RCPCH Audits

# National Neonatal Audit Programme

## A guide to the 2019 audit measures

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RCPCH
Royal College of Paediatrics and Child Health
Leading the way in Children's Health

# National Neonatal Audit Programme (NNAP): A guide to the 2019 audit measures

This document sets out the details of the 2019 NNAP audit measures and describes the following details for each measure:

- NNAP audit measure
- Changes to the audit measure for 2018 data
- NNAP standard and source of standard
- Inclusion criteria
- Attributing results
- Deriving outcomes
- Where the required data should be entered on BadgerNet

# About the NNAP dataset and methodology

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 or health board. 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. In Scotland, a separate approval was received from the Public Benefit and Privacy Panel for health and social care.

## Inclusion criteria

The following inclusion criteria apply to all NNAP measures:

- Babies who were admitted for neonatal care
- Babies who had care provided by an NNAP unit
- Babies whose parents or carers have not opted them out of secondary use of their data

Further criteria specific to each audit measure can be found in the measure descriptions.

## Case ascertainment

In usual practice, every baby admitted to a participating neonatal unit is entered on the BadgerNet patient record system, and is eligible for inclusion in the 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.

## Data collection period

Unless otherwise stated, the cohort of babies included in the 2019 audit year are babies who experience their final neonatal discharge in the calendar year 1 January 2019 to 31 December 2019. There are some exceptions to this; Encephalopathy and Minimising 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 2016 and June 2017.

## Describing gestational age

Gestation refers to “completed weeks” of gestation, based on the best available estimate recorded by clinical staff in BadgerNet. Gestation is typically described in bands – where we refer to all babies born at less than 32 weeks we mean all babies with a gestation at birth of up to 31 weeks and six days inclusive. Where we refer to 23-33 weeks inclusive, we mean to include all babies with a gestation at birth of 23 weeks and 0 days to babies with a gestation at birth of 33 weeks and 6 days.

# Antenatal steroids

*Is a mother who delivers a baby between 23 and 33 weeks gestational age inclusive given at least one dose of antenatal steroids?*

**Change to audit measure for the 2019 data year:** None. Note that prior to 2018, the NNAP reported on babies born between 24 and 34 weeks gestational age inclusive.

## NNAP standard

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

**Source of standard:** NNAP Project Board

**Comparison standard for outlier analysis:** National rate

## Inclusion criteria

- Babies who experienced their final neonatal discharge in the calendar year of analysis.
- Babies with gestational age at birth between 23 and 33 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.

## Attribution

Results will be reported for each hospital of birth and network of birth. When the place of birth is unknown, a non-hospital location, or a hospital without a neonatal unit, the place of birth will be assigned as *Other*.

## Deriving outcomes

NNAP will use data from steroids given and steroid courses to determine if the baby's mother received any antenatal steroids. When these two fields contain contradictory information then "the most positive"* data will be assumed correct (Table 1). When multiple births present different data, data will be taken from the baby with "the most positive" outcome will be considered for the audit.

**Table 1: Categorising data for antenatal steroids from BadgerNet fields Steroids given and Steroid courses**

| Steroids given | Steroid courses | | |
|---|---|---|---|
| | Complete course | Incomplete course | Unknown / missing data |
| Yes | Steroids given | Steroids given | Steroids given |
| No | Steroids given | Steroids given | Steroids not given |
| Unknown / missing data | Steroids given | Steroids not given | Missing / unknown data |

*Most to least positive: steroids given, steroids not given, unknown / missing data.

## BadgerNet data source

**Data from the** *Pregnancy Details* **page, for** *Steroids during pregnancy* **will be used to determine if antenatal steroids were given.**

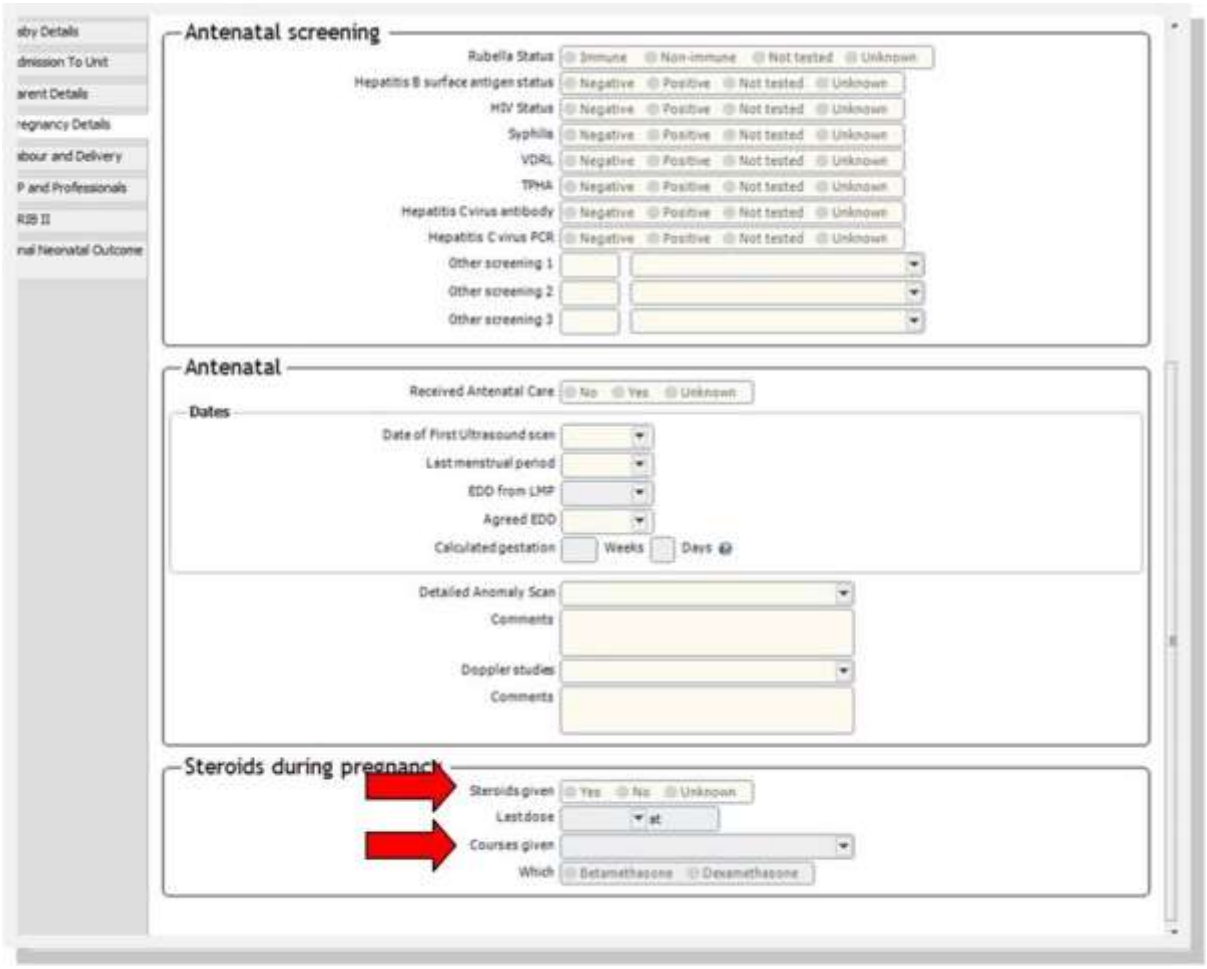


**Figure 1: Pregnancy Details page, BadgerNet**

# Antenatal magnesium sulphate

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

**Change to audit measure for 2019 data year:** None.

## NNAP standard

**Developmental standard:** Eighty-five percent (85%) of eligible mothers should receive antenatal magnesium sulphate.

**Source of standard:** PReCePT[1].

**Comparison standard for outlier analysis:** National rate

## Inclusion criteria

- Babies who experienced their final neonatal discharge in the calendar year of analysis.
- Babies with 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.

## Attribution

Results will be reported for each hospital of birth and network of birth. When the place of birth is unknown, a non-hospital location, or a hospital without a neonatal unit, the place of birth will be assigned as "Other".

## Deriving outcomes

NNAP will use data from *Mother received magnesium sulphate in 24 hours prior to delivery* to categorise the administration of magnesium sulphate. When multiple births present different data, data will be taken from the baby with "the most positive"* for the audit (Table 2).

**Table 2: Categorising antenatal magnesium sulphate from BadgerNet field *Mother received magnesium sulphate in 24 hours prior to delivery***

| Mother received magnesium sulphate in 24 hours prior to delivery | NNAP category |
|---|---|
| Yes | Magnesium sulphate given |
| No | Magnesium sulphate not given |
| Missing / unknown | Missing / unknown data |

*Most to least positive: magnesium sulphate given, magnesium sulphate not given, missing / unknown data.

## BadgerNet data source

**Data from the** *Labour and Delivery* **page for** *Mother received magnesium sulphate in 24 hours prior to delivery* **will be used to determine if magnesium sulphate was given.**

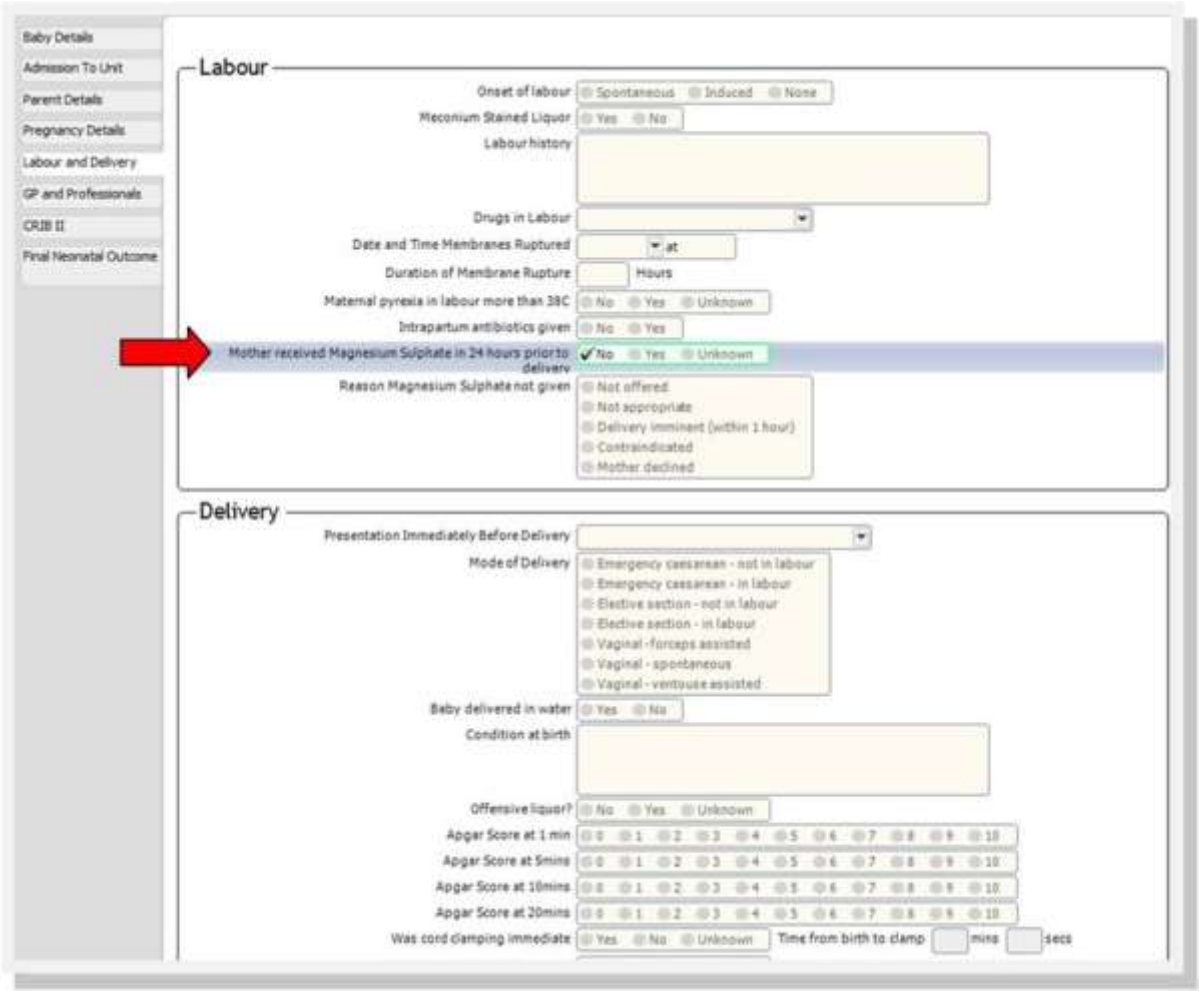


**Figure 2: Labour and delivery page, BadgerNet**

## Additional information

Strong systematic review evidence of more than 6000 babies in meta-analysed randomised controlled trials suggests that antenatal magnesium sulphate therapy reduces the risk of cerebral palsy by about 30%, with benefits seen regardless of the reason for administration[2]. Royal College of Obstetricians and Gynaecologists guidance supports its use[3].

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

*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[4]?*

**Change to audit measure for 2019 data year:** None.

## NNAP standard

**Developmental standard:** Eighty-five (85%) of babies born at less than 27 weeks gestational age should be delivered in a maternity service on the same site as a NICU.

**Source of standard:** Neonatal Critical Care Clinical Reference Group, NHS England.

**Comparison standard for outlier analysis:** National rate

## Inclusion criteria

- Babies who experienced their final neonatal discharge in the calendar year of analysis.
- Babies with 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.

