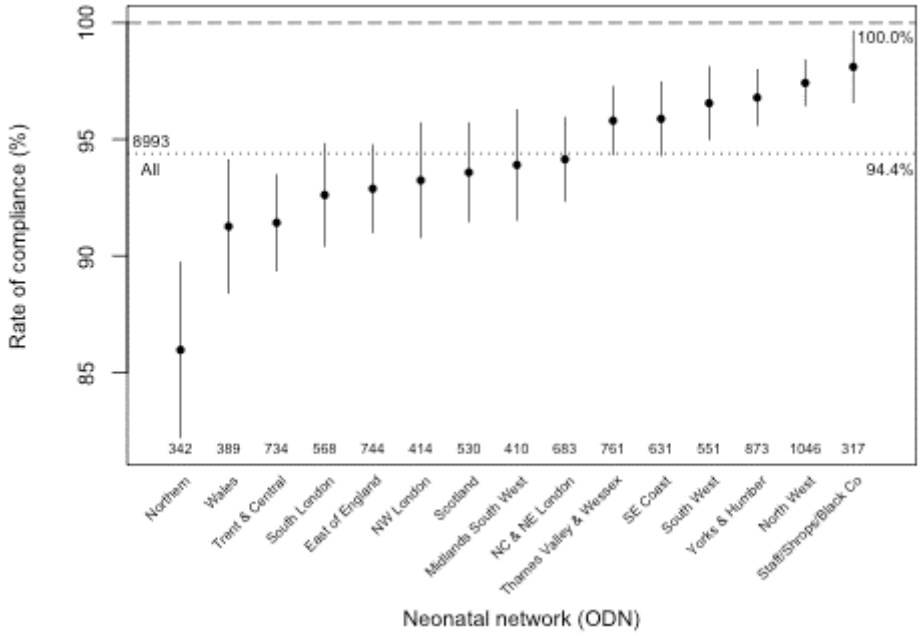


Table 5.7.3: Timing of ROP screening, by NNAP reporting year (2009–2017).

NNAP year	NNU	Babies	Any screen (%)	Screening time					No screen (%)
				On time			Early (%)	Late (%)	
				During care	After discharge	On time total (%)			
2009	167	7,913	5,336	-	-	2,098 (26.5%)	1,859 (23.5%)	1,379 (17.4%)	2,577 (32.6%)
2010	171	8,278	5,879	-	-	4,455 (53.8%)	297 (3.6%)	1,127 (13.6%)	2,399 (29%)
2011	164	7,887	6,460	-	-	5,310 (67.3%)	233 (3%)	917 (11.6%)	1,427 (18.1%)
2012	173	7,996	6,312	4,842	477	5,319 (66.5%)	122 (1.5%)	871 (10.9%)	1,684 (21.1%)
2013	175	8,000	7,497	6,25s8	737	6,995 (87.4%)	70 (0.9%)	432 (5.4%)	503 (6.3%)
2014	173	8,224	7,997	6,723	930	7,653 (92.8%)	61 (0.7%)	283 (3.4%)	227 (2.8%)
2015	179	8,821	8,604	7,138	1,088	8,226 (93.3%)	54 (0.6%)	324 (3.7%)	217 (2.5%)
2016	181	9,131	8,968 (98.2%)	7,456	1,141	8,597 (94.2%)	38 (0.4%)	333 (3.6%)	163 (1.8%)
2017	179	8,999	8,828 (98.1%)	7,373	1,119	8,492 (94.4%)	57 (0.6%)	279 (3.1%)	171 (1.9%)

5.8. Encephalopathy

Encephalopathy is a brain illness. Encephalopathic babies have impaired consciousness and often have seizures. Encephalopathy in newborn babies has a variety of causes. Encephalopathy most commonly occurs in babies who are born at or near term and who appear to have got into difficulty during labour or delivery. It is important that hospitals gain understanding of their rates of encephalopathy in newborn babies to identify opportunities to improve midwifery and obstetric practice.

The key findings and recommendations for this audit measure are found on page 39.

NNAP audit measure

Does an admitted baby born at 35 weeks gestational age or above have an encephalopathy within the first three full calendar days after birth?

Change to the audit measure for the 2017 data year: None.

NNAP standard

Benchmarking.

Inclusion criteria

All babies born at 35 weeks gestational age or above within the year of analysis, regardless of neonatal admission, will be included as the denominator for this question. Details on this denominator will be obtained externally to the NNRD, which typically forms the denominator for NNAP audit measure (see data sources for more details).

Results

There were **2,060,531** babies born at greater than or equal to 35 weeks gestation between 01 January 2014 and 31 December 2016. Of these **3,372** were recorded as having an encephalopathy within three days of birth. Encephalopathy occurred in **1.64** babies per 1000 births (95% confidence intervals: 1.69 – 1.58).

Live birth data was not available for the year 2014 for one trust, and two trusts had no live birth data for any years.

Table 5.8.1: Encephalopathy rates per 1000 births.

All live births	Live births ≥ 35 weeks	Encephalopathy	Encephalopathy rate per 1000 births (95% CI)	Missing data (%)
2,181,353	2,060,531	3,372	1.64 (1.69-1.58)	657 (0.03%)

5.9. Bloodstream infection

Sick and premature babies are prone to infection with germs including some that are normally harmless to healthy people. Infections can lengthen the stay in the neonatal unit and may worsen the long term developmental outlook for babies.[30] Neonatal unit staff and parents can reduce the risk of infection by following good infection prevention and control practice.

The NNAP focusses on reporting measures of bloodstream infection. To look for infection in babies, neonatal staff usually take blood cultures to check whether bacteria are present in the blood. They may also take a sample of cerebrospinal fluid (CSF). For 2017 data NNAP reports rates of blood cultures positive for bacteria, fungi or yeasts, and two different measures of bloodstream infection that occurs on the same day as a central line is present.

The key findings and recommendations for this audit measure are found on page 40.

NNAP audit measure

What percentage of babies admitted to a neonatal unit have:

- one or more episodes of a pure growth of a pathogen from blood;
- one or more episode of a pure growth of a pathogen from CSF;
- either a pure growth of indeterminate significance or a mixed growth with three or more clinical signs at the time of blood sampling?

Change to the audit measure for the 2017 data year: For the 2017 data report, the list of organisms of which a growth is regarded as unequivocal evidence of infection has been reviewed, and can be found in *Appendix F: "Pathogens" in the NNAP*.

For the 2018 data year, cerebrospinal fluid (CSF) cultures will be removed from the audit measure, Data will be presented on bloodstream infection, without reference to the presence of symptoms and signs.

NNAP standard

Benchmarking.

Inclusion criteria

Babies were included for analysis if they met the following criteria:

- Final neonatal discharge in the calendar year of analysis
- Had care provided by an NNAP unit.

Results

Overall, **70,066** blood cultures were reported from **104,183** babies in **179** neonatal units, giving an average of less than **1** culture per baby. Of these blood cultures, **81.4%** have a result entered. Less than half of blood cultures have symptoms and signs entered into the audit.

A total of **75,935** blood and CSF cultures were recorded for these babies; pathogens results, including 'no growth' were entered for **81.1%** of these known culture samples.

At lower gestations, **16,016** blood cultures were reported from **8,394** babies (birth gestational age of less than 32 weeks), while at higher gestations **54,045** blood cultures were reported from **95,727** babies. On aggregate blood culture results are recorded for **81.4%** of entered blood cultures. However, the proportion of positive blood cultures whose results are recorded remains unknown, except in the **74** neonatal units who have confirmed they have entered 100% of all positive blood cultures.

Of all blood cultures entered in the audit, **49.7%** have clinical symptoms and signs data entered.

Table 5.9.1: Completeness of blood and CSF cultures, by gestational age group.

Gestational age group	Babies	Blood cultures			CSF cultures	
		Number entered	Results entered (%)	Clinical signs entered (%)	Number entered	Results entered (%)
≤ 27 weeks	2,563	7,716	6,275 (81.3%)	3,501 (45.4%)	632	513 (81.2%)
28-31 weeks	5,831	8,300	6,835 (82.3%)	4,111 (49.5%)	434	332 (76.5%)
32-36 weeks	29,745	19,439	15,927 (81.9%)	9,888 (50.9%)	767	570 (74.3%)
≥ 37 weeks	65,982	34,606	28,006 (80.9%)	17,355 (50.2%)	4,036	3,138 (77.8%)
Missing	62	5	4 (80%)	2 (40%)	0	0 (0%)
Total	**104,183**	**70,066**	**57,047 (81.4%)**	**34,857 (49.7%)**	**5,869**	**4,553 (77.6%)**

These findings make clear that inter-unit comparisons based on NNAP reported rates of bloodstream infections and central line associated bloodstream infection (CLABSI) can only be made with any level of confidence for the units with known 100% entry of positive cultures, and that any measures of infection depending on entry completeness of symptoms and signs should be interpreted with caution.

- **985** babies had blood culture results recorded with a pure growth of a pathogen.
- **14** babies had one or more positive CSF culture result recorded with a pure growth of a pathogen.
- For blood cultures, **51** babies had a growth of indeterminate significance with three or more clinical predefined clinical signs, and **17** a mixed growth with three or more predefined clinical signs.

For the least mature babies, born at less than 28 weeks gestational age, confirmed infection rates appear high. 2563 babies had 521 growths of a pathogen – confirming the clinical importance of infection in this patient group. Under reporting remains a concern. This number of positive growths is much higher than in 2016 (2016 - 276) and therefore it remains possible that higher overall rates of infection might be reported in the event of complete capture of all positive organisms from all units.

Table 5.9.2: Positive blood cultures, by gestational age group.

Gestational age group	Babies	Admissions	Positive blood cultures		
			One or more pure growths of a pathogen (%)	One or more skin commensal growths and ≥ 3 clinical signs	One or more mixed growths and ≥ 3 clinical signs
≤ 27 weeks	2563	5536	521 (20.3%)	31	12
28-31 weeks	5831	8915	246 (4.2%)	13	5
32-36 weeks	29745	33612	112 (0.4%)	5	0
≥ 37 weeks	65982	70480	106 (0.2%)	2	0
Missing	62	63	0 (0%)	0	0
Total	**104183**	**118606**	**985 (0.9%)**	**51**	**17**

Table 5.9.3: Positive CSF cultures, by gestational age group.

Gestational age group	Babies	Admissions	Positive CSF cultures
			One or more pure growths of a pathogen (%)
≤ 27 weeks	2563	5536	6 (0.2%)
28-31 weeks	5831	8915	2 (0.03%)
32-36 weeks	29745	33612	2 (0.006%)
≥ 37 weeks	65982	70480	4 (0.006%)
Missing	62	63	0 (0%)
Total	**104183**	**118606**	**14 (0.01%)**

5.10. Quality Improvement Surveillance Definition: Central line associated bloodstream infection

The key findings and recommendations for this audit measure are found on page 40.

NNAP audit measure

How many babies have a positive blood culture (any species) with a central line present, after the first 72 hours of life, per 1000 central line days?

Change to the audit measure for the 2017 data year: None.

NNAP standard

Benchmarking.

Inclusion criteria

Babies will be included for analysis if they meet the following criteria:

- Experienced their final neonatal discharge in the calendar year of analysis
- Had care provided by an NNAP unit
- All days where a central line (surgical venous line, umbilical venous catheter (UVC), umbilical arterial catheter (UAC), peripherally inserted central catheter (PICC)) was present will be included in the number of line days when calculating number of babies experiencing one or more bloodstream infections per 1000 line days.

Results

104,183 babies in **179** neonatal units received **1,190,039** days of care. In total **13.8%** of all care days included a central line and **756** babies with **921** bloodstream infections (definition outlined above) were reported for these central line days; **4.61** babies with bloodstream infections per 1000 central line days (**5.85** in babies less than 32 weeks gestational age, **2.15** in babies greater than or equal to 32 weeks gestational age).

In the **74** units with complete data entry, central line associated bloodstream infection occurred in **8.17** babies of less than 32 weeks gestational age per 1000 line days and in **2.84** babies of greater than or equal to 32 weeks gestational age per 1000 line days.

Table 5.10.1: Babies with central line associated bloodstream infections, by gestational age group.

