National Neonatal Audit Programme (NNAP) 2022 Data: Extended Analysis Report

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 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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Further details of the NNAP governance structure are available at:
https://www.rcpch.ac.uk/work-we-do/quality-improvement-patient-safety/national-neonatal-audit-programme/governance-delivery

1. Introduction

This document is a supplementary extended analysis report to accompany the National Neonatal Audit Programme (NNAP) Summary report on 2022 data. It provides results by NNAP measure at unit level (Special Care Unit (SCU), Local Neonatal Unit (LNU), Neonatal Intensive Care Unit (NICU)), by neonatal network, and for England, Scotland and Wales combined, grouped by theme, with a summary of key findings and suggestions for next steps for services seeking to make improvements and links to further resources and case studies.

The NNAP Summary report on 2022 data describes the key messages and recommendations by theme with links to further information about the audit provided within the report. It is available to download at: www.rcpch.ac.uk/nnap.

Full annual results at unit and network level, interactive reporting tools and unit posters are available on NNAP Online at: https://nnap.rcpch.ac.uk/.

Inclusion of Scottish data in 2022 NNAP reporting

Scottish Health Boards originally started participating in the NNAP in 2015, however due to a decision by the Scottish Government not to join the overarching contract for the delivery of the NNAP, Scottish services were not included in reporting in 2020 and 2021. The NNAP team at the RCPCH now has access to Scottish data relating to admissions from 1 April 2022, and therefore this report includes Scotland in analyses wherever possible. Where English and Welsh results include a full calendar year, coverage is only 9 months for Scottish results.

It should also be noted that Scottish services only had access to the final quarterly data quality and completeness report, which was issued after the end of the calendar year. This means that their opportunities to review their provisional results and take early interventions may have been limited. These factors should be borne in mind when interpreting the results.

Methodology and statistical analysis plan

A number of changes have been applied to the data flow and data cleaning processes applied to NNAP 2022 data, as well as to the derivation of the NNAP measures. This means that in some cases, caution should be applied when comparing this year's results to

previous years, and when interpreting the longitudinal bar charts. Notes for interpretation are included with the charts and results for individual measures where relevant.

The overarching changes are as follows:

- The National Data Opt-Out (NDO), which allows patients in England to opt out of their information being used for purposes beyond their direct care, does not apply to the NNAP. The NNAP received this exemption in December 2022[1]. NDO exclusions were applied to 2021 data in the report released in 2022. NDO exclusions have not been applied to 2022 data described in this report. Where 2021 results have been reanalysed for the purposes of providing direct comparison in this report, NDO exclusions are not applied. It will also not be applied to the new NNAP time-series reports. For more information about this and how we use information about babies receiving neonatal care and their mothers, please see the NNAP privacy notices, available at: www.rcpch.ac.uk/nnap.

- To increase the timeliness of reporting NNAP results, the inclusion criteria for several NNAP measures has been changed to include babies admitted in the calendar year of interest, rather than babies discharged in the year, with episodes of care being added to the NNAP data flow 10 days after a baby's first admission to a neonatal unit. This means that sometimes the NNAP will receive episodes that are still active.