## Attribution

Attribution will be to the neonatal network of birth. Outcomes will be reported by neonatal network of birth. When mothers deliver in a location not associated with a neonatal network (home, in transit, unknown, etc.) they will be assigned to a neonatal network based on the hospital of first admission.

## Deriving outcomes

NNAP will use data from the place of birth to determine the level of neonatal unit within the hospital where babies were delivered (Table 3).

**Table 3: Categorising birth in a centre with a NICU from BadgerNet field *Place of birth***

| Place of birth | NNAP category |
|---|---|
| Hospital with a designated NICU | Delivered in appropriately designated location (NICU) |
| Hospital with a designated local neonatal unit (LNU) / special care unit (SCU) | Delivered in inappropriately designated location (LNU / SCU) |
| Hospital with no designated neonatal unit/ non-hospital location | Delivered in location without neonatal facilities |

## BadgerNet data source

Data on place of birth are captured on BadgerNet on the *Details at Birth and Admission* page. Values from the *Place of birth* field are used by NNAP for analysis (Figure 3).

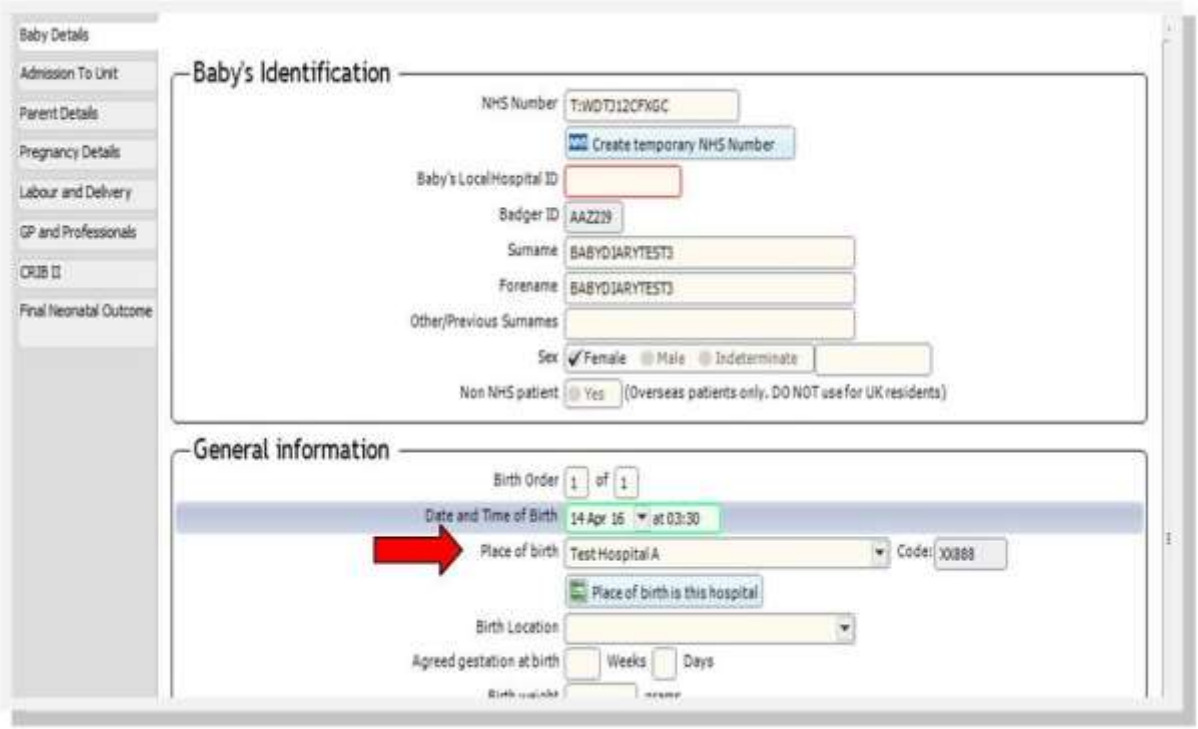


**Figure 3: Details at birth and admission page, BadgerNet**

## Additional information

### Background

Under the service specification[4], neonatal networks intend to concentrate the delivery of babies to be born at less than 27 weeks gestation in units configured to deliver their care, i.e. a NICU. Evidence suggests that outcomes are improved by providing the care of the most vulnerable babies in units with a higher turnover, and minimising postnatal transfers.

### Opportunities for quality improvement

Rates of delivery at less than 27 weeks appear to vary by neonatal network, and have changed over time. Ongoing "transformation" of specialist neonatal care may result in further modifications of patient pathways. In networks where a significant number of babies are delivered in centres without a NICU on site, there may be a quality improvement opportunity.

# Promoting normal temperature on admission for very preterm babies

*Does an admitted baby born at less than 32 weeks gestational age have a first temperature on admission which is both between 36.5–37.5°C and measured within one hour of birth[4,5]?*

**Change to audit measure for 2019 data year:** None.

## NNAP standard

**Developmental standard:** First temperature on admission should be taken within an hour of birth for all eligible babies.

The composite measure of timeliness and normal temperature should be met for at least ninety percent (90%) of babies.

**Source of standard:** NNAP Project Board

**Comparative standard for outlier analysis:** National rate.

## Inclusion criteria

- Babies with gestational age at birth of less than 32 weeks.
- Babies who were admitted to a neonatal unit within an hour of birth.
- Babies who experienced their final neonatal discharge in the calendar year of analysis.
- Only the first known episode of care will be considered for analysis.

## Attribution

Results will be reported for each hospital of birth and network of birth. When the place of birth is unknown, a non-hospital location, or a hospital without a neonatal unit, the place of birth will be assigned as “Other”.

## Deriving outcomes

NNAP will use data from the first temperature taken after admission to categorise when babies had their temperature taken, and the value of temperature measurement (Table 4).

**Table 4: Categorising temperature measurement from BadgerNet fields *Temperature measured after admission*, *Temperature value* and *Temperature not recordable***

| Time of first temperature measurement (minutes from birth) | Value of first temperature measurement | | | | |
|---|---|---|---|---|---|
| | Temp. not taken | < 35.9 | 36-36.4 | 36.5-37.5 | >37.5 |
| Temperature not taken after admission | Not taken | Not taken | Not taken | Not taken | Not taken |
| Within an hour (≤ 60 minutes from birth) | Not taken | Within an hour | Within an hour | Within an hour and between 36.5-37.5 | Within an hour and >37.5 |
| After an hour (> 60 minutes from birth) | Not taken | Late | Late | Late | Late |

**Categorising temperature values**

Babies with a temperature measured *Within an hour* will be further categorised into the following groups based on their temperature values:

- Less than 32.0°C
- 32.0°C-35.9°C
- 36.0°C-36.4°C
- 36.5°C-37.5°C (normothermic)
- Greater than 37.5 °C

When the temperature value was not recordable, babies will be assigned to the 32.0°C-35.9°C group.

## BadgerNet data source

Details on temperature measurement are captured on BadgerNet on the *Details at Birth and Admission* page. Values from the *Temperature measured after admission*, *Temperature value* and *Temperature not recordable* fields are used by NNAP for analysis (Indicated below).

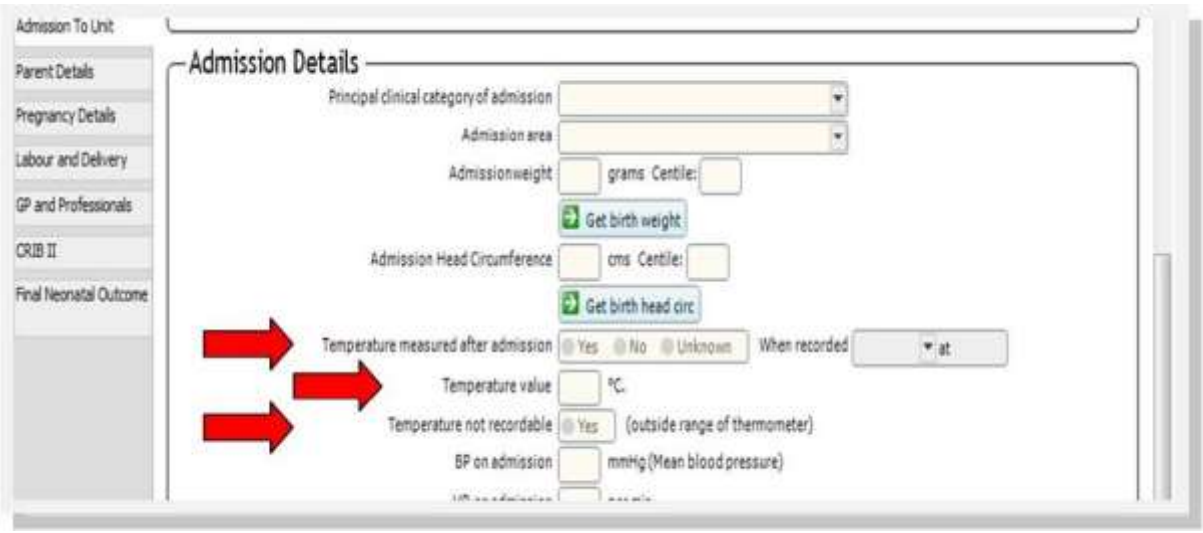


**Figure 4: Details at birth and admission page, BadgerNet**

# Parental consultation within 24 hours of first admission

*Is there a documented consultation with parents by a senior member of the neonatal team within 24 hours of a baby's first admission[6,7,13]?*

*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 audit measure for 2019 data year:** None.

## NNAP standard

**Developmental standard:** A consultation should take place within 24 hours of first admission for every baby (100%).

**Source of standard:** NNAP Project Board

**Comparison standard for outlier analysis:** National rate.

## Inclusion criteria

- Babies who experienced their final neonatal discharge in the calendar year of analysis.
- Babies who were admitted to neonatal care for at least 12 hours in their first episode, receiving special care or a higher order of neonatal care.
- Babies receiving neonatal care in non-neonatal unit locations (postnatal ward, transitional care etc.) will not be included.

## Attribution

Results will be attributed to the neonatal unit and network of admission.

## Deriving outcomes

The recorded time for first consultation with a senior member of staff is compared to the time of admission to determine when consultation takes place. The NNAP standard is aimed specifically at consultation at or after the time of admission, and so consultations prior to admission or birth cannot meet the NNAP standard (Table 5).

**Table 5: Categorising consultation with parents from BadgerNet fields *Parents seen by senior staff* and *Time first seen***

| Time of first consultation | NNAP category |
|---|---|
| Before admission | Before admission |
| Time of admission – 24 hours after admission | Within 24 hours (NNAP standard) |
| More than 24 hours after admission | After 24 hours |
| Confirmed "no consultation" | No consultation |
| Confirmed "unknown" | Missing / unknown data |
| Missing consultation time | Missing / unknown data |

## BadgerNet data source

Details on first consultation are captured on BadgerNet on the *Details at Birth and Admission* page. The answer to the question *Parents seen by senior staff* and the *Time first seen* are used by NNAP for analysis.

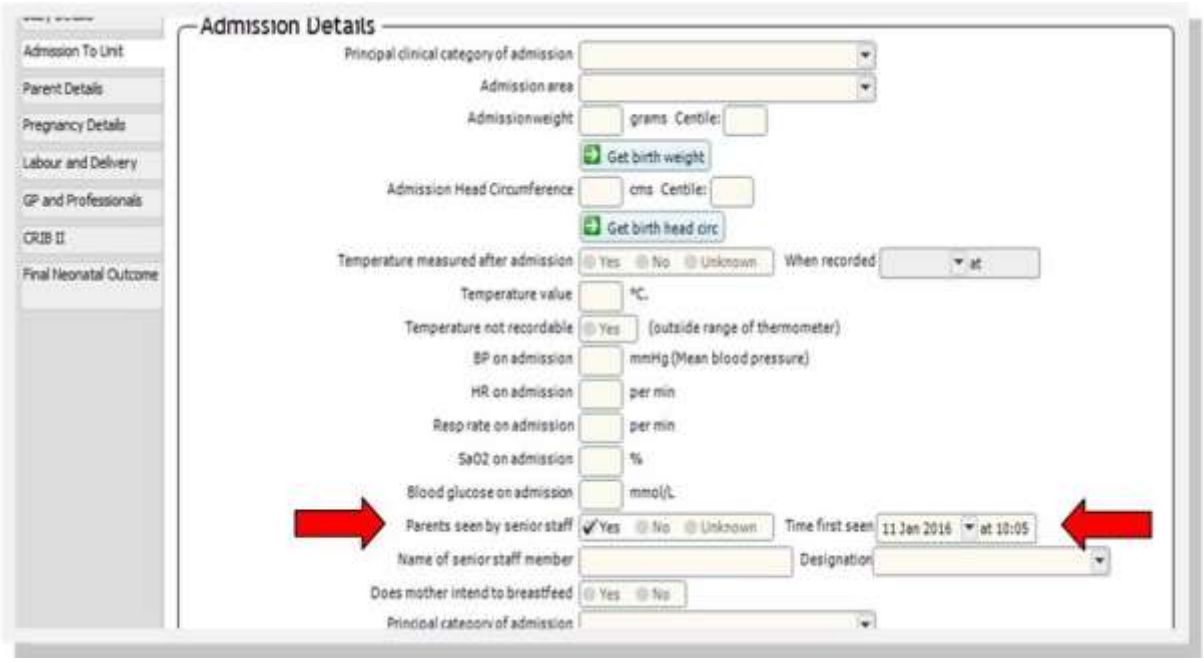


**Figure 5: Details at birth and admission page, BadgerNet**

# Parental presence at consultant ward rounds

*For a baby admitted for more than 24 hours, did at least one parent attend a consultant ward round[6,7,8]?*

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

**Change to audit measure for 2019 data year:** None.

## NNAP standard

**Developmental standard:** Benchmarking only.

**Comparison standard for outlier analysis:** Not applicable, no outlier analysis.

## Inclusion criteria

- Babies who experienced their final neonatal discharge in the calendar year of analysis.
- Admissions will be included if there is at least 24 hours (≥ 1440 minutes) between the admission time and discharge time for the episode of care.
- It is possible for one baby to have multiple eligible admissions for this analysis.
- Babies receiving all neonatal care in non-neonatal unit locations (postnatal ward, transitional care etc.) will not be included.