Gestational age group	Babies	Line days	Babies with central line associated blood stream infections	Babies with central line associated bloodstream infection per 1000 central line days
< 32 weeks	8,394	109,080	638	5.85
≥ 32 weeks	95,727	54,832	118	2.15
Missing	62	2	0	0.00
Total	**104,183**	**163,914**	**756**	**4.61**

5.11. Central line associated bloodstream infection

NNAP audit measure

How many blood stream infections[a] are there on the neonatal unit per 1000 central line[b] days?

a: the growth of a recognised pathogen in pure culture, or in the case of a mixed growth, or growth of indeterminate significance, the added requirement for 3 or more of 10 predefined clinical signs

b: central line = umbilical artery catheter(UAC), umbilical venous catheter (UVC), percutaneous long line or surgically inserted long line.

Change to the audit measure for the 2017 data year: The list of organisms regarded as indicative of infection without the need for confirmatory symptoms and signs has been revised with expert assistance and can be found in Appendix F: "Pathogens" in the NNAP.

For the 2018 data year, this measure will not be included.

NNAP standard

Benchmarking.

Inclusion criteria

Babies will be included for analysis if they meet the following criteria:

- Experienced their final neonatal discharge in the calendar year of analysis
- Had care provided by an NNAP unit
- All days where a central line (surgical venous line, umbilical venous catheter (UVC), umbilical artery catheter (UAC), peripherally inserted central catheter (PICC)) was present will be included in the number of line days.

Results

104,183 babies in **179** neonatal units received **1,190,039** days of care. In total **13.8%** of all care days included a central line and **729** bloodstream infections (definition as outlined above) were reported for these central line days.

A minimum estimate for the number of infections per 1000 days of central line care is **4.45** (**5.68** for babies less than 32 weeks gestation; **1.99** for babies of 32 weeks or more gestation). However, such an estimate is potentially undermined both by incomplete blood culture data in some units, but also by incomplete data on "symptoms and signs" *(Table 5.9.1)*.

Table 5.11.1: Central line associated bloodstream infections, by gestational age group.

Gestational age group	Babies	Line days	Central line associated blood stream infections	Central line associated bloodstream infection per 1000 central line days
< 32 weeks	8,394	109,080	620	5.68
≥ 32 weeks	95,727	54,832	109	1.99
Missing	62	2	0	0
Total	**104,183**	**163,914**	**729**	**4.45**

5.12. Bronchopulmonary dysplasia (BPD)

Babies born preterm often don't have fully developed lungs and may require support with their breathing from a ventilator or other device. Simply being born early can cause some ongoing breathing difficulty. Being on a ventilator can cause damage to the lungs, exacerbate breathing problems later in life and put babies at risk of chest infections. This condition is known as bronchopulmonary dysplasia (BPD), also called chronic lung disease. NNAP reports on the proportion of babies born very early who are still receiving help with their breathing or extra oxygen four weeks before their due date.

Variations in rates of BPD might reflect different management or could reflect the way that neonatal units use oxygen in most mature babies.

The key findings and recommendations for this audit measure are found on page 43.

NNAP audit measure

Does an admitted baby born at less than 32 weeks develop bronchopulmonary dysplasia (BPD)?

Change to the audit measure for the 2017 data year: None.

For the 2018 data year, the NNAP is amending this measure in line with published evidence that oxygen or dependence on respiratory support at 36 weeks gestational age better predicts longer-term lung disease.[31] This pragmatic definition of BPD, which does not take account of oxygen dependence in the first 28 days, is widely used in clinical trial and other academic work to describe this outcome.

NNAP standard

Benchmarking.

Inclusion criteria

Babies will be included for the BPD analysis if they meet the following criteria:

- Gestational age at birth is less than 32 weeks

and

- The baby was still an inpatient in a neonatal unit at 36 weeks postmenstrual age or had been discharged alive from neonatal care at less than 36 weeks postmenstrual age.

Results

There were **25,418** babies born less than 32 weeks, discharged between 01 January 2015 and 31 December 2017 as reported by **190** neonatal units who were considered eligible for this audit measure. Of these babies, **901** were excluded as the complete data required for analysis of BPD was not available from units participating in the NNAP. In total **24,517** babies were eligible for inclusion in the analysis.

Over 3 years **52.3%** babies were assessed as not having BPD, whilst **16.9%** of babies were defined as having mild BPD and **30.9%** were categorised as having significant BPD. BPD could not be determined for **0.2%** of babies. **1,880** babies died before they reached 36 weeks corrected gestational age.

All babies were assigned to their recorded place of birth for this analysis. For the following tables responses are assigned "Other" if the mother was recorded as delivering the baby at home, in transit, in an unknown location or in a maternity unit not allied with a NNAP participating unit in the first neonatal unit admission.

Table 5.12.1: BPD only, by neonatal unit level.

NNU level	NNU	Babies	Deaths before 36 weeks cga (%)	Babies alive at 36 weeks with sufficient data to attribute BPD outcome	BPD Status			Significant BPD or death (%)	*Missing data (%)*
					No BPD	Mild BPD	Significant BPD (%)		
SCU	45	1,324	93 (7%)	1,228	803	173	252 (20.5%)	345 (26.1%)	*3 (0.2%)*
LNU	89	8,833	470 (5.3%)	8,344	5,042	1,413	1,889 (22.6%)	2,359 (26.8%)	*19 (0.2%)*
NICU	56	14,360	1,317 (9.2%)	13,023	5,966	2,227	4,830 (37.1%)	6,147 (42.9%)	*20 (0.1%)*
Total	**190***	**24,517**	**1,880 (7.7%)**	**22,595**	**11,811 (52.3%)**	**3,813 (16.9%)**	**6,971 (30.9%)**	**8,851 (36.2%)**	***42 (0.2%)***
Other	*31*	*420*	*68 (16.2%)*	*352*	*182*	*59*	*111 (31.5%)*	*179 (42.6%)*	*0 (0%)*
Isle of Man	*1*	*8*	*0 (0%)*	*8*	*6*	*1*	*1 (12.5%)*	*1 (12.5%)*	*0 (0%)*

***Number of neonatal units higher than number participating in 2017 due to three-year data.**

Figure 5.12.1: Caterpillar plot of the rates of significant BPD or death; neonatal units.

Rates of significant BPD or death with the national rate of BPD or death. The 95% confidence intervals are indicated by vertical bars. The units can be identified in NNAP Online.

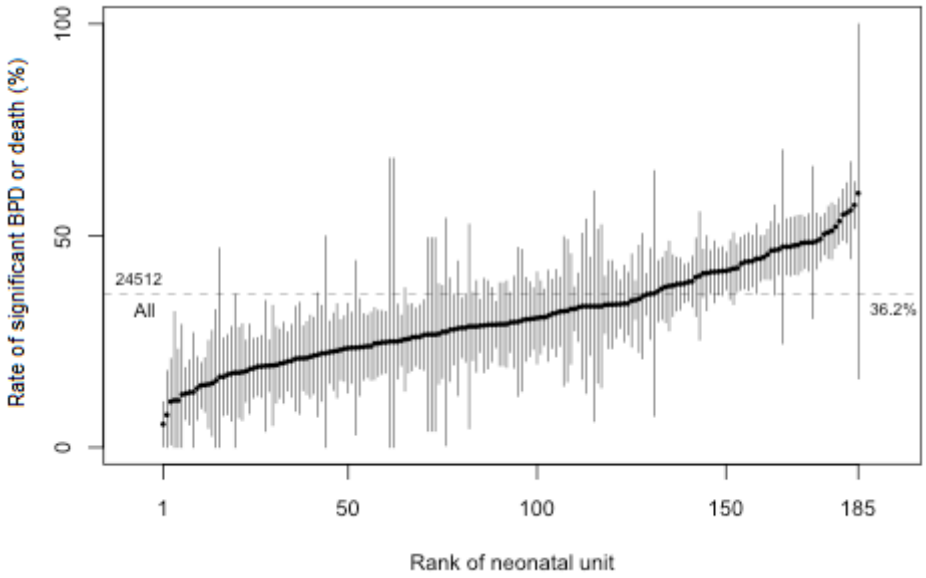


Table 5.12.2: BPD only, by neonatal network.

Network	Babies	Deaths before 36 weeks cga (%)	Babies alive at 36 weeks with sufficient data to attribute BPD outcome	BPD status			Significant BPD or death (%)	Missing data (%)
				No BPD	Mild BPD	Significant BPD (%)		
East of England Neonatal ODN	1,923	109 (5.7%)	1,814	1,055	313	446 (24.6%)	555 (28.9%)	*0 (0%)*
Midlands South West Newborn Neonatal ODN	1,147	124 (10.8%)	1,022	540	174	308 (30.1%)	432 (37.7%)	*1 (0.1%)*
North Central & North East London Neonatal ODN	1,797	96 (5.3%)	1,690	848	310	532 (31.5%)	628 (35.2%)	*11 (0.6%)*
North West London Neonatal ODN	1,124	80 (7.1%)	1,033	535	163	335 (32.4%)	415 (37.3%)	*11 (1%)*
North West Neonatal ODN	3,173	303 (9.5%)	2,869	1,448	432	989 (34.5%)	1,292 (40.7%)	*1 (0%)*
Northern Neonatal ODN	1,080	79 (7.3%)	996	479	137	380 (38.2%)	459 (42.7%)	*5 (0.5%)*
Scotland	1,266	111 (8.8%)	1,155	570	203	382 (33.1%)	493 (38.9%)	*0 (0%)*
South East Coast Neonatal ODN	1,732	117 (6.8%)	1,615	883	286	446 (27.6%)	563 (32.5%)	*0 (0%)*
South London Neonatal ODN	1,593	111 (7%)	1,482	744	227	511 (34.5%)	622 (39.0%)	*0 (0%)*
South West Neonatal ODN	1,514	101 (6.7%)	1,407	698	268	441 (31.3%)	542 (35.8%)	*6 (0.4%)*
Staffordshire, Shropshire and Black Country Neonatal ODN	901	110 (12.2%)	791	396	159	236 (29.8%)	346 (38.4%)	*0 (0%)*
Thames Valley & Wessex ODN	2,040	119 (5.8%)	1,919	1,053	308	558 (29.1%)	677 (33.2%)	*2 (0.1%)*
Trent Perinatal & Central Newborn Neonatal ODN	1,895	164 (8.7%)	1,727	897	312	518 (30%)	682 (36.1%)	*4 (0.2%)*
Wales	990	64 (6.5%)	925	467	179	279 (30.2%)	343 (34.7%)	*1 (0.1%)*
Yorkshire & Humber Neonatal ODN	2,342	192 (8.2%)	2,150	1,198	342	610 (28.4%)	802 (34.2%)	*0 (0%)*
Total	**24,517**	**1880 (7.7%)**	**22,595**	**11,811**	**3813**	**6971 (30.9%)**	**8,851 (36.2%)**	***42 (0.2%)***
Other	*420*	*68 (16.2%)*	*352*	*182*	*59*	*111 (31.5%)*	*179 (42.6%)*	*0 (0%)*
Isle of Man	*8*	*0 (0%)*	*8*	*6*	*1*	*1 (12.5%)*	*1 (12.5%)*	*0 (0%)*

Figure 5.12.2: Caterpillar plot of rates of BPD or death in very preterm babies cared for in neonatal networks in England, Wales and Scotland 2015-2017.

Rates of significant BPD or death with the national rate for BPD or death. The 95% confidence intervals are indicated by vertical bars. The networks are presented in the ascending order of the rates in 2017.