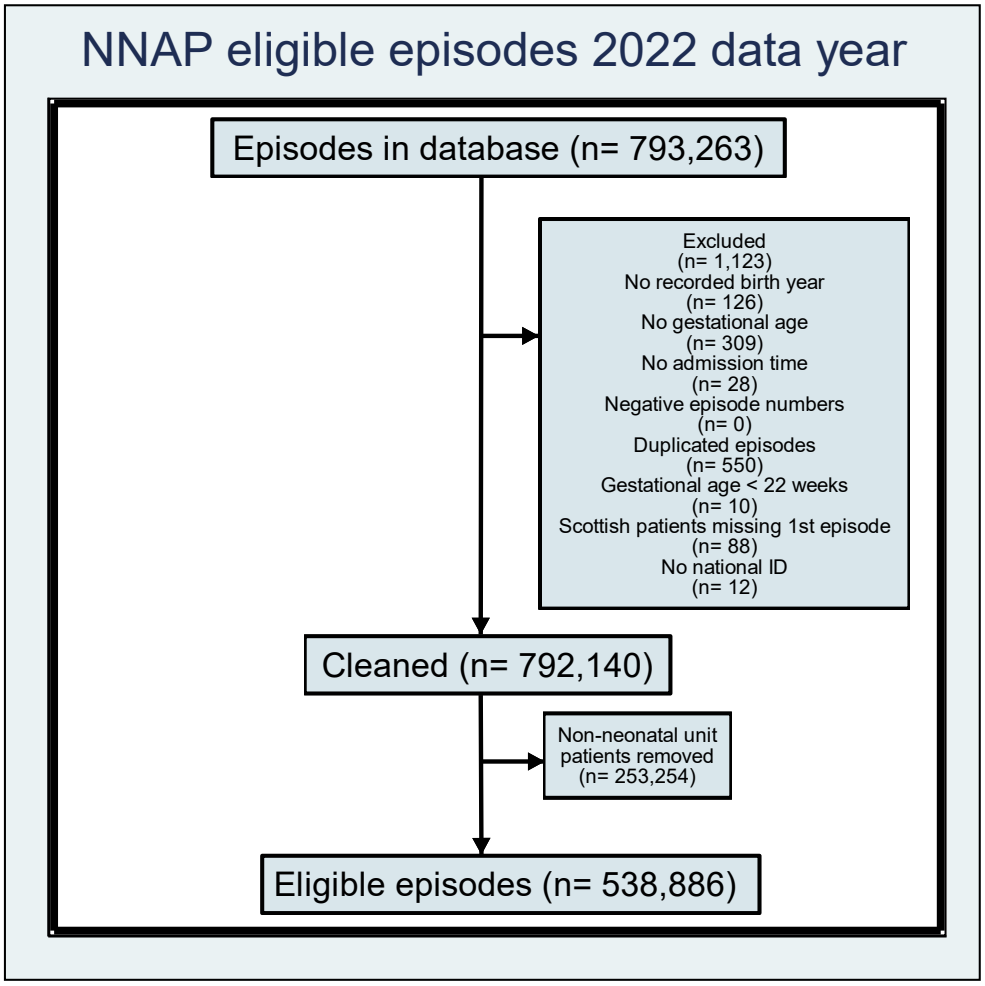
- The cleaning process has been amended so that only patients with no episodes at all on a neonatal unit (e.g. only transitional care) are excluded. If a patient has another episode with days spent on a neonatal unit, their transitional care episode is retained.

- Patients with a gestational age at birth of less than 22 weeks are now excluded from the audit by default. Previously, some measures without lower gestational age limits included these patients.

Figure 1 describes the exclusions and episodes eligible for inclusion in analysis.

[1] HRA. NNAP CAG deferral outcome letter 21 December 2022. Available at: https://www.rcpch.ac.uk/work-we-do/clinical-audits/nnap/data-flow.

Figure 1: Flow diagram, episodes eligible for the NNAP, 2022 data year.



The full NNAP methodology and statistical analysis plan is available at: https://www.rcpch.ac.uk/nnap-data-flow-methodology

Future NNAP reporting

The RCPCH entered a new three-year contract for the delivery of the NNAP in April 2022. The new contract brings changes to the way NNAP reporting will be delivered, including the definition of 10 headline metrics, and the introduction of more frequent reporting in the public domain.

2023 NNAP measures

From 2023, NNAP reporting has been streamlined to 10 headline performance metrics, some of which are composite (or bundled) metrics, which support the NNAP's improvement strategy and improvement goals. Reporting of the component measures sitting behind these 10 performance metrics will continue to enable and support local monitoring and quality improvement activity.

The metrics are summarised below.

1. Mortality until discharge
2. Optimal perinatal care composite metric
   (Component measures: antenatal steroids, antenatal magnesium sulphate, birth in a centre with a NICU, deferred cord clamping, normal temperature on admission, breastmilk feeding in the first 2 days of life)
3. Clinical outcomes composite metric
   (Component measures: bloodstream infection, BPD, NEC, preterm brain injury)
4. Parental consultation within 24 hours of every admission
5. Parental inclusion in consultant ward rounds
6. Breastmilk feeding composite metric
   (Component measures: breastmilk feeding at day 14, breastmilk feeding at discharge home)
7. Follow-up at two years
8. On-time screening for retinopathy of prematurity
9. Neonatal nurse staffing
10. Type and duration of respiratory support

Full details of the metrics and component measures, inclusion criteria, data sources and how they are derived in the 2023 measures guide: https://www.rcpch.ac.uk/work-we-do/clinical-audits/nnap/measures.

Frequent reporting of NNAP results

In 2023, results for the 10 headline performance metrics are published with quarterly refreshes, moving to monthly refreshes in 2024, subjected to further feasibility assessment. This new reporting provides more timely access to the latest available results, facilitating earlier identification of the need for improvement and data to support improvement work.