## Attribution

Attribution will be to the neonatal unit providing care in each eligible admission.

## Deriving outcomes

NNAP will use data captured as part of the daily summary of care to confirm parental presence on consultant led ward rounds, and admissions will be classified based on aggregated attendance data (Table 6).

**Table 6: Categorising parental presence at consultant ward rounds from BadgerNet field *Parent present on consultant ward round today?***

| Number of days where a parent was present on consultant ward round | NNAP category |
|---|---|
| None | Parent(s) not present for any ward rounds during admission |
| One or more | Parent(s) present for one or more ward rounds during admission |

Days where no data is entered concerning parental presence on ward rounds, or where daily data is missing, will be considered as parental absence from the ward round.

## BadgerNet data source

Details on daily parental presence on ward rounds are captured on BadgerNet in daily summary forms in the *Parent present on consultant ward round today?* field. A form can be created for each baby for each calendar day where they are an inpatient, and NNAP will consider all of the forms created in relation to each eligible admission when determining parental presence.

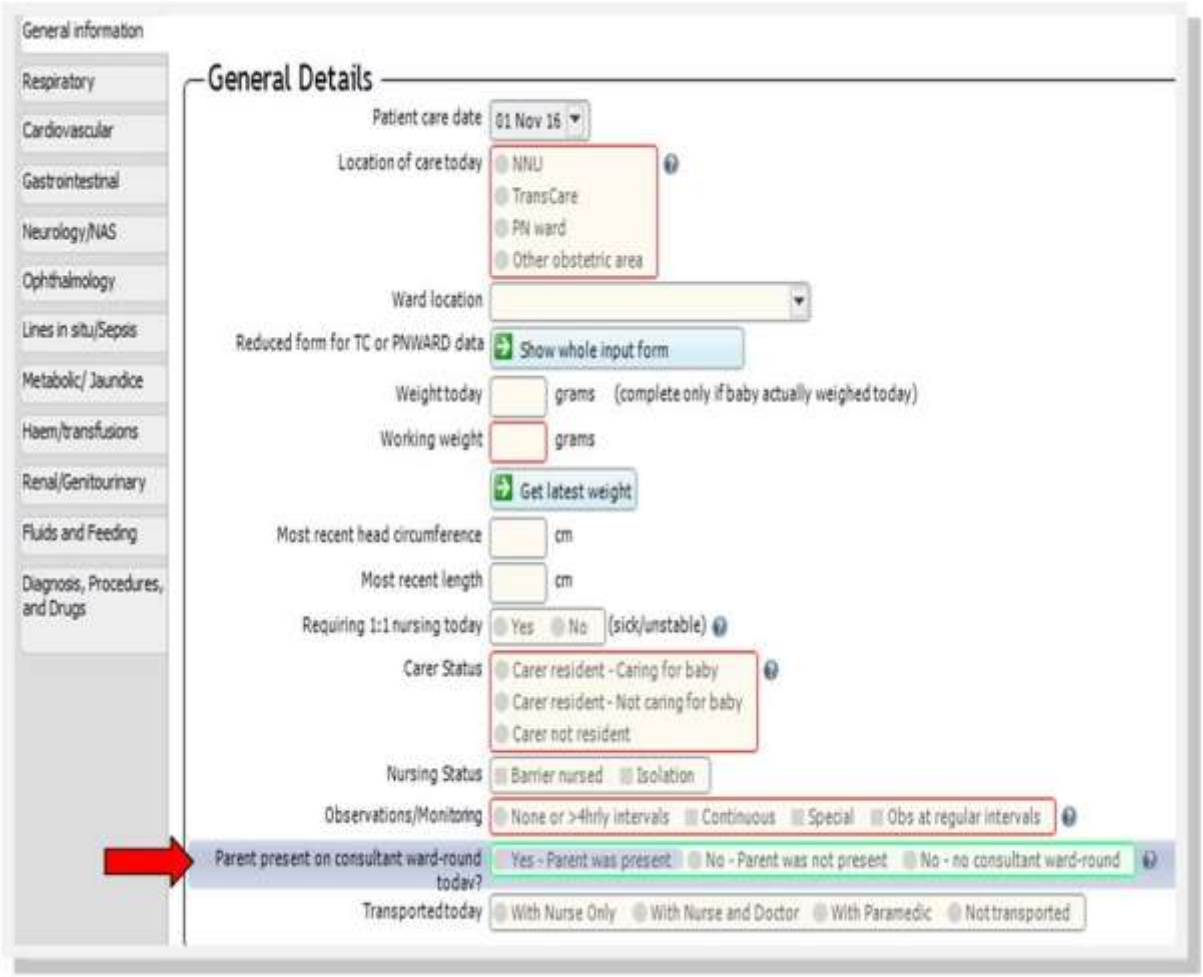


**Figure 6: Daily summary, BadgerNet**

## Additional information

### Background

The parents of babies admitted for care in neonatal units find themselves in a difficult and stressful situation, feeling that they have very little control in, or input towards, the care of their baby. It is therefore crucial that neonatal unit staff continue to keep parents informed of how their babies are being cared for and also listen to parents, try to understand how they are feeling and respond to any questions that they may have. This continual dialogue will also help parents to prepare for discharge, and transfer if required, by understanding the progress their babies have made and the progress they need to make prior to these stages.

This question is in addition to the consultation with parents within 24 hours of admission question.

### Opportunities for quality improvement

The proposed metric will allow units to compare a measure of daily parental involvement with similar types of unit and might allow units to reflect on whether different levels of parental involvement in ward rounds might improve parental partnership in care.

# On-time screening for retinopathy of prematurity

*Does an admitted baby born weighing less than 1501 g, 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[9]?*

**Change to audit measure for 2019 data year:** None.

## NNAP standard

**Developmental standard:** All (100%) of eligible babies should receive ROP screening within the time windows for first screening recommended in the guidelines.

**Source of standard:** National standard (RCPCH, RCOphth, BAPM and Bliss, *Guideline for the Screening and Treatment of Retinopathy of Prematurity*, 2008 [9]).

**Comparison standard for outlier analysis:** National rate

*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 (***Table 7***).*

**Table 7: ROP screening windows**

| Gestational age at birth (completed weeks) | ROP screening windows | |
|---|---|---|
| | National guideline ROP screening window | NNAP ROP screening window |
| Less than 27 | $30^{+0}$ to $30^{+6}$ weeks corrected gestational age inclusive | 29 to 31 weeks corrected gestational age inclusive |
| Greater than or equal to 27 | 4 to 5 weeks from birth (28-35 days) | 3 to 6 weeks from birth (21-42 days) |

## Inclusion criteria

- Babies who experienced their final neonatal discharge in the calendar year of analysis
- The baby was 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 1500 g or less.

## Attribution

If a ROP screen is conducted in accordance with the NNAP standard this is assigned to the neonatal unit performing the first screen within the NNAP ROP screening window.

If a baby is not screened in accordance with the NNAP standard this is assigned to the neonatal unit of care at the time that the national guideline screening window (not the extended NNAP ROP screening window) closed, or the neonatal unit of final discharge when the infant was discharged before the closure of the national guideline screening window.

Babies who died before the end of screening window, and who do not have a record of being "Screened on time" will be not be attributed to a unit.

## Deriving outcomes

ROP status will be derived from the ad -hoc and daily summary of care sections of BadgerNet to confirm if a screening took place and whether it took place during the NNAP ROP screening window (Table 8).

**Table 8: NNAP ROP screening done categories**

| These categories are totalled to give 'Any screen': | | | No screening data |
|---|---|---|---|
| Within NNAP ROP screening window | Before NNAP ROP screening window opened | After NNAP ROP screening window | No ad-hoc ROP form or ROP screen data on daily care summary |
| Screened on time | Screened early | Screened late | No screening data |

## BadgerNet Data source

Details on ROP screenings are captured on BadgerNet via ad-hoc forms for ROP screening and from the daily summary form when *ROP screen today* is answered *Yes*. Where evidence of ROP screening is available from both sources for the same day ad-hoc screening data will be used preferentially.

The *Date and time* from the ad-hoc form is used to determine the time of screening, whilst daily summary is considered to have happened at the very beginning of the day (00:00).

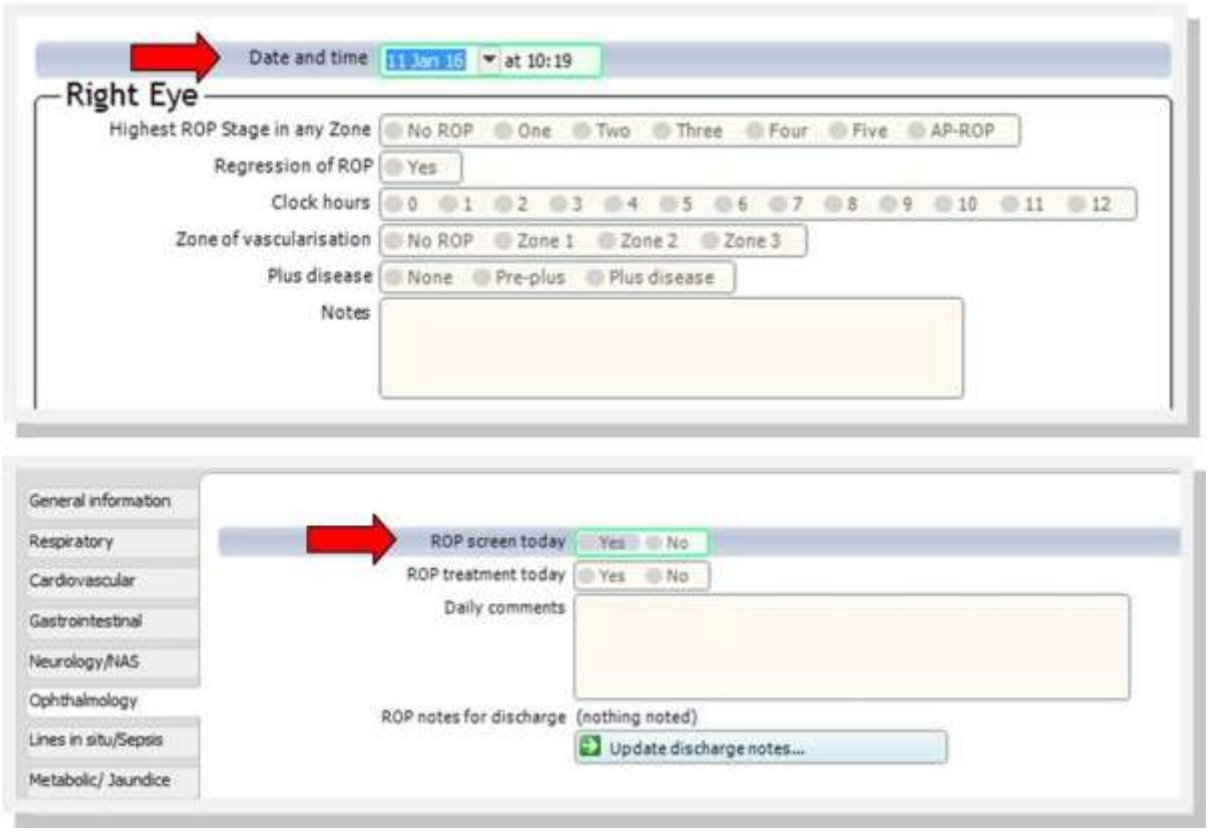


**Figure 7: Ad-hoc form for ROP screening (top) and daily summary form (bottom), BadgerNet**

# Encephalopathy

*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 audit measure for 2019 data year:** Encephalopathy will not be reported for 2019 data, however as results are published one year in arrears, 2018 results will be reported in the 2018 data report.

## NNAP standard

**Developmental standard:** Benchmarking only.

**Comparison standard for outlier analysis:** Not applicable, no outlier analysis.

## 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 attained externally to the National Neonatal Research Database (NNRD), which typically forms the denominator for NNAP audit measure (see data sources for more details).

## Attribution

Attribution will be to the neonatal unit of birth. When the place of birth is unknown, a non-hospital location, or a hospital without a neonatal unit, the place of birth will be assigned as *Other*, and will not be included in the results of the analysis.

## Deriving outcomes

Encephalopathy will be categorised under the following circumstances:

- The baby was born in the year of analysis
- The baby was admitted to neonatal care for at least 72 hours
- Within the daily data summaries associated with the first 72 hours of life the baby shows two or more of the following neurological signs in the same daily data summary:
    - Tone: Abnormal
    - Consciousness: Lethargic or Comatose
    - Convulsions: Yes

Encephalopathy rates will then be calculated as a rate per 1000 births.