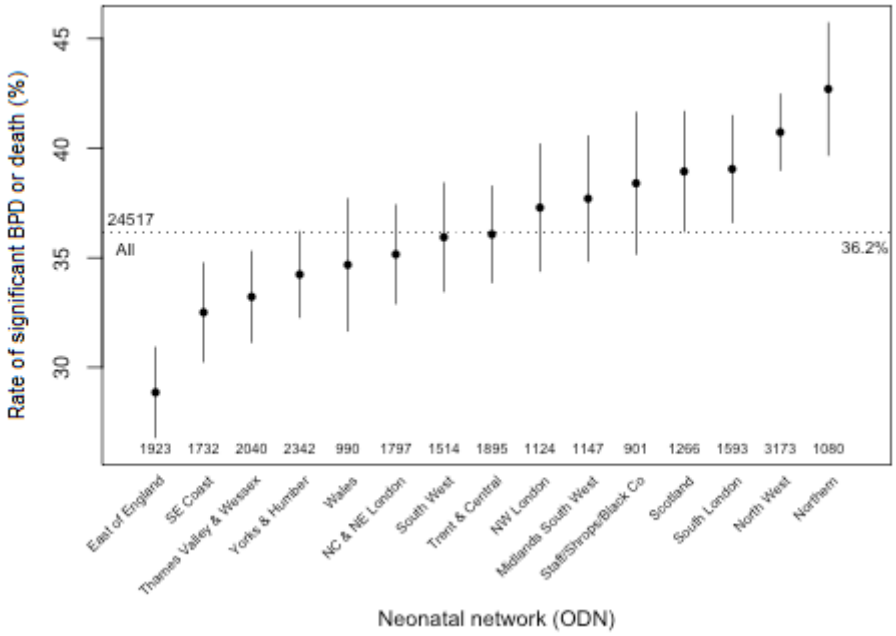
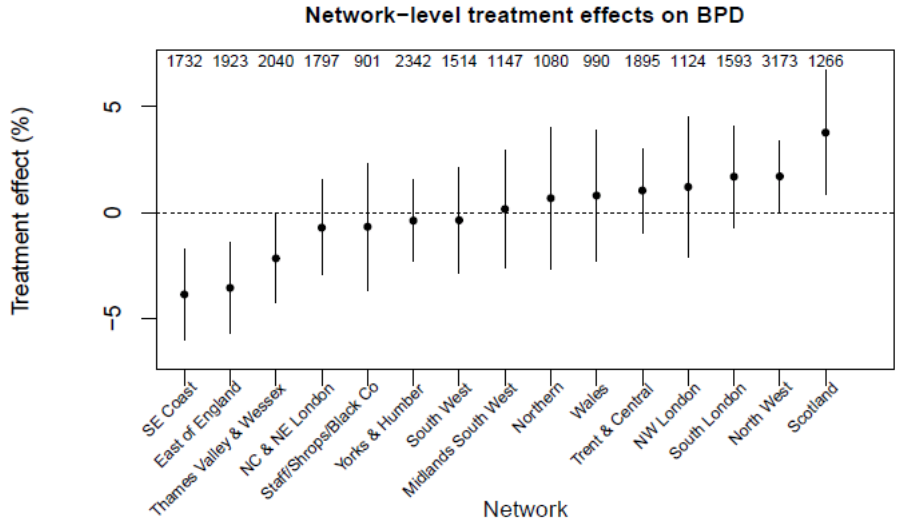


Figure 5.12.3: Caterpillar plot of 'treatment effect' on rates of BPD or death in very preterm babies cared for in neonatal networks in England, Wales and Scotland 2015-2017.



"Treatment effect" is the difference between the rate of BPD or death in babies cared for in a neonatal network compared to the observed rate for a matched group of babies with very similar case mix, cared for in all neonatal units. A positive treatment effect indicates that the rate of BPD or death is higher in the network of interest than for a comparable

group of babies cared for in all neonatal units. Where the 95% confidence interval for this effect excludes 0, the treatment effect is unlikely to be a chance finding.

Explaining 'treatment effect'

As an example, consider the combined rate of BPD or death in the Northern region. It is the highest of the networks' rates, and the 95% confidence intervals indicate that this is not a chance finding. However, within the network treatment effect analysis, babies cared for in the Northern region had comparable rates of BPD or death compared to those cared for in all participating units – and therefore only a small treatment effect, whose 95% confidence intervals cross zero. Therefore it is likely that explanations other than how babies are cared for in the Northern region explain the high reported rates of BPD or death.

By contrast the upper panel shows that the combined rate of BPD or death in the South East Coast Neonatal Network is lower than the national rate. When the rate of BPD or death for a set of babies matched to those cared for in the South East Coast Neonatal Network is compared, a negative treatment effect is observed, with 95% confidence intervals excluding zero. This suggests that treatment in South East Coast Neonatal Network is associated with 3.9% lower rates of BPD or death.

Table 5.12.3: Rates of BPD only, by NNAP reporting period (2013–2017).

NNAP Year	NNU	Babies	With outcome	Significant BPD (%)	*Missing data (%)*
2013-2015	182	21,805	21,673	6,508 (30%)	*132 (0.6%)*
2014-2016	183	22,049	21,978	6,792 (30.9%)	*71 (0.3%)*
2015-2017	190	24,517	22,595	6,971 (30.9%)	*42 (0.2%)*

5.13. Necrotising enterocolitis

Necrotising enterocolitis (NEC) is a devastating illness which can follow preterm birth. Bowel inflammation prevents milk feeding, surgery may be needed and babies who develop NEC typically stay in hospital for a long time. Rates of mortality in babies with NEC are high, at over 20%. Babies who survive NEC can have developmental problems when they are older.

The key findings and recommendations for this audit measure are found on page 45.

NNAP audit measure

Does an admitted baby born at less than 32 weeks gestational age meet the NNAP surveillance definition for necrotising enterocolitis (NEC) on one or more occasion?

For this outcome, babies are assigned to the unit of presence at the age of 48 hours as a proxy measure of the unit that was intended to provide ongoing care for them.

Change to the audit measure for the 2017 data year: New measure for the 2017 data year.

NNAP standard

Benchmarking.

Inclusion criteria

Babies were included for analysis if they meet the following criteria:

- Final neonatal discharge in the calendar year of analysis
- Care provided by an NNAP unit
- Born at less than 32 weeks gestational age and survived to at least 48 hours after birth
- Admitted for one or more episodes of care in a neonatal unit.

Results

8,228 babies were born at less than 32 weeks and survived to 48 hours after birth. Of these, **5.6%** had a confirmed case of NEC on one or more occasion.

For **600** babies it was not possible to determine whether the baby had NEC at any point in their neonatal care.

Table 5.13.1: NEC, by neonatal unit level.

NNU level	NNU	Babies	With outcome	NEC Status			*Missing data*	
				Died prior to discharge home, but no NEC	No NEC	NEC	*Alive at discharge (%)*	*Death before discharge (%)*
SCU	33	186	174	0	171	3 (1.7%)	*11 (5.9%)*	*1 (0.5%)*
LNU	85	2,542	2,304	16	2,220	68 (3%)	*234 (9.2%)*	*4 (0.2%)*
NICU	54	5,469	5,122	267	4,501	354 (6.9%)	*242 (4.4%)*	*105 (1.9%)*
Other	-	31	28	0	25	3 (10.7%)	*3 (9.7%)*	*0 (0%)*
Total	**172**	**8,228**	**7,628**	**283**	**6,917**	**428 (5.6%)**	***490 (6%)***	***110 (1.3%)***

Table 5.13.2: NEC, by neonatal network.

Network	Babies	With outcome	NEC status			*Missing data*	
			Died prior to discharge home, but no NEC	No NEC	NEC	*Alive at discharge (%)*	*Death before discharge (%)*
East of England Neonatal ODN	633	607	18	547	42 (6.9%)	26 (4.1%)	0 (0%)
Midlands South West Newborn Neonatal ODN	356	324	13	288	23 (7.1%)	23 (6.5%)	9 (2.5%)
North Central & North East London Neonatal ODN	574	545	16	500	29 (5.3%)	28 (4.9%)	1 (0.2%)
North West London Neonatal ODN	363	350	13	321	16 (4.6%)	8 (2.2%)	5 (1.4%)
North West Neonatal ODN	1,039	952	44	864	44 (4.6%)	53 (5.1%)	34 (3.3%)
Northern Neonatal ODN	307	250	5	233	12 (4.8%)	49 (16%)	8 (2.6%)
Scotland	495	457	20	416	21 (4.6%)	31 (6.4%)	7 (1.4%)
South East Coast Neonatal ODN	587	549	19	493	37 (6.7%)	34 (5.8%)	4 (0.7%)
South London Neonatal ODN	514	468	17	402	49 (10.5%)	40 (7.8%)	6 (1.2%)
South West Neonatal ODN	562	496	22	458	16 (3.2%)	64 (11.4%)	2 (0.4%)
Staffordshire, Shropshire and Black Country Neonatal ODN	292	279	15	247	17 (6.1%)	10 (3.4%)	3 (1%)
Thames Valley & Wessex ODN	711	675	23	622	30 (4.4%)	27 (3.8%)	9 (1.3%)
Trent Perinatal & Central Newborn Neonatal ODN	598	544	18	485	41 (7.5%)	46 (7.7%)	8 (1.3%)
Wales	333	323	7	299	17 (5%)	6 (1.8%)	4 (1.2%)
Yorkshire & Humber Neonatal ODN	830	778	33	714	31 (4%)	42 (5.1%)	10 (1.2%)
Isle of Man	3	3	0	3	0 (0%)	0 (0%)	0 (0%)
Other	31	28	0	24	3 (10.7%)	3 (9.7%)	0 (0%)
Total	**8,228**	**7,628**	**283**	**6,917**	**428 (5.6%)**	490 (6%)	110 (1.3%)

5.14. Minimising separation of mother and term baby

Some babies admitted to neonatal units may be separated from their mothers for longer than necessary. It may be possible to care for some babies in transitional care, a setting which takes an interdisciplinary approach of both midwives and neonatal staff to deliver high-quality care to both mothers and babies and avoid their separation. [32] This measure seeks to describe the number of babies admitted to neonatal units for low dependency care and to compare the number of days that babies were separated from their mothers.

The measure describes the number of "separation days" for each admission to a neonatal unit. Separation days are defined as days of low dependency care where breathing support was not needed. For some babies, separation from their mother may be able to be avoided altogether, with all their neonatal care delivered in a transitional care setting. For other babies where a neonatal unit admission is unavoidable, there may still be opportunities to reduce separation care days during admission, particularly where separation days are high.

The key findings and recommendations for this audit measure are found on page 47.

NNAP audit measure

For a baby born at gestational age greater than or equal to 37 weeks, who did not have any surgery or a transfer during any admission, how many special care[a] or normal care[b] days were provided when oxygen was not administered?

a= Healthcare Resource Group (HRG) 3, or b= HRG 5, as defined by the NHS England neonatal critical care service specification.[24]

Change to the audit measure for the 2017 data year: New measure for the 2017 data year.

NNAP standard

Benchmarking.

Inclusion criteria

Babies were included for analysis if they met the following criteria:

- Gestational age at birth greater than or equal to 37 weeks
- Received all their care in one NNAP unit
- Admitted for at least 12 hours
- Did not have major surgery
- Had care given on a neonatal unit at any point during the admission

Normal or special care days for these eligible babies were counted where they met the following criteria:

- Nursed on a neonatal unit on that day, or days
- No oxygen or other form of non-invasive respiratory support was provided on that day or days
- HRG level was 3 or 5

Results

Almost all (**28,524** of **31,725**, **89.9%**) of admitted term babies, who did not have surgery and were not transferred, had some special or normal care days on which oxygen was not administered. **100,771** special care and normal care days (**67,069 special care**; **33,702 normal care**) were provided to these 28,524 babies. On average **3.2** special care or normal care days were given for each neonatal unit admitted baby in this gestation category.

The NNAP notes that some neonatal units provide in house accommodation for mother and baby, which, in the absence of midwifery input, is not currently recorded as neonatal transitional care; this may result in some local over estimation of term baby separation.

Table 5.14.1: Babies spending one or more days in special or normal care, by neonatal unit level.

NNU level	NNU	Babies	Babies who received one or more eligible days in special or normal care (%)	Number of eligible care days			Number of separation days per baby
				Special care	Normal care	Total special and normal care days	
SCU	**37**	3,667	3,374 (92%)	7,648	4,531	12,179	3.3
LNU	**88**	13,958	12,791 (91.6%)	29,074	15,524	44,598	3.2
NICU	**54**	14,100	12,359 (87.7%)	30,347	13,647	43,994	3.1
Total	**179**	**31,725**	**28,524 (89.9%)**	**67,069**	**33,702**	**100,771**	**3.2**

Table 5.14.2: Babies spending one or more days in special or normal care, by neonatal network.