These reports can be accessed at: https://www.rcpch.ac.uk/resources/nnap-data-dashboard

Annual results for 2022 and previous years continue to be available on NNAP Online, until all reporting is moved over to the new reporting platform.

2. Outcomes of neonatal care

2.1. Mortality until discharge home

What proportion of very preterm babies die before discharge home, or 44 weeks post-menstrual age (whichever occurs sooner)?

The NNAP reports mortality until discharge, or 44 weeks post-menstrual age (whichever occurs sooner), for a three-year cohort of babies born at 24 to 31 weeks gestational age inclusive between 1 July 2019 and 30 June 2022.

This measure of mortality supplements other measures of mortality, such as that reported by Mothers and Babies: Reducing Risk through Audits and Confidential Enquiries in the UK (MBRRACE-UK). The NNAP measure only includes very preterm babies because they experience higher mortality and is limited to babies born alive and admitted to neonatal units, describing mortality up to the point of hospital discharge. MBRRACE-UK report neonatal mortality, defined as that occurring before 28 days of age, by centre, for all gestational ages. There is evidence that notable numbers of babies die after 28 days.[2] MBRRACE-UK have published data showing national rates of infant mortality (death before a year of age for babies born before 27 weeks gestational age).[3]

The comparative mortality reporting in this report excludes admissions of babies born at 22 and 23 weeks gestation, consistent with previous years. This exclusion was agreed with partners based on evidence that rates of admission for attempted curative intensive care vary. Given high rates of mortality at the lowest gestations, the potential impact on mortality reporting is significant, although this decision will be kept under review. However, in addition to comparative mortality reporting of babies born at 24 to 31 gestational age, we report separately, for the first time, the proportion of admitted babies born at 22 and 23 weeks gestational age who do not survive to 44 weeks PMA or discharge home.

In reporting mortality, the NNAP describes the observed number of infants who died, and a "balanced proportion" which is the proportion of mortality in a matched group of babies

[2] Berrington J.B., *et al.* Deaths in Preterm Infants: Changing Pathology Over 2 Decades. *J Peds*;160(1):49-53. Available at: https://www.ncbi.nlm.nih.gov/pubmed/21868028.

[3] Smith, L., *et al.* on behalf of the MBRRACE-UK collaboration. *MBRRACE-UK Supplementary report on survival up to one year of age for babies born before 27 weeks gestational age*. 2019. Available at: https://www.npeu.ox.ac.uk/assets/downloads/mbrrace-uk/reports/MBRRACE-UK%20supplementary%20tables%20on%20births%20before%2027%20weeks%20gestation%202016.pdf

with similar baseline characteristics to those in the network of interest. Comparing the balanced proportion to the observed proportion allows calculation of a "treatment effect". Treatment effect is the difference in the observed and balanced proportion. Therefore, a negative treatment effect suggests that the babies were more likely to survive in the network than elsewhere in the country, and a positive treatment effect suggests that the babies would have been more likely to survive had they been born and treated elsewhere.

The baseline characteristics used in the balancing analysis are; mother's ethnicity, smoking status, mother's age, number of previous pregnancies, multiplicity, type of labour, problems in pregnancy, baby's sex, month and year of birth, weight, gestational age, and deprivation quintile.

Full details of this measure can be found in the NNAP 2022 audit measures guide: https://www.rcpch.ac.uk/work-we-do/clinical-audits/nnap/measures.

For a full description of the NNAP methodology and statistical analysis plan, see: https://www.rcpch.ac.uk/nnap-data-flow-methodology