## BadgerNet data source

Details on the neurological signs used to determine encephalopathy are captured on BadgerNet in daily summary forms. A form is created for each baby for each calendar day where they are an inpatient on a neonatal unit and the fields *Tone*, *Consciousness* and *Convulsions today* will be used by the NNAP.


**Figure 8: Daily summary form, BadgerNet**

# Bloodstream infection

*Does an admitted baby have one or more episodes of bloodstream infection, characterised by one or more positive blood cultures taken, after 72 hours of age?*

**Change to audit measure for 2019 data year:** Since the 2018 data year, cerebrospinal fluid (CSF) cultures have been removed from the audit question. Data will be presented on bloodstream infection, without reference to the presence of symptoms and signs.

Change to the inclusion criteria to so that the denominator includes only babies still present on the neonatal unit at 72 hours of age.

## NNAP standard

**Developmental standard:** Benchmarking only.

**Comparison standard for outlier analysis:** Not applicable, no outlier analysis.

## Inclusion criteria

- Babies who experienced their final neonatal discharge in the calendar year of analysis.
- Babies who were present on the neonatal unit at 72 hours of age.

## Attribution

Blood cultures will be attributed to the neonatal unit of care when the culture was taken, or for units where there were two such units on a day of care, the unit completing the culture form. Babies will be counted as eligible once in each neonatal unit they were admitted to.

## Deriving outcomes

Culture records will be considered as complete if the pathogen results for the culture are entered including 'None' or 'No growth'.

Fungal, and bacterial culture growths will be categorised as pure growths of a clearly pathogenic organism, mixed growths or organisms of uncertain significance (including skin commensals) according to a predefined list of clearly pathogenic known pathogens (see Appendix 1 for the list used for 2017 data).

Data pertaining to late onset bloodstream infection will be presented in gestational age sub groups, and subdivided by positive cultures for "known pathogens" and "skin commensal" organisms (organisms which may represent "false positive" blood cultures).

Data viewing will be further enhanced by presentation of an indication that all positive blood cultures have been entered, for centres where this is the case.

## BadgerNet data source

Details for blood cultures and their results will be captured via ad-hoc forms for cultures on BadgerNet.

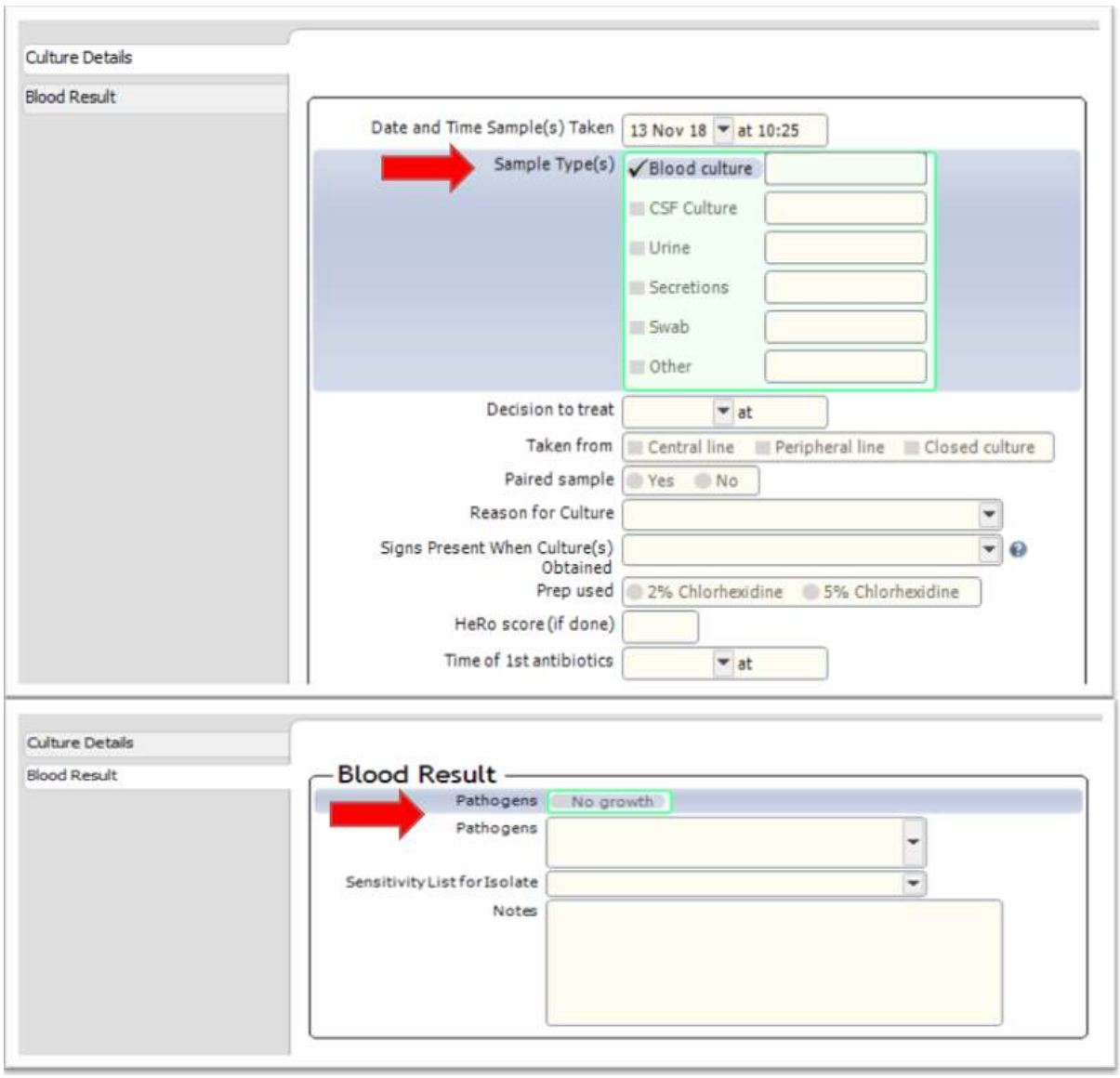


**Figure 9: Ad-hoc form for blood culture taken (top), and ad-hoc form for blood culture results (bottom)**

# Central line associated bloodstream infection (Quality Improvement Surveillance Definition)

*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 audit measure for 2019 data year:** None.

Change to the inclusion criteria to so that the denominator includes only babies still present on the neonatal unit at 72 hours of age.

## NNAP standard

**Developmental standard:** None, benchmarking only.

**Comparison standard for outlier analysis:** Not applicable, no outlier analysis.

## Inclusion criteria

- Babies who experienced their final neonatal discharge in the calendar year of analysis.
- Babies who were present on the neonatal unit at 72 hours of age.
- 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 when calculating proportions per 1000 line days.

## Attribution

Positive growths will be attributed to the neonatal unit completing the culture form and babies will be counted as eligible once in each neonatal unit they were admitted to.

## Deriving outcomes

To ensure that early onset infections are not counted in error cultures from the first 72 hours of life will initially be included in the analysis. A blood culture that presents any growth will be considered positive, and recurring growths that are less than 72 hours apart will be removed so that only the earliest known instance of the growth remains in the data. Once this comparison has been complete, any remaining cultures from the first 72 hours of life will be removed from the analysis.

The time the culture was taken will then be used to map to daily data records to determine if a central line was present on the calendar day the culture was taken. If a daily record is not available for the day, the culture was taken then it will be assumed that a central line was not present.

## BadgerNet data source

Details for blood cultures and their results will be captured via ad-hoc forms for cultures on BadgerNet, whilst data on *Lines in situ today* from daily data summaries will be used to determine line days for the analysis.

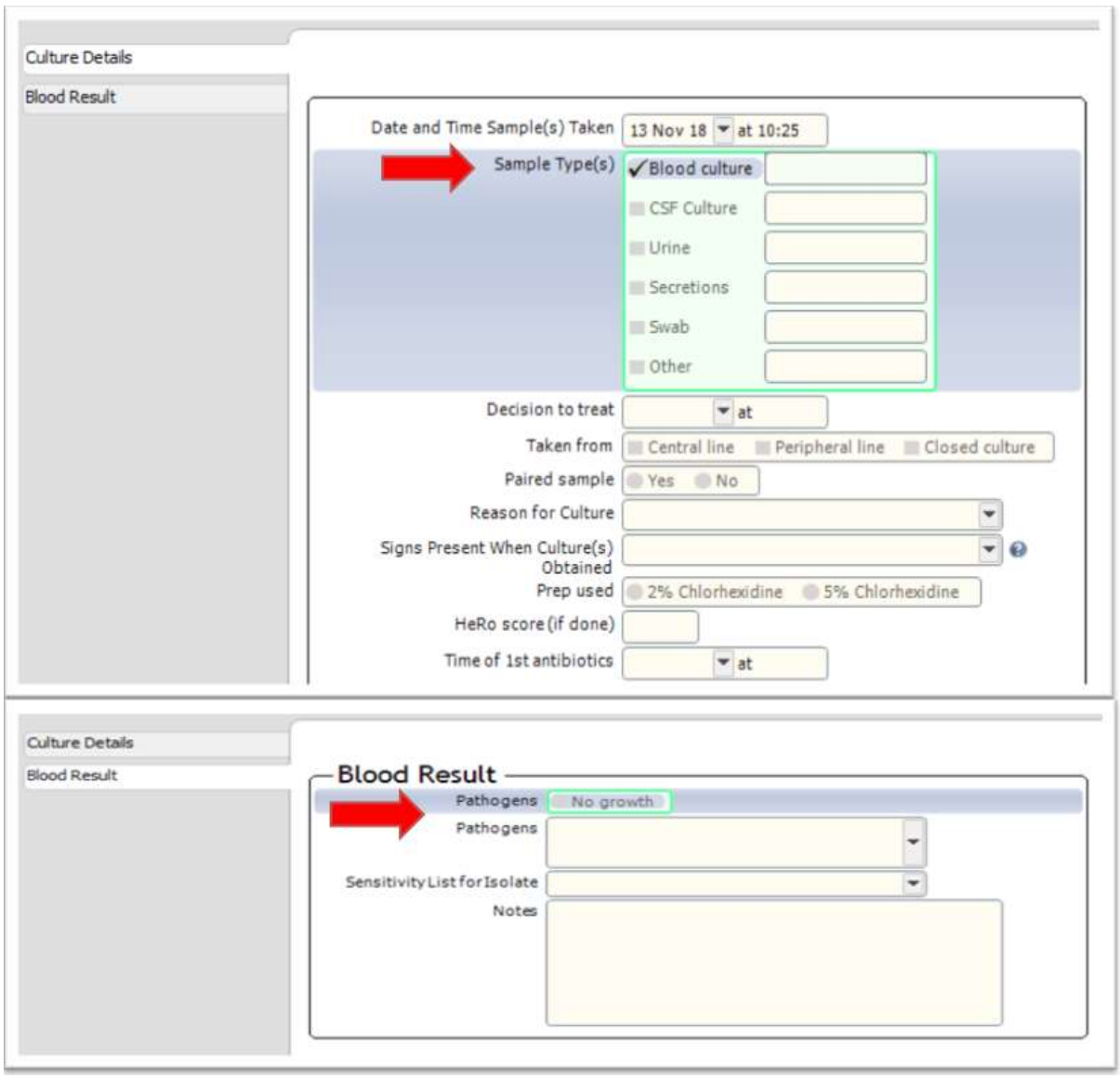


**Figure 10: Ad-hoc form for blood culture taken (top), and ad-hoc form for blood culture results (bottom), BadgerNet**

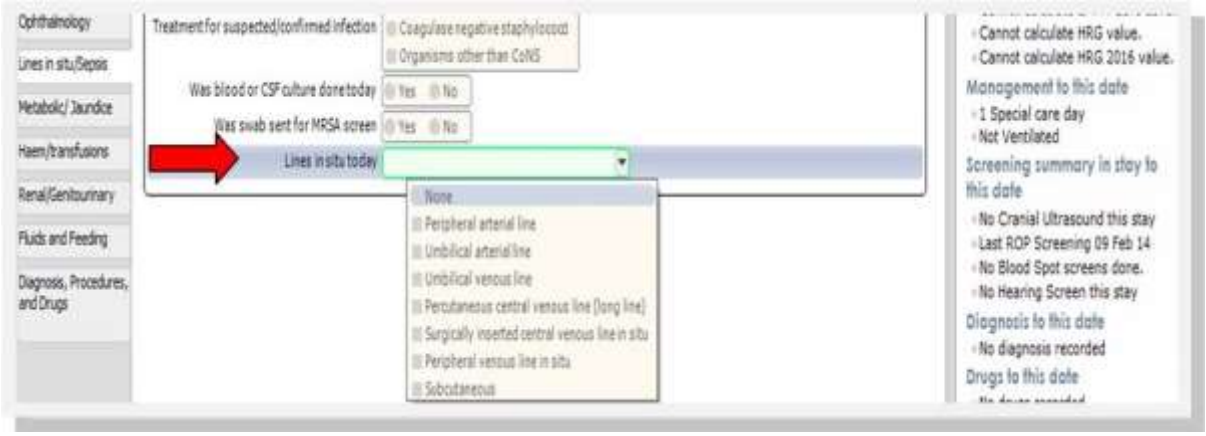


**Figure 11: Daily summary form, BadgerNet**

# Bronchopulmonary dysplasia

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

**Change to audit measure for 2019 data year:** On 28 September 2017 the Methodology and Dataset group agreed to amend this measure in line with published evidence[10] that oxygen or dependence on respiratory support at 36 weeks gestational age predicts longer-term lung disease. This pragmatic definition of BPD is widely used in clinical trials and other research to describe this outcome. The audit measure is defined as significant BPD or death prior to (corrected) post menstrual age of 36 weeks.