Network	Babies	Babies who received one or more eligible days in special or normal care (%)	Number of eligible care days			Number of separation days per baby
			Special care	Normal care	Total special and normal care days	
East of England Neonatal ODN	4,110	3,716 (90.4%)	8,654	3,855	12,509	3
Midlands South West Newborn Neonatal ODN	1,841	1,560 (84.7%)	3,181	2,040	5,221	2.8
North Central & North East London Neonatal ODN	2,570	2,379 (92.6%)	6,464	2,795	9,259	3.6
North West London Neonatal ODN	994	883 (88.8%)	2,023	1,116	3,139	3.2
North West Neonatal ODN	3,367	3,195 (94.9%)	8,513	4,167	12,680	3.8
Northern Neonatal ODN	1,053	943 (89.6%)	2,190	1,253	3,443	3.3
Scotland	2,216	2,075 (93.6%)	4,758	3,168	7,926	3.6
South East Coast Neonatal ODN	1,899	1,664 (87.6%)	3,523	1,776	5,299	2.8
South London Neonatal ODN	2,006	1,844 (91.9%)	5,115	1,635	6,750	3.4
South West Neonatal ODN	2,530	2,086 (82.5%)	4,287	2,522	6,809	2.7
Staffordshire, Shropshire and Black Country Neonatal ODN	1,026	874 (85.2%)	1,954	1,083	3,037	3
Thames Valley & Wessex ODN	2,301	2,088 (90.7%)	4,880	2,178	7,058	3.1
Trent Perinatal & Central Newborn Neonatal ODN	2,223	2,057 (92.5%)	4,259	1,825	6,084	2.7
Wales	1,196	1,094 (91.5%)	2,457	1,442	3,899	3.3
Yorkshire & Humber Neonatal ODN	2,330	2,005 (86.1%)	4,656	2,751	7,407	3.2
Isle of Man	63	61 (96.8%)	155	96	251	4
Total	**31,725**	**28,524 (89.9%)**	**67,069**	**33,702**	**100,771**	**3.2**

5.15. Minimising separation of mother and late preterm baby (34–36 weeks)

The key findings and recommendations for this audit measure are found on page 47.

NNAP audit measure

For a baby born at 34-36 weeks gestational age, who did not have any surgery or a transfer during any admission, how many special care [a] or normal care[b] days were provided when oxygen was not administered?

a= HRG 3 or b= HRG 5, as defined by the NHS England neonatal critical care service specification.[24]

Change to the audit measure for the 2017 data year: New measure for the 2017 data year.

NNAP standard

Benchmarking.

Inclusion criteria

Babies will be included for analysis if they meet the following criteria:

- Born between 34 and 36 weeks gestational age
- Received all their care in one NNAP unit
- Admitted for at least 12 hours
- Did not have major surgery

Normal or special care days for these eligible babies will be counted where they meet the following criteria:

- Nursed on a neonatal unit on a day, or days
- No oxygen or other form of non-invasive respiratory support was provided on that day or days

- HRG level is 3 or 5

Results

Almost all (**14,917** of **15,649**; **95.3%**) of admitted babies born at 34-36 weeks gestation received one or more days of special or normal care on which oxygen was not administered. **105,723** special and normal care days (**81,604** special care; **24,119** normal care) were provided, meaning that on average **6.8** special care or normal care days were given for each neonatal unit admitted baby in this gestation category.

Table 5.15.1: Babies spending one or more days in special or normal care, by neonatal unit level.

NNU level	NNU	Babies	Babies who received one or more eligible days in special or normal care (%)	Number of eligible care days			Number of separation days per baby
				Special care	Normal care	Total special and normal care days	
SCU	**37**	2,021	1,975 (97.7%)	11,598	3,727	15,325	7.6
LNU	**88**	7,496	7,235 (96.5%)	39,298	12,564	51,862	6.9
NICU	**54**	6,132	5,707 (93.1%)	30,708	7,828	38,536	6.3
Total	**179**	**15,649**	**14,917 (95.3%)**	**81,604**	**24,119**	**105,723**	**6.8**

Table 5.15.2: Babies spending one or more days in special or normal care, by neonatal network.

Network	Babies	Babies who received one or more eligible days in special or normal care (%)	Number of eligible care days			Number of separation days per baby
			Special care	Normal care	Total special and normal care days	
East of England Neonatal ODN	1,854	1,778 (95.9%)	8,578	2,258	10,836	5.8
Midlands South West Newborn Neonatal ODN	689	622 (90.3%)	2,968	935	3,903	5.7
North Central & North East London Neonatal ODN	1,005	978 (97.3%)	5,965	1,747	7,712	7.7
North West London Neonatal ODN	476	449 (94.3%)	2,529	770	3,299	6.9
North West Neonatal ODN	1,905	1,867 (98%)	11,545	3,758	15,303	8
Northern Neonatal ODN	628	609 (97%)	3,939	1,089	5,028	8
Scotland	1,211	1,173 (96.9%)	7,316	1,819	9,135	7.5
South East Coast Neonatal ODN	1,134	1,069 (94.3%)	5,529	1,428	6,957	6.1
South London Neonatal ODN	819	796 (97.2%)	4,503	1,021	5,524	6.7
South West Neonatal ODN	1,025	951 (92.8%)	5,390	1,805	7,195	7
Staffordshire, Shropshire and Black Country Neonatal ODN	528	481 (91.1%)	2,423	785	3,208	6.1
Thames Valley & Wessex ODN	1,115	1,078 (96.7%)	5,912	1,631	7,543	6.8
Trent Perinatal & Central Newborn Neonatal ODN	1,193	1,128 (94.6%)	4,688	1,449	6,137	5.1
Wales	601	579 (96.3%)	2,755	986	3,741	6.2
Yorkshire & Humber Neonatal ODN	1,437	1,330 (92.6%)	7,321	2,596	9,917	6.9
Isle of Man	29	29 (100%)	243	42	285	9.8
Total	**15,649**	**14,917 (95.3%)**	**81,604**	**24,119**	**105,723**	**6.8**

5.16. Breastmilk feeding at discharge home

Premature babies are vulnerable to infection, and their own mother's milk provides an important line of defence through the protective antibodies that it provides. These significant health benefits include a reduction in infection and bowel problems, as well as improved longer-term health and neurodevelopmental outcomes.

The key findings and recommendations for this audit measure are found on page 50.

NNAP audit measure

Does a baby born at less than 33 weeks gestational age receive any of their own mother's milk at discharge to home from a neonatal unit?[28]

Change to the audit measure for the 2017 data year: None.

NNAP standard

Benchmarking.

Inclusion criteria

Babies were included in the analysis if they met the following criteria:

- Born at less than 33 weeks gestational age
- Received all their neonatal care in one neonatal unit, and were discharged home at the end of their neonatal care
- Experienced their final neonatal discharge in the calendar year of analysis
- Had care provided by an NNAP unit

Results

Of the **11,282** babies born at less than 33 weeks and admitted to an NNAP neonatal unit, there were **6,418** babies who met the criteria for inclusion in this question.

Daily data summaries for the last or penultimate day of care indicated that **60.5%** of eligible babies were receiving mother's milk, exclusively or with another form of feeding, at the time of their discharge from neonatal care. Of the remaining babies, **39.5%** were recorded as receiving other types of feeding at discharge and **0.4%** had no feeding data available from the last or penultimate day of care. Other types of enteral feeds are; 'Formula', 'Donor expressed breast milk' and 'Nil by mouth'.

This question is restricted to non-transferred babies, so that unit-level analysis can attribute this outcome solely to unit processes. However, in doing so **4,024** otherwise eligible babies are excluded from the analysis, which remains a limitation to the utility of this metric.

Table 5.16.1: Breastmilk feeding at discharge, by neonatal unit clinical level.

NNU level	NNU	Babies	With outcome	Enteral feeds at the time of discharge		*Missing Data (%)*
				Any breast milk (%)	No breast milk (%)	
SCU	34	341	336	230 (68.5%)	106 (31.5%)	5 (1.5%)
LNU	88	2,851	2,841	1,761 (62%)	1,080 (38%)	10 (0.4%)
NICU	54	3,226	3,217	1,875 (58.3%)	1,342 (41.7%)	9 (0.3%)
Total	**176**	**6,418**	**6,394**	3,866 (60.5%)	2,528 (39.5%)	24 (0.4%)

Figure 5.16.1: Caterpillar plot of the rates of breastmilk feeding at discharge; neonatal units.

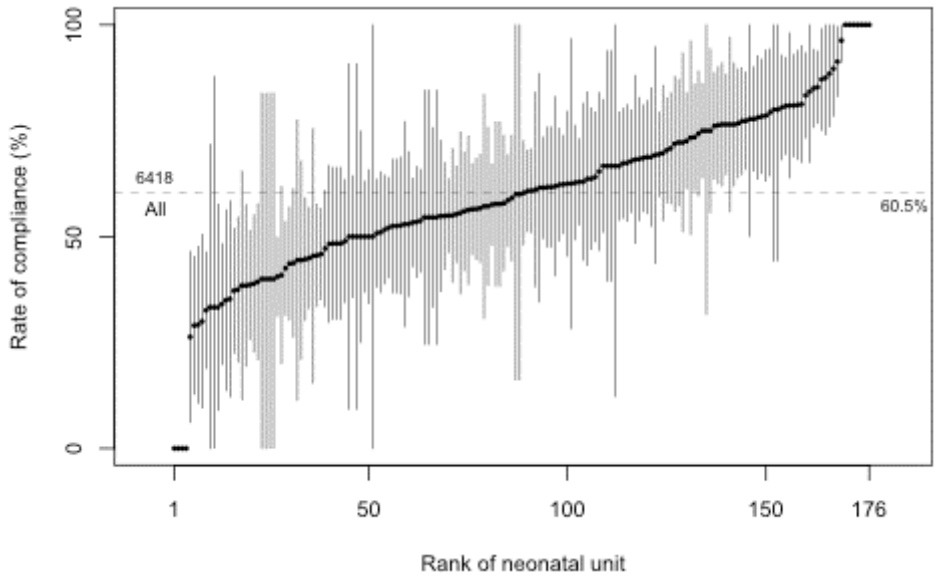


Table 5.16.2: Breastmilk feeding at discharge, by neonatal network.

Network	Babies	With outcome	Enteral feeds at the time of discharge		*Missing Data (%)*
			Any breast milk (%)	No breast milk (%)	
East of England Neonatal ODN	560	556	379 (68.2%)	177 (31.8%)	*4 (0.7%)*
Midlands South West Newborn Neonatal ODN	279	279	175 (62.7%)	104 (37.3%)	*0 (0%)*
North Central & North East London Neonatal ODN	428	428	319 (74.5%)	109 (25.5%)	*0 (0%)*
North West London Neonatal ODN	273	271	238 (87.8%)	33 (12.2%)	*2 (0.7%)*
North West Neonatal ODN	747	743	368 (49.5%)	375 (50.5%)	*4 (0.5%)*
Northern Neonatal ODN	213	212	109 (51.4%)	103 (48.6%)	*1 (0.5%)*
Scotland	457	456	239 (52.4%)	217 (47.6%)	*1 (0.2%)*
South East Coast Neonatal ODN	433	433	271 (62.6%)	162 (37.4%)	*0 (0%)*
South London Neonatal ODN	344	339	264 (77.9%)	75 (22.1%)	*5 (1.5%)*
South West Neonatal ODN	429	427	264 (61.8%)	163 (38.2%)	*2 (0.5%)*
Staffordshire, Shropshire and Black Country Neonatal ODN	257	257	125 (48.6%)	132 (51.4%)	*0 (0%)*
Thames Valley & Wessex ODN	564	563	367 (65.2%)	196 (34.8%)	*1 (0.2%)*
Trent Perinatal & Central Newborn Neonatal ODN	507	504	270 (53.6%)	234 (46.4%)	*3 (0.6%)*
Wales	250	250	131 (52.4%)	119 (47.6%)	*0 (0%)*
Yorkshire & Humber Neonatal ODN	672	671	345 (51.4%)	326 (48.6%)	*1 (0.1%)*
Isle of Man	5	5	2 (40%)	3 (60%)	*0 (0%)*
Total	**6,418**	**6,394**	**3,866 (60.5%)**	**2,528 (39.5%)**	***24 (0.4%)***

Figure 5.16.2: Caterpillar plot of the rates of breastmilk feeding at discharge; neonatal networks.