## NNAP standard

**Developmental standard:** None, benchmarking only.

**Comparison standard for outlier analysis:** Treatment effect of 0% (network level only).*

**Note: BPD in a network is assessed by comparing its rate with the rate of a comparable set of babies in the UK (or NNAP) as a whole. More information about this method is found in the NNAP statistical analysis plan.*

## Inclusion criteria

- Babies with a gestational age at birth of less than 32 weeks.
- Babies who experienced their final neonatal discharge in the calendar year of analysis.

AND

- Babies who were still an inpatient in a neonatal unit at 36 weeks postmenstrual age, had been discharged alive from neonatal care at less than 36 weeks postmenstrual age, or had died before 36 weeks postmenstrual age.

## Attribution

Attribution will be to the hospital of birth. Outcomes will also be reported by network of birth. When the place of birth is unknown, a non-hospital location, or a hospital without a neonatal unit, the place of birth will be assigned as *Other*.

## Deriving outcomes

### Definition of bronchopulmonary dysplasia

BPD will be defined by the level of respiratory support received at 36 weeks postmenstrual age (Table 9).

When a baby was discharged from neonatal care before reaching 36 weeks corrected gestational age, data from the time of discharge will be used instead.

**Table 9: Categorising BPD or death in NNAP based on daily respiratory support data**

| Survival at 36 weeks CGA | Respiratory data from 36 weeks corrected gestational age / final discharge | | |
|---|---|---|---|
| | Not receiving respiratory support | Receiving respiratory support* | Missing required respiratory data** |
| Died before 36 weeks CGA | Died | Died | Died |
| Survived to 36 weeks CGA | No BPD | BPD | BPD not determinable |

*'Respiratory Support' is defined as receiving any of the following at the specified time:

- Ventilation
- CPAP
- Non-invasive ventilation (e.g. BiPAP)
- Hi flow nasal cannula therapy (i.e. ≥ 2 lpm gas flow)
- Oxygen treatment

** In instances where respiratory data is not available for the specified day, data from the subsequent day of care (or penultimate day of care for babies discharged less than 36 weeks) will be sought instead. When respiratory data is also missing from this second source the baby will be classified as 'Missing required data' for that period.

Babies will be defined as having missing data if there is no data available to determine respiratory support.

## BadgerNet data source

Details on respiratory support used to calculate levels of BPD are captured on BadgerNet in daily summary forms. A form is created for each baby for each calendar day where they are an inpatient on a neonatal unit, and the fields *Respiratory Support*, *Added oxygen*, *Mode of ventilation* and *Mode of non-invasive support* will be used to by the NNAP.


**Figure 12: Daily summary form, BadgerNet**

# Necrotising enterocolitis

*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?*

**Change to audit measure for 2019 data year:** None.

## NNAP standard

**Developmental standard:** Benchmarking

**Comparison standard for outlier analysis:** Not applicable, no outlier analysis.

## Background and evidence base

## Inclusion criteria

- Babies who experienced their final neonatal discharge in the calendar year of analysis.
- Babies born at less than 32 weeks gestational age and survived to at least 48 hours after birth.

## Attribution

- Babies will be attributed to their location of care at 48 hours of life, which is intended as a proxy measure of the intention to provide ongoing care for a baby in a given neonatal unit.
- When a baby is in transit between units at 48 hours the baby will be assigned to the transferring hospital. When multiple admission locations exist at 48 hours of life, the baby will be attributed to the earliest associated admission time.

## Deriving outcomes

The analysis is based upon where the baby was resident at 48 hours of age. NEC may be diagnosed at surgery, post-mortem or based on the following clinical and radiographic signs.

At least one clinical feature from:

a) Bilious gastric aspirate or emesis
b) Abdominal distension
c) Occult or gross blood in stool (no fissure)

And at least one radiographic feature from:

a) Pneumatosis
b) Hepato-biliary gas
c) Pneumoperitoneum

Infants clinically diagnosed as NEC using the clinical and radiographic criteria who are found at surgery or post-mortem to have “Focal Intestinal Perforation” should not be recorded as having NEC.

**Table 10: Categorisation of NEC diagnosis**

| Survival to discharge home | Was NEC Diagnosed during any admission? | | | | | |
|---|---|---|---|---|---|---|
| | NEC diagnosis based on surgery | NEC diagnosis based on post-mortem | NEC diagnosis based on presence of clinical signs | | NEC not diagnosed | NEC diagnosis data missing |
| | | | At least 1 radiographic and 1 clinical feature | Radiographic or clinical features missing | | |
| Survived to discharge home | NEC | NEC | NEC | Missing data (alive at discharge) | No NEC | Missing data (alive at discharge) |
| Died prior to discharge home | NEC | NEC | NEC | Missing data (died before discharge) | No NEC but died prior to discharge | Missing data (died before discharge) |

## BadgerNet data source

For babies born at less than 32 weeks, the field *Was NEC diagnosed during this admission?* will appear on the *Discharge details*. Data from this field, and it's follow on question (*Based on*, *Clinical feature(s)*, *Radiographic Features*.

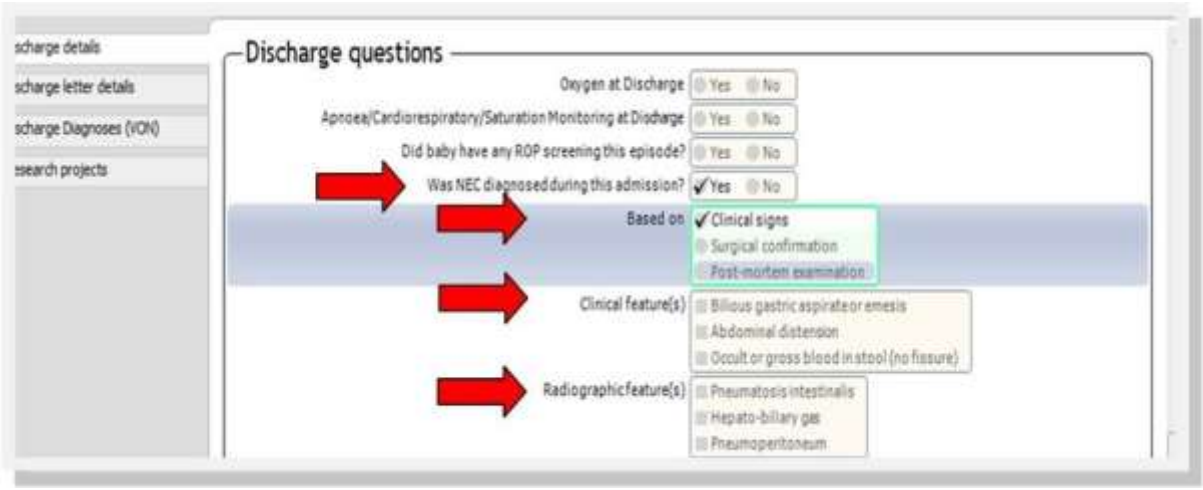


**Figure 13: Discharge details page, BadgerNet**

## Additional information

### Background

Necrotising enterocolitis (NEC) is a devastating consequence of preterm delivery typically affecting around 5% of babies born at less than 32 weeks gestation, with known variation between centres. Mortality is high, exceeding 20%. Observational evidence suggests that survivors experience substantially higher rates of developmental impairment. Hospital stays in survivors are typically prolonged, and frequently require transfer with prolonged care, often in surgical centres. As well as being disadvantageous for babies and families, this confounds analyses of incidence where cases are attributed to the hospital providing the majority of the care days.

**Opportunities for quality improvement**

NEC is known to be influenced by antenatal factors, such as in utero growth. The evidence base for the widely-held view that postnatal feeding strategies influence necrotising enterocolitis is, as yet, inconclusive. Limited evidence supports the assertion that alterations in feeding increments can moderate the risk of NEC. However, meta-analyses based on older trials of donor breast milk suggest that using formula milk substantially increases the risk of NEC. Finally, meta-analysis of probiotic trials in very large numbers of preterm babies suggests that probiotic use moderates the risk of NEC.

Measuring rates of NEC will therefore afford neonatal units opportunities to compare their rates of NEC with those of other neonatal units, in a way unaffected by variations in interventions rates according to local surgical practice. Units with higher NEC rates will wish to address their adherence to strands from known quality improvement initiatives.

It is known that a significant number of babies with NEC die without surgery – describing the site where NEC is first diagnosed potentially represents a quality improvement opportunity.

# Minimising inappropriate separation of mother and term baby

*For a baby born at greater than or equal to 37 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= Healthcare Resource Group (HRG) 3 or b= HRG 5, as defined by the NHS England neonatal critical care service specification[4].

**Change to audit measure for 2019 data year:** None.

## NNAP standard

**Developmental standard:** None, benchmarking only.

## Inclusion criteria

- Babies born greater than or equal to 37 weeks.
- Babies who received all their care in one unit.
- Babies who were admitted for at least 12 hours.
- Babies who did not have major surgery.
- Babies who were nursed on a neonatal unit on a day, or days.
- Babies receiving neonatal care in non-neonatal unit locations (postnatal ward, transitional care etc.) will not be included.

A second denominator of all live births within the gestational age range in the hospital (greater than or equal to 37 weeks) will be used when available.

## Attribution

Attribution will be to the neonatal unit of admission.

## Deriving outcomes

NNAP will use the pre-calculated care levels from BadgerNet to determine care days that are classified as HRG 3 or HRG 5, with *no added oxygen* and no other form of non-invasive respiratory support provided. In addition, only care days that occurred in a neonatal unit location will be counted.

Days of care will be defined as having missing data if there is no data available to determine respiratory support.

## BadgerNet data source

Details from the *Any major surgery today* field from daily data summaries will be used to determine and exclude babies who received surgery from the analysis.

Furthermore, the pre-calculated care level from each daily data summary, and the respiratory support details for that day, will be used to categorise care days.

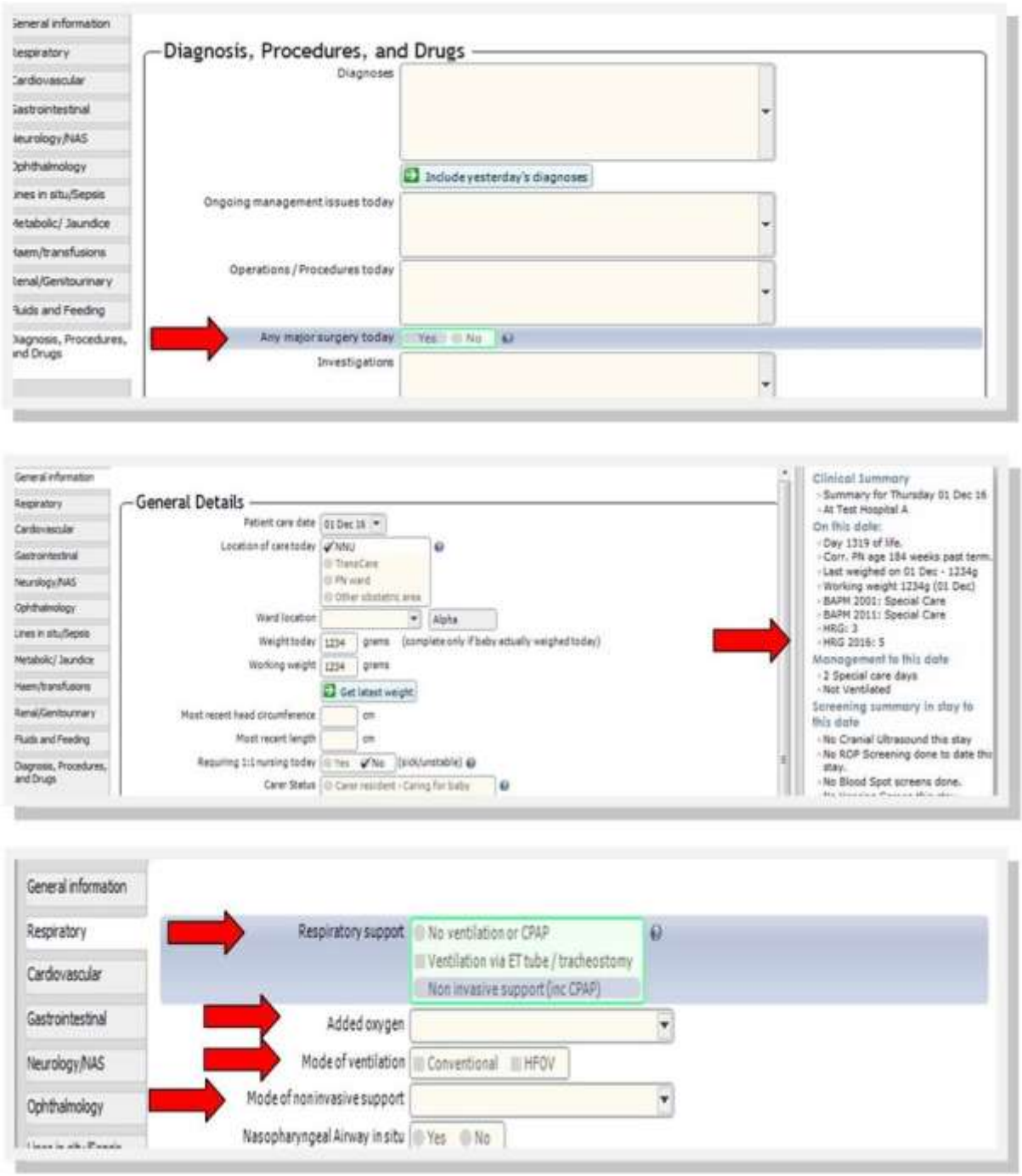


**Figure 14: Daily summary form – diagnosis, procedures and drugs (top), general information (middle) and respiratory (bottom), BadgerNet**

## Additional information

### Background

Between 2011 and 2014, the number of term live births in England declined by 3.6% yet the number of term babies admitted to the neonatal units increased by 31%. This increase is seen across all categories of care but especially marked in the special care category where almost 10,000 more babies were admitted for this type care in 2015 compared to 2011. If more facilities were available to nurse baby and mother together when babies require monitoring or intervention that is not part of "normal care", it is possible that many such admissions and unnecessary separation of babies from their mothers can be avoided.

**Opportunities for quality improvement**

Analysis of retrospective patient level data for term neonatal admissions between 2011 and 2014 commissioned by NHS England suggests that a substantial proportion of these admissions may be preventable with different care model. For example, 23% of admissions for respiratory problems had a length of stay of less than 48 hours and needed special care only, with 10% not needing oxygen at all. Most babies admitted for jaundice required phototherapy only and could be more appropriately managed in a transitional care setting. Similarly, amongst babies admitted for hypoglycaemia, 30% of admissions occurred before four hours of age - a period of physiological transition in glucose metabolism (with half of these within an hour of birth), 44% admitted directly from the delivery suite, and admission blood glucose concentration being above the operational threshold in a quarter of these admissions, suggesting little or no postnatal ward interventions. This was supported by the finding that nearly 75% of babies admitted for hypoglycaemia within an hour of birth did not need intravenous glucose infusion.

A recent quality improvement initiative showed a 73% reduction in admissions of later preterm and term babies for hypoglycaemia by adhering to the currently available guidance[11]. This, together with the retrospective data analysis suggests opportunities for wider quality improvement and reductions in unnecessary separation of mothers and their babies.

This metric will:

- Be inclusive - all neonatal units irrespective of their designation will be able to participate in the resulting quality improvement
- Address the largest group of babies admitted to any neonatal unit (term neonates)
- Forge a genuine partnership in quality improvement including not only neonatal, obstetric and midwifery healthcare professionals but also active involvement of the parents.

# Minimising inappropriate separation of mother and late preterm baby

*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[4].

**Change to audit measure for 2019 data year:** None.

## NNAP standard

**Developmental standard:** Benchmarking only.

## Inclusion criteria

- Babies born between 34 and 36 weeks gestational age.
- Babies who received all their care in one unit.
- Babies who were admitted for at least 12 hours.
- Babies who did not have major surgery.
- Babies who were nursed on a neonatal unit on a day, or days.
- Babies receiving neonatal care in non-neonatal unit locations (postnatal ward, transitional care etc.) will not be included.

A second denominator of all live births within the gestational age range in the hospital (34-36 weeks) will be used when available.

## Attribution

Attribution will be to the neonatal unit of admission.

## Deriving outcomes

NNAP will use the pre-calculated care levels from BadgerNet to determine care days that are classified as HRG 3 or HRG 5 with *no added oxygen* and no other form of non-invasive respiratory support provided. In addition, only care days that occurred in a neonatal unit location will be counted.

Days of care will be defined as having missing data if there is no data available to determine respiratory support.

The rate of potentially avoidable mother and baby separation days will be presented per admission. Data for each unit will also describe the number of admitted babies considered.

## BadgerNet data source

Details from the *Any major surgery today* field from daily data summaries will be used to determine and exclude babies who received surgery from the analysis.

Furthermore, the pre-calculated care level from each daily data summary, and the respiratory support details for that day, will be used to categorise care days.

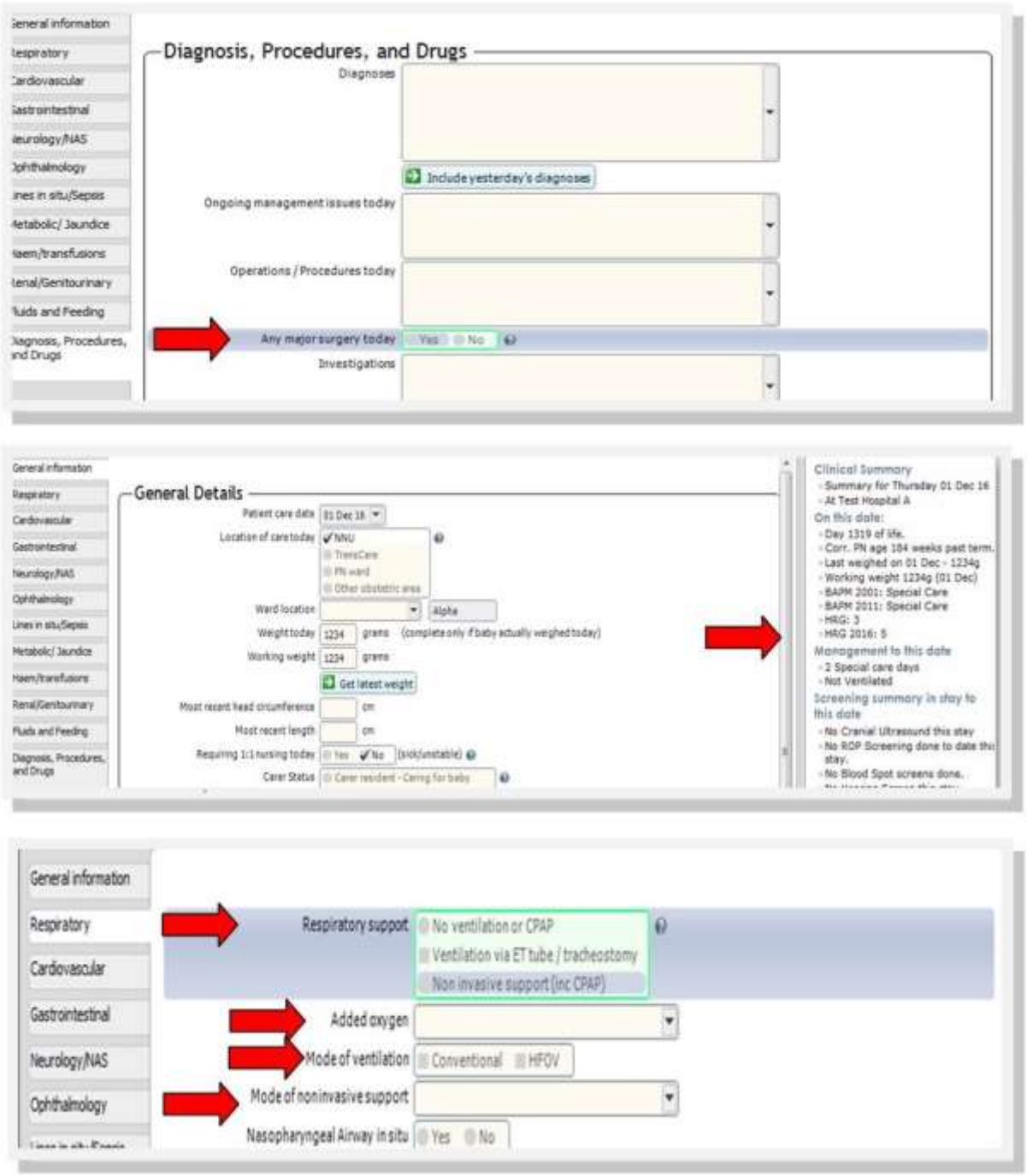


**Figure 15: Daily summary form - diagnosis, procedures and drugs (top), general information (middle) and respiratory (bottom), BadgerNet**

## Additional information

### Background

Nationally, 20% of admissions to neonatal units are of babies between 34 and 36 weeks gestation, weighing more than 1800 g at birth. Not all such babies are nursed in neonatal units – practice varies according to clinical preference and availability of appropriate facilities. There are clear parent and organisational drivers to encourage clinically appropriate use of transitional care – now described by Healthcare Resource Group (HRG) definitions. There is a strong indication from NHS England that payment structures will favour delivery of HRG 4 (special care parent present) which has been reconfigured according to a consensus of current clinical practice.

**Opportunities for quality improvement**

The metric will allow benchmarking of the proportion of care days per relevant admission to a neonatal unit that would be potentially suitable for HRG 4 care. NNAP will not suggest by this metric that all such days would be suitable for HRG 4 care, but the measure will facilitate comparison between services, and highlight a group of babies of whom a subpopulation might benefit from the development of appropriate services, such as transitional care, or other provision of HRG 4 care. The inclusion of babies receiving intravenous fluids within this definition is deliberate, reflecting that some babies receiving intravenous fluids could tolerate and benefit from enteral feeds.

# Early breastmilk feeding

*Does a baby born at less than 32 weeks gestational age receive any of their own mother's milk at day 14 of life?*

**Change to audit measure for 2019 data year:** None, new measure for the 2019 data year.

## NNAP standard

**Developmental standard:** Benchmarking only.

## Inclusion criteria

- Babies born at less than 32 weeks gestational age who survive on the neonatal unit to their 14th day of life.
- Babies who experienced their final neonatal discharge in the calendar year of analysis.

## Attribution

- Babies will be attributed to their location of care at 48 hours of life, which is intended as a proxy measure of the intention to provide ongoing care for a baby in a given neonatal unit.
- When a baby is in transit between units at 48 hours the baby will be assigned to the transferring hospital. When multiple admission locations exist at 48 hours of life, the baby will be attributed to the earliest associated admission time.

## Deriving outcomes

Babies will be classified as meeting the NNAP standard if they are noted to have received any of the following types of enteral feed on their 14th day of life.

- Suckling at the breast
- Mother's fresh expressed breastmilk
- Mother's frozen expressed breastmilk

## BadgerNet data source

The primary source for information on feeding at discharge is daily summary data on enteral feeds for the 14th day of neonatal care on the BadgerNet system. When enteral feeding data is missing for the 14th day, data from 13th or 15th day of care will be used instead (the most positive result will be used).

## Additional information

Breastmilk confers benefit for preterm babies, both through reducing adverse outcomes such as necrotising enterocolitis, and also by long term effects on neurodevelopment.[1,2,3] In order for babies to benefit from both early risk modification (e.g. reduction in NEC) and long-term benefits, mothers of very preterm babies have to be successful in establishing expression of breastmilk, and to sustain this expression and intent to breastmilk feed over a long period. The existing measure of breastmilk feeding within NNAP (prevalence of any breastmilk feeding at discharge home) assesses establishment of expression and its continuation to such a point where a baby can be discharged breastmilk feeding. This new measure is designed to assess the success of initiation of breastmilk expression, in order to facilitate comparison between units, and quality improvement activities based on this.

**Opportunities for quality improvement:**

Given the widely acknowledged importance of breastmilk in promoting improved outcomes among very preterm infants, units with lower rates of breastmilk feeding at 14 days will wish to compare their practices to those with higher rates of breastmilk feeding. Measures addressing practical, professional, environmental and peer support for breastmilk expression may be of relevance to unit and network based neonatal quality improvement teams.

# Breastmilk feeding at discharge home

*Does a baby born at less than 32 weeks gestational age receive any of their own mother's milk at discharge to home from a neonatal unit?*[8]

**Change to audit measure for 2019 data year:** Change of gestational age upper limit to babies born at less than 32 weeks gestational age. Change of inclusion criteria so that babies transferred during their neonatal care are no longer excluded.

## NNAP standard

**Developmental standard:** Eighty percent (80%) of babies born at less than 32 weeks gestational age should receive at least some of their mother's milk at discharge home from the neonatal unit.

**Source of standard:** By consensus, in consultation with BAPM.

**Comparison standard for outlier analysis:** Not applicable, no outlier analysis.

## Inclusion criteria

- Babies born at less than 32 weeks gestational age.
- Babies who are discharged home alive.
- Babies who experienced their final neonatal discharge in the calendar year of analysis.

## Attribution

Attribution will be to the neonatal unit of final discharge.

## Deriving outcomes

Babies will be classified as meeting the NNAP standard if they are noted to have received any of the following types of enteral feed on their final day of care:

- Suckling at breast
- Mother's fresh expressed breast milk
- Mother's frozen expressed breast milk.

Data will be presented subdivided by rates of breastfeeding, and breastmilk feeding by bottle.

## BadgerNet data source

The primary source for information on feeding at discharge is daily summary data on enteral feeds for the last day of neonatal care on the BadgerNet system. When enteral feeding data is missing for the final day, data from the penultimate day of care will be used instead.


**Figure 16: Daily summary form, BadgerNet**

# Follow-up at two years

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

*Does a baby have complete results of a structured assessment recorded?*[4,12]

**Change to audit measure for 2019 data year:** focus on performance of follow-up, rather than results of assessment.

## NNAP standard

**Developmental standard:** Ninety percent (90%) of babies with two-year follow-up data entered.

**Source of standard:** NNAP Project Board

**Comparison standard for outlier analysis:** National rate.

## Inclusion criteria

- Babies born at less than 30 weeks who are not recorded as deceased within their episodic data (including final neonatal outcome).
- The eligible cohort runs for births from July to June each year, for babies who would have reached two years corrected age since the last annual report. Current and projected denominators are shown in Table 11.