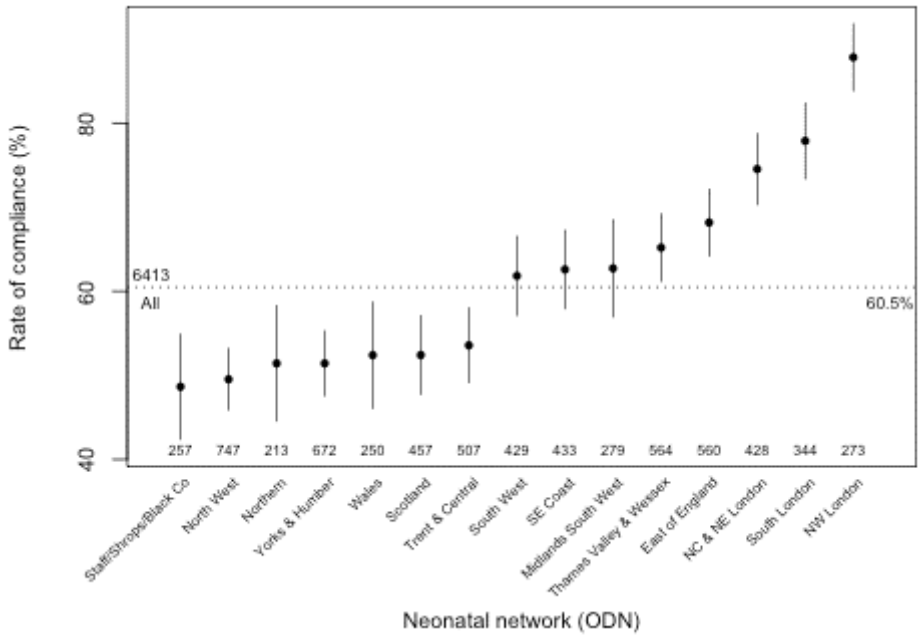


Table 5.16.3: Breastmilk feeding at discharge, by NNAP reporting year (2013–2017).

NNAP Year	NNU	Babies	With outcome	Enteral feeds at the time of discharge		*Missing data (%)*
				Any breast milk (%)	No breast milk (%)	
2013	170	5,920	5,902	3,509 (59.5%)	2,393 (40.5%)	*18 (0.3%)*
2014	169	5,942	5,866	3,570 (60.9%)	2,296 (39.1%)	*76 (1.3%)*
2015	175	6,323	6,268	3,693 (58.9%)	2,575 (41.1%)	*55 (0.9%)*
2016	176	6,574	6,473	3,866 (59.7%)	2,607 (40.3%)	*101 (1.5%)*
2017	176	6,418	6,394	3,866 (60.5%)	2,528 (39.5%)	*24 (0.4%)*

5.17. Follow-up at two years of age

It is important that the development of very preterm babies is monitored by a paediatrician or neonatologist after the baby is discharged from the neonatal unit. This measure looks at whether there is a documented follow up consultation at two years of age for babies born at less than 30 weeks gestational age between July 2014 and June 2015 who survived and were discharged home from the neonatal unit. The follow up consultation assesses whether there are any significant problems with movement, the senses, and whether there are delays in development or other health problems. Babies born very early encounter these problems more often than those born at full term and it is important for those involved in the care of babies to know how the babies are developing as they get older so that they can arrange appropriate treatment.

The key findings and recommendations for this audit measure are found on page 52.

NNAP audit measure

Does a baby born at less than 30 weeks gestational age receive medical follow-up at two years corrected age (18-30 months gestationally corrected age)?

Does a baby have complete results of a structured assessment recorded[24,33]?

Babies are assigned to their final neonatal unit of discharge for this measure, on the basis that most babies are discharged from the centre which will be responsible for arranging follow up.

Change to the audit measure for the 2017 data year: None

NNAP standard

100% of babies with two-year follow-up data entered.

Source of standard: NNAP Project Board

Outlier analysis: Yes

Inclusion criteria

- Babies born at less than 30 weeks who are not recorded as deceased within their episodic data (including final neonatal outcome).
- Babies whose parents or carers have not opted them out of secondary use of their data.
- The eligible cohort runs for births from July 2014 to June 2015.

Results

There were **4,043** babies less than 30 weeks gestation born between July 2014 and June 2015 who survived and were discharged from a neonatal unit to home, to a ward or to foster care. Of these babies **62.6**% had some/all health data entered. The remaining **1,512** (**37.4**%) babies had no two-year follow-up health data entered at all.

48.7% of babies who had two-year follow-up health data entered and did not die post discharge, had data entered in the standardised assessment sections (Bayley III, Griffiths or Schedule of Growing) of the two-year follow-up forms on BadgerNet.

Table 5.17.1: Two year follow up assessment for babies born between July 2014 and June 2015.

Year	Babies	Some health data entered (%)	No health data entered (%)
2017	4,043	2,531 (62.6%)	1,512 (37.4%)

Figure 5.17.1: Caterpillar plot of the rates of two year follow up assessment; neonatal units.

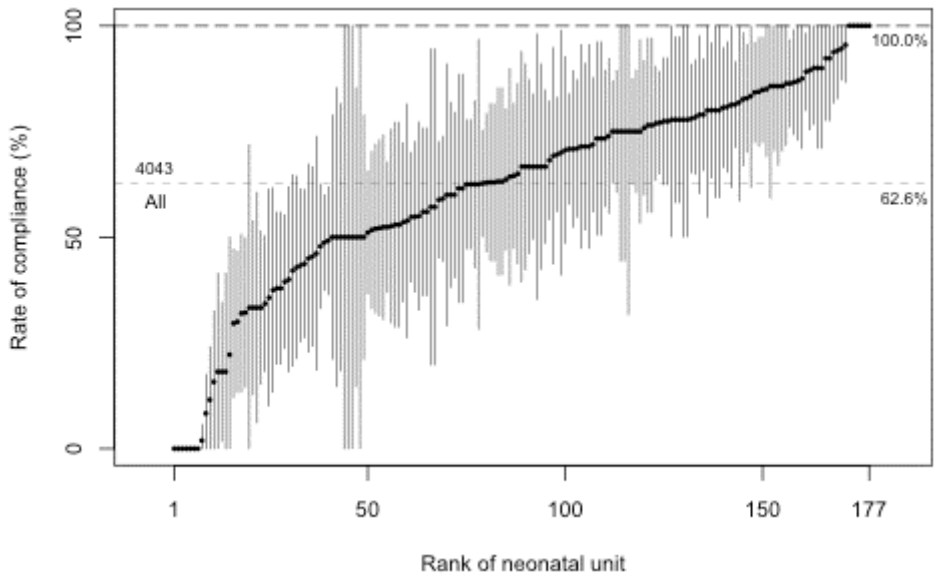


Table 5.17.2: Two year follow up assessment for babies born between July 2014 and June 2015, by neonatal network.

Network	Babies	Some health data entered (%)	No health data entered (%)
East of England Neonatal ODN	366	213 (58.2%)	153 (41.8%)
Midlands South West Newborn Neonatal ODN	195	142 (72.8%)	53 (27.2%)
North Central & North East London Neonatal ODN	315	151 (47.9%)	164 (52.1%)
North West London Neonatal ODN	155	86 (55.5%)	69 (44.5%)
North West Neonatal ODN	528	327 (61.9%)	201 (38.1%)
Northern Neonatal ODN	169	99 (58.6%)	70 (41.4%)
Scotland	188	128 (68.1%)	60 (31.9%)
South East Coast Neonatal ODN	297	170 (57.2%)	127 (42.8%)
South London Neonatal ODN	267	144 (53.9%)	123 (46.1%)
South West Neonatal ODN	270	192 (71.1%)	78 (28.9%)
Staffordshire, Shropshire and Black Country Neonatal ODN	119	82 (68.9%)	37 (31.1%)
Thames Valley & Wessex ODN	319	233 (73%)	86 (27%)
Trent Perinatal & Central Newborn Neonatal ODN	316	192 (60.8%)	124 (39.2%)
Wales	153	104 (68%)	49 (32%)
Yorkshire & Humber Neonatal ODN	386	268 (69.4%)	118 (30.6%)
Total	4,043	**2,531 (62.6%)**	**1,512 (37.4%)**

Figure 5.17.2: Caterpillar plot of the rates of two year follow up assessment; neonatal networks.

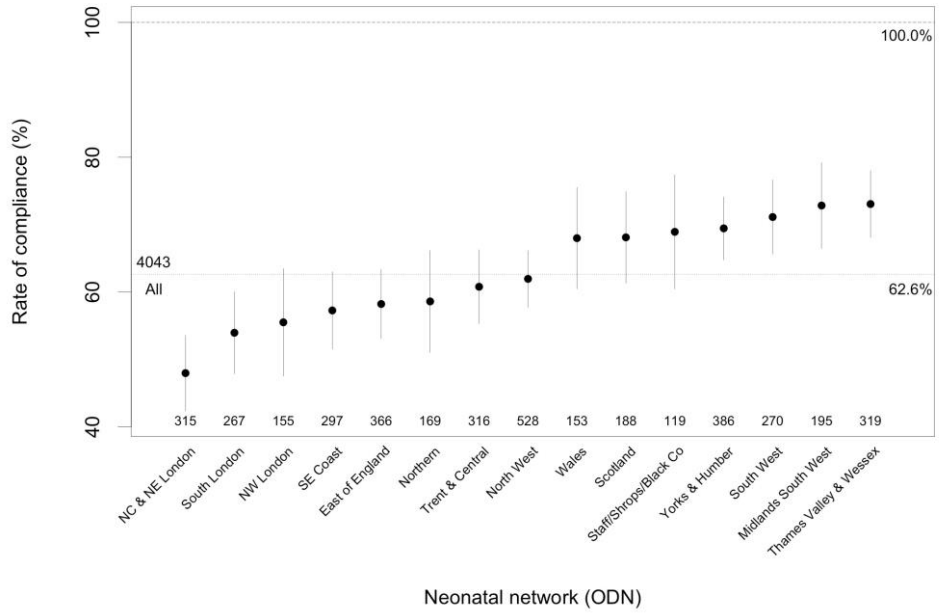


Table 5.17.3: Two year follow up rates of compliance, by NNAP reporting year (2012-2017).

Year	Babies	Some health data entered (%)	No health data entered (%)
2012	2,967	1,242 (41.9%)	1,725 (58.1%)
2013	3,488	1,561 (44.8%)	1,927 (55.2%)
2014	3,656	1.993 (54.5%)	1,663 (44.5%)
2015	3,744	2,265 (60.5%)	1,479 (39.5%)
2016	4,023	2,450 (60.9%)	1,573 (39.1%)
2017	4,043	2,531 (62.6%)	1,512 (37.4%)

Table 5.17.4: Assessments used for two-year follow up and network

Network	Babies with health data entered who did not die post discharge	Bayley III, Griffiths or Schedule of growing assessment used (%)	Assessment used			Other	Unknown
			Bayley III	Griffiths	Schedule of growing		
East of England Neonatal ODN	207	161	148	10	3	2	44
Midlands South West Newborn Neonatal ODN	141	65	4	0	61	0	76
North Central & North East London Neonatal ODN	148	87	82	4	1	3	58
North West London Neonatal ODN	85	43	40	3	0	1	41
North West Neonatal ODN	319	27	18	0	9	9	283
Northern Neonatal ODN	98	61	58	0	3	0	37
Scotland	127	60	48	0	12	3	64
South East Coast Neonatal ODN	169	100	73	1	26	2	67
South London Neonatal ODN	143	98	63	18	17	0	45
South West Neonatal ODN	191	159	136	19	4	1	31
Staffordshire, Shropshire and Black Country Neonatal ODN	79	56	55	0	1	2	21
Thames Valley & Wessex ODN	230	79	67	0	12	11	140
Trent Perinatal & Central Newborn Neonatal ODN	191	62	21	0	41	6	123
Wales	103	81	66	11	4	2	20
Yorkshire & Humber Neonatal ODN	259	73	1	0	72	4	182
Total	**2,490**	**1,212 (48.7%)**	**880**	**66**	**266**	**46**	**1,232**

Appendix A: Data completeness and unit level of participating units

For each NNAP audit measure, there is an associated rate of missing entries. The rate of missing entries is described as M/T, where M is the number of missing entries and T is the number of all cases. To summarise data completeness across all NNAP measures, an average was taken of the rates of missing entries associated with a given unit. This methodology was applied to the 2017 data shown in this report (see Table A).

ROP was not included in the data completeness summary measure as it is not possible to differentiate between a negative ("never screened") outcome and missing data. Infection data is known to be incompletely entered on to the BadgerNet system and is omitted from the data completeness summary measure. In addition, it is not possible to calculate a rate of missing entries for the number of care days given for the minimising avoidable mother baby separation measures so these measures are also omitted.

For the NEC, BPD and Encephalopathy measures, the rate of missing entries is derived from the completeness of the daily or episodic data items used to categorise the results for these measures for the 2017 data year. This ensures units' completeness is measures using the information they have responsibility for inputting into BadgerNet.

To calculate the number of eligible babies for one or more NNAP measures, a sum of all the eligible babies reported for each unit for the 2017 data year is taken.

Babies that are included in the Encephalopathy measure are not included in this count as it covers 2014-2016 data only. Similarly, only eligible babies for the 2017 data year for the BPD measure are included in this count.

For full details of unit level missing data, please see NNAP Online.

Table A: NNAP participating neonatal units[1] (2017 data), average missing data and eligible babies.

Note that some units that are included in the Encephalopathy measure are not included in this table as they did not contribute 2017 data to the audit due to closure.

Neonatal unit	Unit level	Average missing data (%)	Number of babies eligible for one or more NNAP measures
ENGLAND			
East of England Neonatal ODN			
Bedford Hospital	SCU	5.0%	312
Hinchingbrooke Hospital	SCU	5.2%	335
James Paget Hospital	SCU	9.3%	416
West Suffolk Hospital	SCU	4.2%	361
Basildon Hospital	LNU	10.0%	451
Broomfield Hospital	LNU	7.3%	397
Colchester General Hospital	LNU	9.2%	477
Ipswich Hospital	LNU	15.3%	711
Lister Hospital	LNU	2.7%	952
Peterborough City Hospital	LNU	6.0%	1265
Princess Alexandra Hospital	LNU	8.5%	485
Queen Elizabeth Hospital, King's Lynn	LNU	4.2%	535
Southend Hospital	LNU	7.8%	361
Watford General Hospital	LNU	2.1%	1,426
Luton & Dunstable Hospital	NICU	3.3%	995
Norfolk & Norwich University Hospital	NICU	5.7%	1,297
Rosie Maternity Hospital, Addenbrookes	NICU	4.9%	911
Midlands South West Newborn Neonatal ODN			
Good Hope Hospital	SCU	10.3%	621
Hereford County Hospital	SCU	3.7%	266
City Hospital, Birmingham	LNU	8.8%	1,217
Worcestershire Royal Hospital	LNU	5.6%	1,172
Birmingham Heartlands Hospital	NICU	12.0%	1,335
Birmingham Women's Hospital	NICU	9.1%	2,011
North Central & North East London Neonatal ODN			
The Royal Free Hospital	SCU	3.3%	396
Barnet Hospital	LNU	4.7%	1,608
Newham General Hospital	LNU	15.1%	648
North Middlesex University Hospital	LNU	8.0%	568
Queen's Hospital, Romford	LNU	4.3%	937
Whipps Cross University Hospital	LNU	22.9%	494
Whittington Hospital	LNU	8.8%	2,188

[1] Three eligible units did not participate in 2017; Dr Gray's Hospital, Elgin, Simpsons Centre for Reproductive Health, Royal Infirmary of Edinburgh, and St John's Hospital, Livingston.

Homerton Hospital	NICU	4.8%	1,466
The Royal London Hospital	NICU	21.8%	811
University College Hospital	NICU	4.0%	971
North West London Neonatal ODN			
West Middlesex University Hospital	SCU	10.7%	532
Hillingdon Hospital	LNU	1.5%	774
Northwick Park Hospital	LNU	11.0%	523
St Mary's Hospital, London	LNU	16.5%	433
Chelsea & Westminster Hospital	NICU	16.1%	806
Queen Charlotte's Hospital	NICU	11.1%	548
North West Neonatal ODN			
Furness General Hospital	SCU	2.1%	85
Countess of Chester Hospital	LNU	5.6%	391
Leighton Hospital	LNU	3.9%	294
Macclesfield District General Hospital	LNU	2.5%	153
North Manchester General Hospital	LNU	2.9%	541
Ormskirk District General Hospital	LNU	10.0%	334
Royal Albert Edward Infirmary	LNU	3.6%	334
Royal Lancaster Infirmary	LNU	2.1%	234
Stepping Hill Hospital	LNU	4.3%	361
Tameside General Hospital	LNU	5.4%	284
Victoria Hospital, Blackpool	LNU	3.6%	445
Warrington Hospital	LNU	9.3%	506
Whiston Hospital	LNU	9.5%	365
Wythenshawe Hospital	LNU	1.3%	396
Arrowe Park Hospital	NICU	8.5%	433
Lancashire Women & Newborn Centre	NICU	7.1%	690
Liverpool Women's Hospital	NICU	18.5%	3,238
Royal Bolton Hospital	NICU	9.4%	676
Royal Oldham Hospital	NICU	7.9%	746
Royal Preston Hospital	NICU	7.6%	520
St Mary's Hospital, Manchester	NICU	6.9%	1,262
Northern Neonatal ODN			
Cumberland Infirmary	SCU	25.1%	199
Darlington Memorial Hospital	SCU	13.1%	151
Northumbria Specialist Emergency Care Hospital	SCU	6.7%	434
Queen Elizabeth Hospital, Gateshead	SCU	12.7%	223
South Tyneside District Hospital	SCU	18.6%	100
University Hospital of North Durham	SCU	12.8%	227
West Cumberland Hospital	SCU	10.5%	135
James Cook University Hospital	NICU	5.8%	475
Royal Victoria Infirmary	NICU	12.5%	713
Sunderland Royal Hospital	NICU	7.5%	300
University Hospital of North Tees	NICU	6.7%	413

South East Coast Neonatal ODN			
Conquest Hospital	SCU	2.8%	457
Darent Valley Hospital	SCU	10.6%	809
Princess Royal Hospital	SCU	8.5%	235
Queen Elizabeth The Queen Mother Hospital	SCU	3.8%	367
Royal Surrey County Hospital	SCU	3.6%	546
Worthing Hospital	SCU	1.9%	543
East Surrey Hospital	LNU	7.3%	807
Frimley Park Hospital	LNU	5.4%	906
Tunbridge Wells Hospital	LNU	11.9%	698
Medway Maritime Hospital	NICU	7.1%	1,148
Royal Sussex County Hospital	NICU	9.1%	956
St Peter's Hospital	NICU	3.2%	578
William Harvey Hospital	NICU	2.0%	584
South London Neonatal ODN			
Epsom General Hospital	SCU	5.0%	192
Princess Royal University Hospital	SCU	22.5%	472
Croydon University Hospital	LNU	10.9%	433
Kingston Hospital	LNU	7.0%	425
Queen Elizabeth Hospital, Woolwich	LNU	15.2%	425
St Helier Hospital	LNU	3.6%	686
University Hospital Lewisham	LNU	12.9%	471
Guy's & St Thomas' Hospital	NICU	12.3%	1,079
King's College Hospital	NICU	6.6%	769
St George's Hospital	NICU	5.9%	2,731
South West Neonatal ODN			
North Devon District Hospital	SCU	9.2%	253
Torbay Hospital	SCU	4.0%	347
Yeovil District Hospital	SCU	4.0%	228
Gloucestershire Royal Hospital	LNU	6.6%	628
Great Western Hospital	LNU	13.4%	784
Royal Cornwall Hospital	LNU	2.5%	705
Royal Devon & Exeter Hospital	LNU	2.5%	633
Royal United Hospital	LNU	6.1%	691
Taunton & Somerset Hospital	LNU	3.0%	597
Derriford Hospital	NICU	6.8%	1,257
Southmead Hospital	NICU	7.4%	3,041
St Michael's Hospital	NICU	11.6%	3,055
Staffordshire, Shropshire and Black Country Neonatal ODN			
Manor Hospital	LNU	4.9%	820
Princess Royal Hospital, Telford	LNU	0.3%	1,207
Russells Hall Hospital	LNU	6.1%	735
New Cross Hospital	NICU	4.9%	1,342
Royal Stoke University Hospital	NICU	3.7%	1,246

Thames Valley & Wessex ODN			
Dorset County Hospital	SCU	2.9%	249
Basingstoke & North Hampshire Hospital	LNU	3.0%	277
Milton Keynes Foundation Trust Hospital	LNU	4.6%	395
Poole Hospital NHS Foundation Trust	LNU	2.2%	445
Royal Berkshire Hospital	LNU	3.4%	522
Royal Hampshire County Hospital	LNU	3.4%	281
Salisbury District Hospital	LNU	3.0%	287
St Mary's Hospital, IOW	LNU	2.3%	192
St Richard's Hospital	LNU	2.2%	642
Stoke Mandeville Hospital	LNU	1.9%	453
Wexham Park Hospital	LNU	1.0%	469
Oxford University Hospitals, John Radcliffe Hospital	NICU	2.7%	1,002
Princess Anne Hospital	NICU	5.5%	872
Queen Alexandra Hospital	NICU	2.9%	586
Trent Perinatal & Central Newborn Neonatal ODN			
George Eliot Hospital	SCU	8.8%	255
Pilgrim Hospital	SCU	11.5%	383
Queen's Hospital, Burton on Trent	SCU	1.2%	387
Warwick Hospital	SCU	7.1%	488
Kettering General Hospital	LNU	4.9%	358
King's Mill Hospital	LNU	5.1%	286
Lincoln County Hospital	LNU	12.7%	677
Northampton General Hospital	LNU	3.9%	589
Royal Derby Hospital	LNU	5.6%	426
Leicester Neonatal Service[2]	NICU	8.9%	1,527
Nottingham City Hospital	NICU	12.1%	931
Nottingham University Hospital (QMC)	NICU	8.1%	810
University Hospital Coventry	NICU	7.3%	1,867
Yorkshire & Humber Neonatal ODN			
Bassetlaw District General Hospital	SCU	11.3%	173
Harrogate District Hospital	SCU	11.7%	132
Scarborough General Hospital	SCU	5.8%	226
Airedale General Hospital	LNU	5.6%	222
Barnsley District General Hospital	LNU	3.3%	348
Calderdale Royal Hospital	LNU	0.8%	505
Chesterfield & North Derbyshire Royal Hospital	LNU	7.7%	469
Diana Princess of Wales Hospital	LNU	5.7%	1,173
Doncaster Royal Infirmary	LNU	7.2%	511
Pinderfields General Hospital	LNU	1.7%	925
Rotherham District General Hospital	LNU	9.0%	394

[2] Leicester Neonatal Service includes data from Leicester Royal Infirmary and Leicester General Hospital.

Scunthorpe General Hospital	LNU	7.0%	668
York District Hospital	LNU	3.5%	407
Bradford Royal Infirmary	NICU	3.4%	842
Hull Royal Infirmary	NICU	6.6%	1,155
Leeds Neonatal Service[3]	NICU	5.5%	1,652
The Jessop Wing, Sheffield	NICU	1.8%	1,646
Isle of Man			
Nobles Hospital	LNU	2.2%	118
SCOTLAND			
Borders General Hospital, Melrose	SCU	23.3%	83
Dumfries & Galloway Royal Infirmary	LNU	15.0%	189
Forth Valley Royal Hospital	LNU	1.8%	375
Raigmore Hospital, Inverness	LNU	8.4%	217
Royal Alexandra Hospital, Paisley	LNU	9.8%	454
Aberdeen Maternity Hospital	NICU	4.9%	843
Ayrshire Maternity Unit, Crosshouse	NICU	5.4%	338
Ninewells Hospital, Dundee	NICU	3.5%	529
Princess Royal Maternity, Glasgow	NICU	2.0%	571
Royal Hospital for Children, Glasgow	NICU	2.6%	999
Victoria Hospital, Fife	NICU	8.5%	354
Wishaw General Hospital	NICU	3.4%	749
WALES			
Ysbyty Gwynedd	SCU	7.2%	226
Glan Clwyd Hospital	LNU	6.3%	243
Glangwili General Hospital	LNU[4]	3.3%	280
Nevill Hall Hospital	LNU[4]	9.5%	213
Prince Charles Hospital	LNU[4]	3%	269
Princess of Wales Hospital	LNU[4]	5.9%	229
Royal Glamorgan Hospital	LNU	2.5%	256
Wrexham Maelor Hospital	LNU	15.2%	207
Royal Gwent Hospital	NICU	3.9%	464
Singleton Hospital	NICU	1.6%	464
University Hospital of Wales	NICU	5.9%	501

[3] Leeds Neonatal Service includes data from Leeds General Hospital and St James' Hospital.
[4] We are aware of designation changes in 2017 at these units, from LNUs to SCUs.