**Table 11: Categorising eligible babies for follow-up at two years of age**

| NNAP data year | Two-year assessment cohort: Time of birth (inclusive) |
|---|---|
| 2017 | July 2014 to June 2015 |
| 2018 | July 2015 to June 2016 |
| 2019 | July 2016 to June 2017 |
| 2020 | July 2017 to June 2018 |

## Attribution

Attribution will be to the neonatal unit of final discharge. When the unit of final neonatal discharge home cannot be ascertained, two-year data is assigned to the last known episode of neonatal care.

## Deriving outcomes

Assessment data will be considered for analysis if it took place between 18 and 30 months corrected age for the infant. This is calculated using assessment date, date of birth and gestational age at birth. If any of these fields are blank, the infant will be classified as *Outside of date range*. If the *Reason child not assessed* field is filled in, any data entered for this record will not count towards the analysis (Table 12).

**Table 12: Categorising two-year follow-up data**

| Two-year follow-up outcome form | NNAP category |
|---|---|
| Any two-year follow-up health data entered | Health data entered: Severe |
| | Health data entered: Mild / moderate |
| | Health data entered: No impairment |
| | Health data entered: Not determinable |
| Lost to follow-up | No health data entered |
| Died post discharge | Health data entered |
| Responsibility of another unit | No health data entered |
| Local decision not to follow-up | No health data entered |
| Empty follow-up form / No follow up form | No health data entered |

Assessment data is categorised based on questions from the TRPG/SEND/NNAP 2-Year Corrected Age Outcome Form. Questions are determined as being related to severe or mild/moderate impairment, and impairment for babies is classified based on the highest order of impairment they show within each NNAP impairment category.

**Table 13: Questions from the outcome form are associated with the following NNAP impairment categories**

| NNAP impairment category | Domains used from TRPG/SEND/NNAP form | Questions related to mild/moderate impairment | Questions related to severe impairment |
|---|---|---|---|
| **Neurodevelopmental** | 1.Neuromotor | a. Does the child have difficulty walking?<br>b. Is the child's gait non-fluent or abnormal reducing mobility?<br>d. Is this child unstable or needs to be supported when sitting?<br>f. Does this child have any difficulty with the use of one hand?<br>g. Does this child have difficulty with the use of both hands? | c. Is this child unable to walk without assistance?<br>e. Is this child unable to sit?<br>h. Is this child unable to use hands (i.e. to feed)? |
| | 6.Neurology | a. Has this child had a fit or seizure in the past 12 months?<br>b. Is this child on any anticonvulsants?<br>d. Has this child ever had ventriculo-peritoneal shunt inserted? | c. Has this child had more than 1 seizures a month despite treatment |
| | 8.Development | a. Is the child's development between 3-6 months behind corrected age?<br>b. Is the child's development between 6-12 months behind corrected age? | c. Is the child's development more than 12 months behind corrected age? |
| | 9.Neurosensory | a. Does this child have a hearing impairment?<br>b. Does this child have hearing impairment corrected by aids?<br>d. Does this child have any visual problems (including squint)?<br>e. Does this child have visual defect that is not fully correctable? | c. Does this child have hearing impairment not correctable with aids?<br>f. Is this child blind or sees light only? |
| | 10.Communication | a. Does this child have any difficulty with communication?<br>b. Does this child have difficulty with speech (< 10 words/signs)?<br>d. Does this child have difficulty with understanding outside of familiar context? | c. Does this child have < 5 meaningful words, vocalisations or signs?<br>e. Is this child unable to understand words or signs? |
| **Respiratory** | 3. Respiratory & CVS system | a. Does this child have limited exercise tolerance with or without treatment? | b. Does child require supplemental oxygen or other respiratory support? |
| **Gastro-intestinal** | 4. Gastro-intestinal Tract | a. Is this child on a special diet?<br>b. Does this child have a stoma? | c. Is this child having renal dialysis or awaiting renal transplant? |

### Categorising missing assessment data

Missing data for individual assessment questions can lead to an infant's developmental outcome being classified as *not determinable*. This occurs when the missing data still has the potential to change the impairment status of the infant. For instance, if an infant is classified as having *mild / moderate* impairment from their entered data there will be no consequence from missing data for other questions associated with mild / moderate impairment. If, however, the same infant was missing an answer to a severe impairment question the status of the infant would be *not determinable*, as the missing data could still impact their impairment classification. Therefore, an infant must have complete data within an NNAP category in order to be classified as having *no impairment*.

### Categorising babies without health assessments

When no health data is entered within the window of 18-30 months corrected age, NNAP will categorise babies based on their reasons for not being assessed, if available. If no reason for missing assessment is provided the infant will be categorised as having *no data entered* (Table 14).

**Table 14: Categorising reason for no two-year follow-up**

| Reason not assessed | NNAP category |
|---|---|
| Died post discharge | Health data entered |
| Lost to follow-up<br>Declined appointment / responsibility of another unit / did not attend appointment / moved out of area / local decision not to follow up<br>None given, and no health data entered | No health data entered |

### Provision of standardised health assessments

An additional analysis is conducted to determine how many babies with health data entered at 18-30 months corrected age were provided with a Schedule of growing, Bayley III or Griffiths assessment. Any data entered in relation to these standardised assessments will be considered as evidence of a standardised assessment being provided.

## BadgerNet data source

Data from the two-year follow-up form will be used to analyse assessment data. Which sections are used for each part of the analysis is indicated below by the coloured arrows:

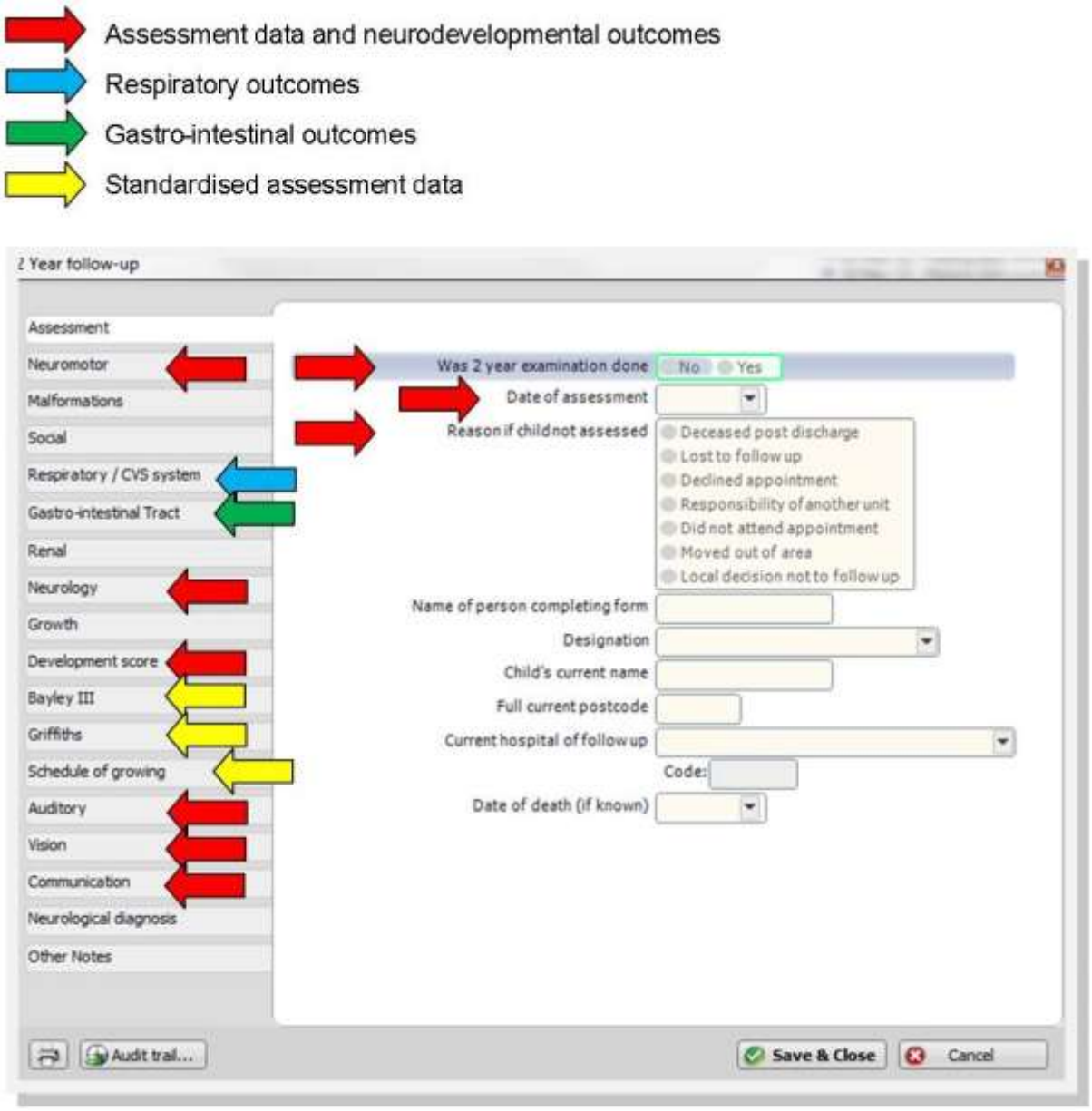


**Figure 17: Two-year follow-up form, BadgerNet**

# Mortality to discharge in very preterm babies

*Does a baby born at less than 32 weeks gestational age die before discharge home, or 44 weeks post-menstrual age (whichever occurs sooner)?*

*Note: Babies discharged to hospice for palliative care (such as for compassionate extubation) and who die prior to 44 weeks post-menstrual age are counted in the numerator.*

**Change to audit measure for 2019 data year:** None

## NNAP standard

**Developmental standard:** None

## Inclusion criteria

**Denominator:** Number of babies admitted to a neonatal unit whose birth gestation was 24 to 31 weeks gestation inclusive.

**Numerator:** Deaths of babies 24 to 31 weeks gestation inclusive, before discharge from hospital to home, or discharge for palliative care with agreed non-intervention plan in place followed by death prior to 44 weeks post-menstrual age (e.g. ventilated baby discharged or hospice). In hospital deaths in units not submitting data to the NNAP will be included. Mortality at or after 44 weeks gestationally corrected age will be excluded.

**Table 15: Categorising eligible babies for Mortality until discharge or 44 weeks PMA**

| NNAP data year | Cohort: Date of birth |
|---|---|
| 2018 | 1 July 2015 to 30 June 2018 |
| 2019 | 1 July 2016 to 30 June 2019 |
| 2020 | 1 July 2017 to 30 June 2020 |
| 2021 | 1 July 2018 to 30 June 2021 |

## Attribution

The NNAP will report mortality on three year rolling epochs. Attribution will be to network of birth.

## Deriving outcomes

Raw and adjusted mortality rates will be published for network and national data, but not for units.

**Case mix adjustment:** For limited variables, including gestation, gender, multiplicity and ethnicity but neither antenatal steroid administration nor congenital anomalies.

The NNAP mortality analysis will only include babies admitted to neonatal units, in the first instance. However, we would like units to report liveborn but not admitted deaths using Badger at gestations down to, and including, 23 weeks. Only the briefest of details are

required to complete a “delivery room death” admission in place of a “neonatal unit admission”.


## Additional information

### Rationale

The National Advisory Group on Clinical Audits and Enquiries (NAGCAE) suggested NNAP report mortality in 2013. The NNAP agreed to form an expert group, and has subsequently discussed reporting with the MBRRACE-UK group. MBRRACE-UK report neonatal mortality (<28 days) on all liveborn babies including those not admitted for neonatal care and do not have plans to report later mortality at this point. NNAP mortality reporting will build on the firm foundations established by NDAU mortality reporting to date.

Mortality is a vitally important outcome of neonatal care: reporting will add to the NNAP’s perspective on neonatal services. In the first phase the NNAP plans to report on mortality to discharge of admitted babies. This definition may facilitate quality improvement of care within the neonatal unit. One reason for omitting babies born at 23 weeks gestation from the initial phase of reporting is that there are known important variations in rates of admission of babies at very low gestations. Low gestation babies have the highest mortality. Starting by reporting only on babies of 24-31 weeks gestation inclusive will maximise the comparability of reported neonatal network mortality to discharge.

### Future phases of mortality reporting

Once NNAP mortality reporting is established, it is anticipated that future phases of reporting will include numerators and denominators extending to 23 weeks gestation, and the inclusion of liveborn, but not admitted cases of mortality.

### What next?

Neonatal services should have systems for ensuring reporting to NNAP, via Badger, of any pre-44 week gestationally corrected age mortality to babies born at 24 to 31 weeks gestation who were discharged to non NNAP reporting units (surgical units, hospices, paediatric wards).

Neonatal services should have systems to report to NNAP, via Badger, liveborn but not admitted babies at 23-31 weeks gestation (inclusive) who later die. These will be small in number, but are significant to research projects, MBRRACE-UK and future NNAP mortality reporting.

# Nurse staffing on neonatal units

- *What proportion of nursing shifts are numerically staffed according to guidelines and service specification?*
- *What proportion of shifts have sufficient staff qualified in speciality (QIS)?*
- *How many additional nursing shifts are required to be worked to meet guidelines and service specification?*

*Note: Shifts are based on corresponding level of cot occupancy calculated by Badger system.*

**Measure one – Proportion of shifts numerically staffed according to guidelines and service specification**

Numerator: Number of shifts where nurse staffing met or exceeded service specification rules (1:1 intensive care; 1:2 high dependency care; 1:4 special care; additional shift coordinator)[4,13,14].

Denominator: Number of shifts (data collection instrument and measure based on a two-shift model of each calendar day).

**Measure two – Proportion of shifts with sufficient staff qualified in speciality (QIS)**

Numerator: Number of shifts in which at least 70% of registered staff on duty were qualified in speciality.

Denominator: Number of shifts (data collection instrument and measure based on a two-shift model of each calendar day).

**Measure three – Number of additional nursing shifts required to meet guidelines and service specification**

This number of shifts is calculated by subtracting the number of nurses that were working on each shift, from the number of nurses that are required under the terms of the service specification, and summing the rounded total over the reporting period [4, 13,14].

**Change to audit measure for 2019 data year:** New measure for 2018 data year.

## NNAP standard

**Developmental standard:** 100% of shifts staffed according to guidelines and service specification.

## Inclusion criteria

A "nurse" is a member of non-medical staff with an allocated patient workload, or acting as a coordinator, with or without Nursing and Midwifery Council (NMC) registration, with or without a qualification in speciality. Staff members without allocated patients, such as housekeepers, research nurses, nurses in primarily educational roles are specifically excluded.

If the supernumerary shift coordinator is QIS, they are included in the count of nurses QIS in measure 2.

When entering data about partially worked day shifts, units should enter early or late shifts as follows: where a nurse is only present for an “early” or “late” part of a day shift, record as 0.5 shifts.

Units where more than 50% of shifts are staffed with three registered nurses or fewer are excluded from measure two.

## Attribution

Attribution will be to the neonatal unit.

## BadgerNet data source

Data from the Nursing numbers update form (Figure 18) in BadgerNet will be used for this measure. The Nursing numbers update form is found within the Unit report section.

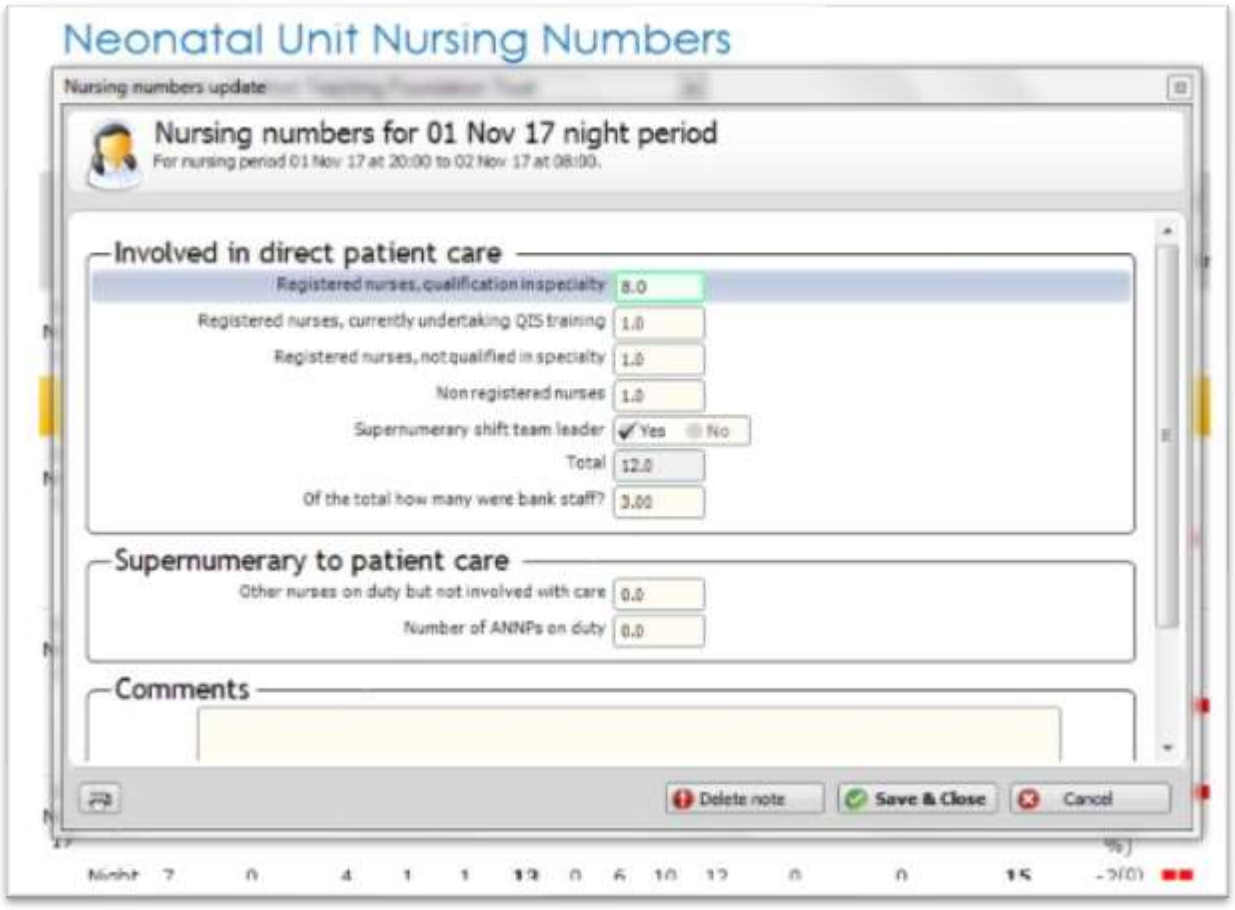


**Figure 18: Nursing numbers update form, BadgerNet**

Data entered into the form is summarised in the Neonatal Unit Nursing Numbers report (Figure 19).Figure 18

| Period | | Nurses caring for patients | | | | | | | Cot occupancy | | | | | Nurses required | | QIS Required (IC & HD | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | With qual. | Undertaking QIS | Without qual. | Not Reg. | Team Leader | Total | Bank Staff | IC | HD | SC | Admissions | Discharges | BAPM Recommends | Difference | Toolkit recommends | Differenc |
| 01 Nov 17 | Day | 6 | 0 | 4 | 1 | 1 | **12** | 1 | 3.3 | 7 | 11.4 | 2 | 2 | **10.6** | 1.4(0) (13 %) | 6.8 | -0.8 |
| | Night | 8 | 1 | 1 | 1 | 1 | **12** | 3 | 4 | 7 | 10.3 | 0 | 1 | **11.1** | 0.9(0) (8 %) | 7.5 | 1.5 |
| 02 Nov 17 | Day | 5 | 0 | 5 | 2 | 1 | **13** | 0 | 4 | 8.2 | 10.3 | 5 | 0 | **11.7** | 1.3(0) (11 %) | 8.2 | -3.2 |
| | Night | 8 | 1 | 2 | 0 | 1 | **12** | 3 | 5.8 | 6 | 12.3 | 2 | 0 | **13.9** | -1.9(0) (-13 %) | 9.8 | -0.8 |
| 03 Nov ++ | Day | 5 | 0 | 7 | 0 | 1 | **13** | 0 | 5 | 8.3 | 10.4 | 2 | 2 | **12.7** | 0.3(0) (2 %) | 9.1 | -4.1 |

**Figure 19: Neonatal unit nursing numbers, BadgerNet**

## Additional information

### Background

Neonatal units in England are commissioned by NHS England specialist commissioning, according to the service specification[4,13,14]. Services in the devolved nations are commissioned on a comparable basis according to the related British Association of Perinatal Medicine (BAPM) standards[14]. Nurse staffing is known to be associated with outcome, with higher levels of nurse staffing associated with improved outcomes[15]. Audit users have asked that BAPM report on measures of nurse staffing, and the NNAP Project Board agreed to report a comparative measure of nurse staffing to allow neonatal units and neonatal networks to identify opportunities to improve the planning and delivery of neonatal unit care.

### Opportunities for quality improvement

It is known that neonatal unit staffing varies, and that some units experience significant challenges in delivering a staffing model that meets with the standards identified in the service specification[4]. This is in part due to the unplanned nature of neonatal care, and random variations in demand. Additionally, challenges in appointing, retaining and providing career progression to a very highly specialist workforce may result in the provision of fewer nurses on individual nursing shifts than are mandated by the service specification. Significant resources are available to help services plan their workforces to meet with the standards.

The measure describes the proportion of nursing shifts which are staffed in accordance with the service specification, and additionally for each period will report how many additional nurse shifts would have been required to provide staffing at least adhering to the service specification, assuming a completely flexible additional workforce.

The NNAP recognises that it is not likely that reporting data will result in immediate moves to fully adherent staffing of all shifts in all units. Rather it is intended that this measure will enable commissioners and providers to focus on efforts to improve staffing in units with the highest deficits.

# NNAP glossary and abbreviations

| | |
|---|---|
| ATAIN | Avoiding Term Admissions into Neonatal units |
| BAPM | British Association of Perinatal Medicine |
| BPD | Bronchopulmonary dysplasia |
| COP | Clinical Outcomes Publication |
| 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 |
| 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 artery catheter |
| UVC | Umbilical venous catheter |

# Appendix 1: "Pathogens" in the NNAP

Bacterial, fungal and yeast positive blood cultures reported to the NNAP 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.

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

**Table 1: Bacterial fungal and yeast organisms included in NNAP reporting.**

| **Clearly pathogenic organisms** | | |
|---|---|---|
| Achromobacter sp | Enterobacter sp. | Pseudomonas sp. |
| Acinetobacter baumanii | Enterococcus faecalis | Pseudomonas stutzeri |
| Acinetobacter lwoffii | Enterococcus faecium | Roseomonas mucosa |
| Acinetobacter sp. | Enterococcus sp. | Rothia spp |
| B haemolytic streptococci | Escherichia coli | S. Aureus |
| Bacillus cereus | Flavimonas oryzihabitans | Salmonella sp. |
| Beta-haemolytic strep. Group b | Flavobacterium sp. | Salmonella unnamed |
| Burkholderia capecia | Gbs | Serratia |
| Burkholderia sp. | Gemella haemolysans | Serratia liquefaciens |
| Candida albicans | Gemella morbilarum | Serratia marcescens |
| Candida dubliniensis | Group b streptococcus | Serratia sp. |
| Candida glabrata | Haemophilus influenzae | Staphylococcus aureus |
| Candida guilliermondii | Haemophilus parainfluenzae | Staphylococcus capitis |
| Candida kefyr | Klebsiella aerogenes | Staphylococcus epidermidis |
| Candida krusei | Klebsiella oxytoca | Staphylococcus haemolyticus |
| Candida parapsilosis | Klebsiella pneumoniae | Staphylococcus hominis |
| Candida sp. | Klebsiella sp. | Staphylococcus warneri |
| Candida tropicalis | Lactobacillus sp. | Stenotrophomonas maltophilia |
| Citrobacter freundii | Listeria | Streptococcus - group b |
| Citrobacter koseri | Listeria monocytogenes | Streptococcus agalactiae |
| Citrobacter sp. | Listeria sp. | Streptococcus bovis |
| Clostridium perfringens | Morganella morganii | Streptococcus milleri |
| Coliform | Mrsa | Streptococcus mitis |
| Corynebacterium diphtheriae | Neisseria meningitidis | Streptococcus pneumoniae |
| Eikenella corrodens | Pasteurella multocida | Streptococcus pyogenes |
| Enterobacter aerogenes | Pasteurella sp. | Streptococcus viridans |
| Enterobacter agglomerans | Proteus mirabilis | Treponema pallidum |
| Enterobacter cloacae | Pseudomonas aeruginosa | Yeast |

| **Other organisms** | | |
|---|---|---|
| Abiotrophia adiacens | Corynebacterium ulcerans | Ralstonia sp. |
| Acanthamoeba sp. | Diphtheroids | Rosemonas gilardii |
| Acid fast bacilli | Gram positive bacilli | Scopulaiopsis brevicaulis |
| Actinomyces bovis | Gram positive cocci | Shigella sonnei |
| Actinomyces sp. | Group g streptococcus | Sphingomonas |
| Aerococcus sp | Haemophilus sp. | Staph saprophyticus |
| Aerococcus viridans | Kocuria species | Staphylococcus - coagulase |

| | | |
|---|---|---|
| | | negative |
| Alcaligenes faecalis | Lactococcus sp. | Staphylococcus - coagulase negative (mixed) |
| Alpha haemolytic streptococci | Micrococcus luteus | Staphylococcus simulans |
| Anaerobes | Micrococcus sp. | Staphylococcus sp. |
| Bacillus sp. | Mixed growth | Stomatococcus mucilaginosus |
| Bacteroides sp. | Moraxella catarrhalis | Streptococcus - group g |
| Campylobacter sp. | Moraxella sp. | Streptococcus anginosus |
| Chryseobacterium sp. | Mycobacterium sp. | Streptococcus oralis |
| Clostridium sp. | Mycoplasma hominis | Streptococcus parasinguinis |
| Coagulase negative staphylococcus | Neisseria sp. | Streptococcus salivarius |
| Cons | Nocardia asteroides | Streptococcus sanguis |
| Cons (mixed) | Peptostreptococcus sp. | Streptococcus sp. |
| Corynebacter | Prevotella sp. | Toxoplasma gondii |
| Corynebacterium bacilli | Propionibacterium sp | Ureaplasma |
| Corynebacterium sp. | Proprionebacterium acnes | Ureaplasma sp. |
| Corynebacterium striatum | Psychrobacter phenylpyruvicus | Yeasts (other) |

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