Appendix B: Recommendations by audience

The NNAP report makes a number of recommendations relating to the key findings from each audit measure. These recommendations are targeted wherever possible to a particular audience. Recommendations are listed by audience in the table below with recommendation number in brackets.

Recommendations for neonatal units and neonatal teams

The key findings and recommendations in this chapter are specific to each audit measure, however there are a number of recommendations for neonatal units relating to quality improvement activities across all NNAP measures:

1. **Neonatal units** should display their NNAP results poster and the accompanying poster describing the ongoing relevant quality improvement activities that the unit is making, in public and professional facing areas of the neonatal unit.
2. **Neonatal units** should use NNAP Online to identify quality improvement opportunities relevant to them, and to identify partner units with results they wish to emulate.
3. **Neonatal units** should ensure they have adequate processes for the timely capture of information for quality improvement.

Antenatal magnesium sulphate	**(8) Neonatal units** with below average rates of magnesium sulphate administration should identify comparable units to their own, that have higher rates of antenatal magnesium sulphate administration using NNAP Online. Working collaboratively with maternity staff, they should use quality improvement methodology and programmes to improve rates of administration in their hospitals. **(10) Neonatal units** with significant levels of missing data should take steps to address this in collaboration with maternity care staff.
Temperature on admission	**(15) Neonatal units** should report all cases where the admission temperature of a very preterm baby is below 36.0^{0}C using local risk reporting mechanisms, and consider a policy of reporting all babies with admission temperature below 36.5^{0}C. **(16) Neonatal units** should ensure that they have a care bundle in place, developed with multidisciplinary input, which mandates the use of evidence-based strategies to encourage admission normothermia of very preterm babies.
Parental consultation	**(17) Neonatal units** should regularly review the reasons why timely parental consultations did not occur. They should look for themes among the reasons, provide regular feedback to neonatal staff, and put processes in place to strengthen their support of parental partnership in care. **(18) Neonatal units** should ensure that parents are aware of the standard, for example as part of a welcome pack or signage in the neonatal unit. **(19) Neonatal units** with poorer data completeness should review and improve their documentation process. For example, by use of a dedicated notes sheet or a document in electronic records to record parental consultations.
Parental presence on consultant ward rounds	**(20) Neonatal units** with poorer data completeness should review and improve their documentation process to ensure that all instances of parental presence on the ward round are recorded. **(21) Neonatal units** should work with local parent representatives to look at ways to improve the attendance of parents on the ward round and parental involvement in decision making. Neonatal units should refer to the BAPM Neonatal Service Quality Indicators[34] and the Bliss Baby Charter[8] for guidance.

On time ROP screening	**(22) Neonatal units and ophthalmologists** should target quality improvement in their organisational, administrative and clinical processes at those babies whose birthweights and gestations are just inside the criteria for screening who constitute the majority of those not screened. **(23) Neonatal units** with low outlier status, and especially those who have been recurrently identified as such, should urgently review their clinical, administrative and organisational arrangements, and keep them under detailed regular review to optimise retinopathy screening and treatment outcomes. **(24) Neonatal units** should, as part of a formal local risk incident investigation, formally review their clinical, organisational and administrative pathways in discussion with their ophthalmology colleagues when cases are screened late, or not at all. **(25) Neonatal units** should clearly describe to parents, prior to the opening of the screening window, but after the first week of life, the need for ROP screening using an individualised written resource which sets out for the parents the anticipated date of first screening for their baby. If their baby is due to be screened after being discharged from the unit, neonatal staff should ensure that parents are aware of the importance of attending the appointment.
Encephalopathy	**(28) Neonatal units** should ensure that all cases of encephalopathy identified by the criteria used by the NNAP have been reviewed by a suitable multidisciplinary group to look for modifiable factors, in accordance with the approach taken in the Royal College of Obstetricians and Gynaecologists' "Each Baby Counts" programme[35].

Measuring rates of infection	**(29) Neonatal units** should enter every blood culture result that is positive for any bacterial or fungal growth (including potential contaminants) and use a regular communication channel with their laboratory services to assure themselves and other NNAP audit users that their data entry is complete. **(30) Neonatal units** with complete entry of positive blood cultures and above average rates of bloodstream infection with a known pathogen in babies of less than 32 weeks gestational age should consider identifying suitable partner units from NNAP Online with lower rates of infection and comparing their infection reduction strategies to seek quality improvement opportunities. **(31) Neonatal units** with complete entry of positive blood cultures and above average rates of bloodstream infection with central line use as measured by the CRG / NNAP quality improvement surveillance definition of central line associated bloodstream infection (QISD CLABSI) should consider identifying suitable partner units from NNAP Online, and comparing their infection reduction strategies to seek quality improvement opportunities.
Bronchopulmonary dysplasia	**(33) Neonatal units** with a positive treatment effect should consider examining the practice of neonatal units with a negative treatment effect to identify potential modifiable factors in their neonatal care which might influence rates of BPD. **(35)** When the NICE guidance on specialist neonatal respiratory care for babies born preterm is published, **neonatal networks and neonatal units** should review their policies to ensure that saturation targets are in line with best practice recommendations.
Necrotising enterocolitis	**(36) Neonatal units** who validated their NEC data for 2017 should use NNAP Online to compare rates of NEC with other units, and use these comparisons to seek quality improvement opportunities. **(37) Neonatal units** should ensure that they will be able to validate their NEC data entry for the 2018 data year.

Minimising separation of mother and baby	**(41) Neonatal units and trusts/health boards** where transitional care cannot be delivered should work with their commissioners to develop the ability to deliver such care to minimise mother and baby separation, following the BAPM guidance A Framework for Neonatal Transitional Care.[11] **(42) Neonatal units** with above average numbers of separation days for term, or late preterm babies should consider if revision of their admission or discharge criteria and processes could reduce the number of mother and baby separation days. **(43) Neonatal units** should implement the BAPM guidance on the management of neonatal hypoglycaemia in term babies unless local circumstances make this inappropriate. Hypoglycaemia is a leading cause of term admission; some admissions for the management of hypoglycaemia could be avoided with the use of BAPM guidance.[12] **(44) Neonatal units** should be aware of their rates of admission for term babies, and use the themes emerging from ATAIN project reviews in England of term admissions to inform possible targeted review of their admission and discharge processes.
Breastmilk feeding at discharge home	**(47) Neonatal units** should use these data, alongside available data concerning breastfeeding practices in non-admitted babies in their local area, to inform local quality improvement activity aiming to improve rates of breastmilk feeding. Neonatal units can use The Baby Friendly Initiative (UNICEF)[14] and the Bliss Baby Charter[8] to support this activity.

Follow up at two years of age	**(49) Neonatal units and networks** should adopt the NICE guideline on Developmental follow-up of children and young people born preterm,[33] and make progress with the implementation of pathways across organisational structures (e.g. Sustainability and transformation plan footprints in England). This requires a multidisciplinary, whole health economy approach. **(50) Neonatal units** with incomplete data capture should ensure that they have the processes in place to document follow up at two years of age. **(51) Neonatal units** should discuss arrangements for two-year follow up with families prior to discharge home of their baby, supported by written communication which includes the expected timeframe for the follow up consultation.

Recommendations for neonatal networks

Antenatal steroids	**(5) Neonatal networks** should review administration rates of antenatal steroids in their units on a quarterly basis, identify any quality improvement opportunities and support units to achieve the best possible neonatal outcomes.
Antenatal magnesium sulphate	**(11) Neonatal networks, maternity networks and local maternity systems** with below average rates of administration, or low rates of improvement review administration rates of magnesium sulphate in their units on a quarterly basis, identify any quality improvement opportunities and support units to achieve the best possible neonatal outcomes.
Birth in a centre with a NICU	**(13) Neonatal networks** should facilitate local and network review of all cases where babies of less than 27 weeks gestational age deliver in a hospital without a NICU with the aim of identifying and sharing opportunities to increase the rate of delivery in hospitals with an onsite NICU. **(14) Neonatal networks, maternity networks and local maternity systems** in England, and their equivalent bodies in Wales and Scotland, which do not achieve delivery of 85% of babies less than 27 weeks in a hospital with an onsite NICU should review whether they have realistic plans to achieve improvements in this area, and develop plans if required.

On time ROP screening	**(26) Neonatal networks** with higher rates of failure to screen on time (for example over 2.5%) should seek to understand the reasons for this failure and address this with any units concerned.
Bronchopulmonary dysplasia	**(34) Neonatal networks** with a positive treatment effect should consider examining the practice of networks with a negative treatment effect to identify potential modifiable factors in their neonatal care which might influence rates of BPD. **(35)** When the NICE guidance on specialist neonatal respiratory care for babies born preterm is published, **neonatal networks and neonatal units** should review their policies to ensure that saturation targets are in line with best practice recommendations.
Necrotising enterocolitis	**(38) Neonatal networks** should support neonatal units providing all levels of care to undertake quality improvement activities relating to NEC.
Minimising separation of mother and baby	**(45) Neonatal networks** should work collaboratively with local maternity system and maternity and neonatal safety collaborative colleagues (or their equivalents in Scotland and Wales) to understand the themes emerging from the ATAIN project and to assist their units in reducing unnecessary separation of the mother and her term baby.
Follow up at two years of age	**(49) Neonatal units and networks** should adopt the NICE guideline on Developmental follow-up of children and young people born preterm,[33] and make progress with the implementation of pathways across organisational structures (e.g. Sustainability Transformation Plan footprints in England). This requires a whole health economy and multidisciplinary team approach.

Recommendations for perinatal services

Antenatal steroids	**(4) Perinatal services** (maternity and neonatal staff) should regard their rates of antenatal steroid administration as a key measure of the achievements of their clinical care. To identify quality improvement opportunities, neonatal and maternity care staff should formally review records of babies born at less than 35 weeks admitted for neonatal care where antenatal steroids were not given to the mother as part of their assurance with respect to NICE guidance.[18]

Antenatal magnesium sulphate	**(9)** To seek missed opportunities, and themes as to why magnesium was not given in line with NICE guidance,[18] **neonatal and maternity care staff in units** with below average rates of administration should formally review records of babies born at less than 30 weeks where magnesium sulphate was not given to the mother.

Recommendations for the NNAP and other national audits

Antenatal steroids	**(6)** The **NNAP** and the **National Maternity and Perinatal Audit** should consider whether antenatal steroid administration could be more appropriately audited as part of the National Maternity and Perinatal Audit from 2019 onwards.
Antenatal magnesium sulphate	**(12)** The **NNAP** and **NMPA** should explore the feasibility of reporting antenatal magnesium administration in NMPA.
Measuring rates of infection	**(32)** The **NNAP** should continue to seek to achieve linkage between other infection surveillance systems and the National Neonatal Research Database (NNRD) to report meaningful data about bloodstream infection.
Necrotising enterocolitis	**(39)** The **NNAP** should consider increasing the time period for reporting NEC, to a rolling period of three years to maximise the discriminatory power of this measure. **(40)** The **NNAP** should consider reporting a combined outcome of NEC or death from the 2019 data year, and should consider applying a matching approach to facilitate comparisons of rates between different networks and units.
Minimising separation of mother and baby	**(46)** The **NNAP** should seek to present the number of admissions and separation days alongside the number of births in each gestational age category.
Breastmilk feeding at discharge home	**(48)** The **NNAP** should develop a measure of early breastmilk feeding.

Recommendations for others

Antenatal steroids	**(7)** Those responsible for defining **national maternity datasets** (NHS Digital in England) should ensure that antenatal steroid administration is captured as part of routine maternity data.
On time ROP screening	**(27) Guideline developers** should take the successful deployment of on time post discharge screening into account when describing appropriate clinical practice for ROP screening.

Appendix C: Glossary and abbreviations

ATAIN	Avoiding Term Admissions Into Neonatal units
BAPM	British Association of Perinatal Medicine
BPD	Bronchopulmonary dysplasia
COP	Clinical Outcomes Publication
CQC	Care Quality Commission
CSF	Cerebrospinal fluid
EPR	Electronic patient record
HQIP	Healthcare Quality Improvement Partnership
HRG	Healthcare resource group
Hyperthermia	A body temperature more than 37.5°C
Hypothermia	A body temperature less than 36.5°C
LNU	Local neonatal unit
MBRRACE-UK	Mothers and Babies: Reducing Risk through Audits and Confidential Enquiries across the UK
MCN	Managed clinical network
NCAB	National Clinical Audit Benchmarking
NCAPOP	National Clinical Audit and Patient Outcomes Programme
NDAU	Neonatal Data Analysis Unit
NEC	Necrotising enterocolitis
NHSE	NHS England
NHSI	NHS Improvement
NICE	National Institute for Health and Care Excellence
NICU	Neonatal intensive care unit
NMC	Nursing and Midwifery Council

NMPA	National Maternity and Perinatal Audit
NNAP	National Neonatal Audit Programme
NNRD	National Neonatal Research Database
NNU	Neonatal unit
Normothermia	A body temperature between 36.5°C and 37.5°C
ODN	Operational delivery network
PICC	Peripherally inserted central catheter
RCM	Royal College of Midwives
RCOG	Royal College of Obstetrics and Gynaecology
RCPCH	Royal College of Paediatrics and Child Health
RCOphth	Royal College of Ophthalmologists
ROP	Retinopathy of prematurity
SCU	Special care unit
UAC	Umbilical arterial catheter
UVC	Umbilical venous catheter

Appendix D: Useful resources

The Royal College of Paediatrics and Child Health

The Royal College of Paediatrics and Child Health (RCPCH) was founded in 1996 and now has over 17,000 members across the world. We play a major role in postgraduate medical education, professional standards, research and policy.

The RCPCH has a number of useful resources, including:

- Courses and online learning
  www.rcpch.ac.uk/education/courses
- Paediatric Care Online
  http://pcouk.org/
- Support for continuing professional development
  www.rcpch.ac.uk/education/continuing-professional-development
- Medicines for Children
  https://www.rcpch.ac.uk/resources/medicines-children-information-parents-carers
- MedsIQ: Sharing QI resources for paediatric medicine safety
  www.medsiq.org/

British Association for Perinatal Medicine

The British Association for Perinatal Medicine improves standards of perinatal care by supporting all those involved in perinatal care to optimise their skills and knowledge, promote high quality, safe and innovative practice, encourage research, and speak out for the needs of babies and their families.

Find out more about BAPM here: https://www.bapm.org/

Bliss

Bliss is a national charity for babies born premature or sick. It exists to give every baby born premature or sick in the UK the best chance of survival and quality of life. Bliss supports families, campaigns for change and supports professionals, and enables life-changing research.

Learn about Bliss here: https://www.bliss.org.uk

The Healthcare Quality Improvement Partnership

The Healthcare Quality Improvement Partnership (HQIP) is led by a consortium of the Academy of Medical Royal Colleges, the Royal College of Nursing and National Voices. Its aim is to promote quality improvement in patient outcomes, and in particular, to increase the impact that clinical audit, outcome review programmes and registries have on healthcare quality in England and Wales. HQIP holds the contract to commission, manage and develop the National Clinical Audit and Patient Outcomes Programme (NCAPOP), comprising around 40 projects covering care provided to people with a wide range of medical, surgical and mental health conditions. The programme is funded by NHS England, the Welsh Government and, with some individual projects, other devolved administrations and crown dependencies. www.hqip.org.uk/national-programmes.

Clinical Outcomes Publication

Clinical Outcomes Publication (COP) is an NHS England initiative, managed by HQIP, to publish quality measures at the level of individual consultant, team and unit level using national clinical audit and administrative data. The programme uses the platforms of MyNHS and NHS Choices and aims to maximise the availability and accessibility of outcomes and performance information to patients, the public and stakeholders.

National Clinical Audit Benchmarking

The National Clinical Audit Benchmarking (NCAB) initiative was originally created as a collaboration between HQIP and CQC, with a vision to enhance the way not just inspectors, but also medical directors, local clinical audit teams and others engage, interact with and share clinical audit data. The NCAB platform distils what can be necessarily complex reporting by national clinical audits into key metrics. Results are presented in an easy to understand visual form, specific for each Trust, hospital and in some cases ward, often against national benchmarks. These results are presented on an intuitive website platform (https://ncab.hqip.org.uk/), searchable by medical specialty or Trust/hospital/ward.

National Maternity and Perinatal Audit

The National Maternity and Perinatal Audit (NMPA) is a national clinical audit of NHS maternity services in England, Scotland and Wales. The audit, commissioned by HQIP, is led by the Royal College of Obstetricians and Gynaecologists in partnership with the Royal College of Midwives (RCM, the Royal College of Paediatrics and Child Health (RCPCH) and the London School of Hygiene and Tropical Medicine (LSHTM).

The audit evaluates a range of care processes and outcomes to identify good practice and areas for improvement in the care of women and babies.

You can find more information, access results and reports here: www.maternityaudit.org.uk.

Neonatal Data Analysis Unit

The Neonatal Data Analysis Unit (NDAU) at Imperial College London holds the National Neonatal Research Database (NNRD). The NNRD holds operational clinical information captured during care and supports health service evaluation and research. The NDAU analyse data for the NNAP.

Find out more about NDAU here: www.imperial.ac.uk/neonatal-data-analysis-unit.

Appendix E: Matching method of comparing outcomes for BPD

In a comparison of the outcomes of two groups that differ in their background profiles (the case-mix), two processes have to be considered:

A. Assignment of babies to units (how a mother/baby end up being treated/cared for in a particular unit)

and

B. How the unit treats babies

When we regard B. as important, and would like to discount A, a regression adjustment method applies a model for how the outcome depends on the treatment applied and on the background variables. When there are many background variables this method is inefficient - the standard errors are large. If the list of background variables is reduced, model selection introduces a bias in the estimates, especially when the selection involves many steps.

In a regression model, we are interested in the average effect associated with each network (or unit). This effect is defined for each individual baby, as well as for the network (or unit). A regression model assumes a particular pattern of the effects; in most cases, this assumption is that the network (or unit) has a 'uniform' (identical) effect on each baby. This assumption is not tenable - the effect is very likely to vary (substantially) across babies.

Fitting a regression model introduces several complications in addition to model selection. First, the analysis (and all the results) refer to the logit scale that does not have a straightforward translation to the probability (or percentage) scale.

The model becomes extremely complex as we introduce the networks as a factor, and the interactions of the networks with the most important background variables (e.g. gestational age). By its nature, model selection is obscure.

An impasse arises when a model that fits well cannot be found. A model cannot be declared in advance of the analysis. It is unlikely that the same model would be selected in the analyses for two consecutive years. By contrast, audit users might expect the same adjustment method to be applied in successive years when attempting to adjust an outcome for background variables. That the conclusions of an adjusted analysis (estimated treatment effects) would depend on the model that is selected, is a concern.

The principal arguments for analysis based on matching:

- The analysis adheres closely to the question that appeals to the clinical audience and is in accord with the purpose of the Audit: If our babies were treated elsewhere, would they have fared better? Or worse?
- The matching approach separates the approach to the two key issues in comparing outcomes. It addresses assignment to networks/units and the quality of care provided by the network/unit in separate parts of the analysis: matching and analysis of the matched subgroups.
- The outcomes are involved in the analysis only once, in the second part.
- There are simple unambiguous criteria for successful matching - balance of the subgroups on all the background variables.
- The small caseloads of numerous units raise no problems in the matching process, nor in the analysis that follows.
- The analysis entails no bias that would arise from repeated use of the outcome variable. (In model selection, the outcomes are used in every model we test.)
- The output from the matching exercise is a simple “treatment effect” percentage, (the difference between the matched rate and the estimated rate) and with an associated 95% confidence interval.

Appendix F: "Pathogens" in the NNAP

Bacterial, fungal and yeast positive blood cultures reported to the NNAP in 2017 for the Bloodstream infection and Central line associated bloodstream infection measures have been classified as shown below into organisms whose growth would be regarded as indicative of a bloodstream infection without further confirmatory evidence, and into a list of other organisms. This list of organisms included for NNAP reporting is available below. We are grateful to Professor Paul Heath* for reviewing and updating this list for the 2017 data year.

**Professor of Paediatric Infectious Diseases and Honorary Consultant, Paediatric Infectious Diseases Research Group; Director, St Georges Vaccine Institute.*

Table B: Organisms included in NNAP reporting for the 2017 data year

Bacterial, fungal or yeast isolates indicating a clinically significant infection without additional data collection		
Acinetobacter sp.	Enterobacter agglomerans	Pseudomonas aeruginosa
Acinetobacter baumannii	Enterobacter cloacae	Pseudomonas stutzeri
Acinetobacter lwoffii	Enterococcus sp.	S. Aureus
B haemolytic streptococci	Enterococcus faecalis	Salmonella sp.
Bacillus cereus	Enterococcus faecium	Salmonella unnamed
Beta-haemolytic strep. Group b	Escherichia coli	Serratia sp.
Burkholderia capecia	Flavobacterium sp.	Serratia
Candida sp.	Gemella haemolysans	Serratia liquefaciens
Candida albicans	Gemella morbilarum	Serratia marcescens
Candida dubliniensis	Group b streptococcus	Staphylococcus aureus
Candida glabrata	Haemophilus influenzae	Staphylococcus capitis
Candida guilliermondii	Haemophilus parainfluenzae	Staphylococcus epidermidis
Candida kefyr	Klebsiella sp.	Staphylococcus haemolyticus
Candida krusei	Klebsiella aerogenes	Staphylococcus hominis
Candida parapsilosis	Klebsiella oxytoca	Staphylococcus warneri
Candida tropicalis	Klebsiella pneumoniae	Stenotrophomonas maltophilia
Citrobacter sp.	Lactobacillus sp.	Streptococcus agalactiae
Citrobacter freundii	Listeria sp.	Streptococcus bovis
Citrobacter koseri	Listeria monocytogenes	Streptococcus milleri

Clostridium perfringens	Morganella morganii	Streptococcus mitis
Coliform	Mrsa	Streptococcus pneumoniae
Corynebacterium diphtheriae	Neisseria meningitidis	Streptococcus viridans
Eikenella corrodens	Pasteurella multocida	Treponema pallidum
Enterobacter sp.	Proteus mirabilis	Yeasts
Enterobacter aerogenes	Pseudomonas sp.	
Organisms		
Acid fast bacilli	Diphtheroids	Rosemonas gilardii
Actinomyces bovis	Gram positive bacilli	Scopulaiopsis brevicaulis
Actinomyces sp.	Haemophilus sp.	Staph saprophyticus
Aerococcus sp	Kocuria species	Staphylococcus sp.
Aerococcus viridans	Lactococcus sp.	Staphylococcus - coagulase negative
Alcaligenes faecalis	Micrococcus sp.	Staphylococcus - coagulase negative (mixed)
Alpha haemolytic streptococci	Mixed growth	Staphylococcus simulans
Anaerobes	Moraxella sp.	Stomatococcus mucilaginosus
Bacillus sp.	Moraxella catarrhalis	Streptococcus sp.
Bacteroides sp.	Mycoplasma hominis	Streptococcus - group g
Chryseobacterium sp.	Neisseria sp.	Streptococcus anginosus
Clostridium sp.	Nocardia asteroides	Streptococcus oralis
Corynebacter	Peptostreptococcus sp.	Streptococcus salivarius
Corynebacterium sp.	Prevotella sp.	Streptococcus sanguis
Corynebacterium bacilli	Propionibacterium sp	Toxoplasma gondii
Corynebacterium striatum	Proprionebacterium acnes	Ureaplasma
Corynebacterium ulcerans	Ralstonia sp.	Yeasts (other)
Gram positive cocci	Shigella sonnei	
Group g streptococcus	Sphingomonas	

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