Results

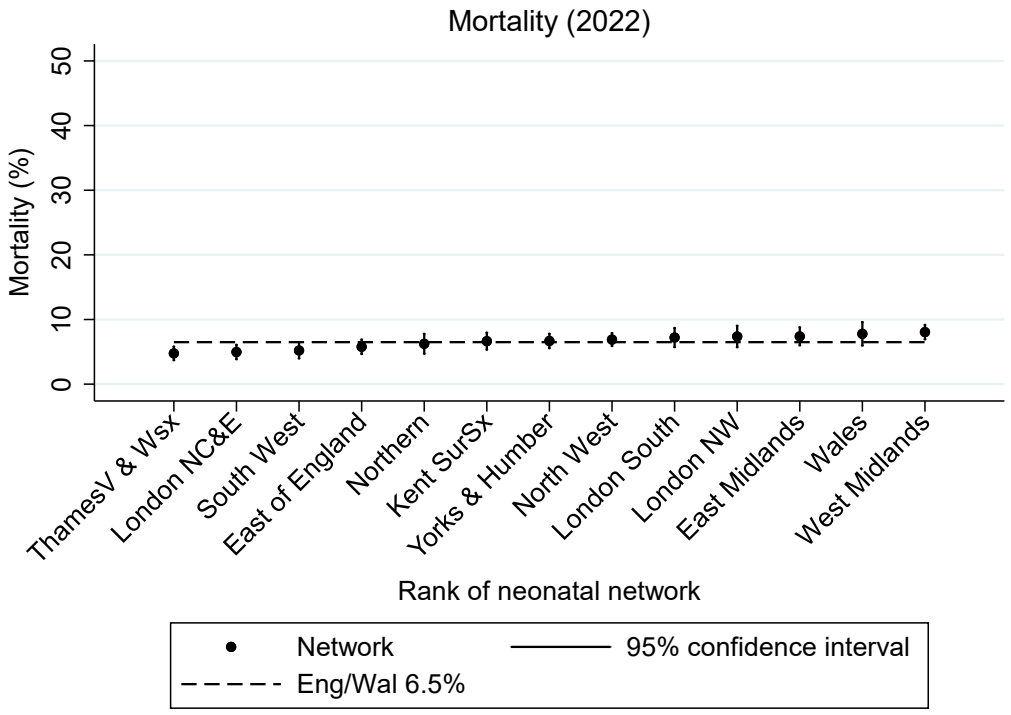
For 2022 data, NNAP clinical leads were not asked to provided assurance that all deaths meeting the inclusion criteria were entered onto BadgerNet due to neglibile numbers of babies with no final neonatal outcome recorded.

Data from Scottish neonatal services are not included in this reporting because Scotland were not part of the audit for the majority of the reporting period and the NNAP does not hold Scottish data relating to this period.

Full results are available on NNAP Online.

Figure 2. Caterpillar plot of observed proportion of mortality until discharge (or 44 weeks PMA) in babies born at less than 32 weeks (top) and mortality treatment effect (bottom), by neonatal network.

Network proportions are represented by dots. The 95% confidence intervals for a network are shown by a vertical line with each dot. Full results are available on NNAP Online.



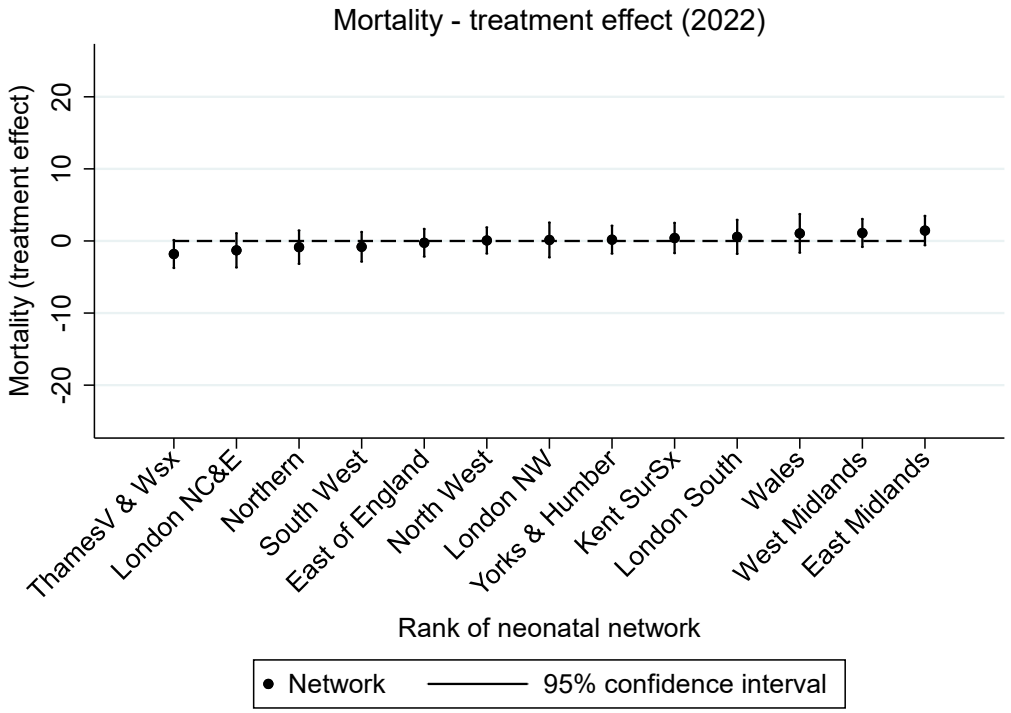


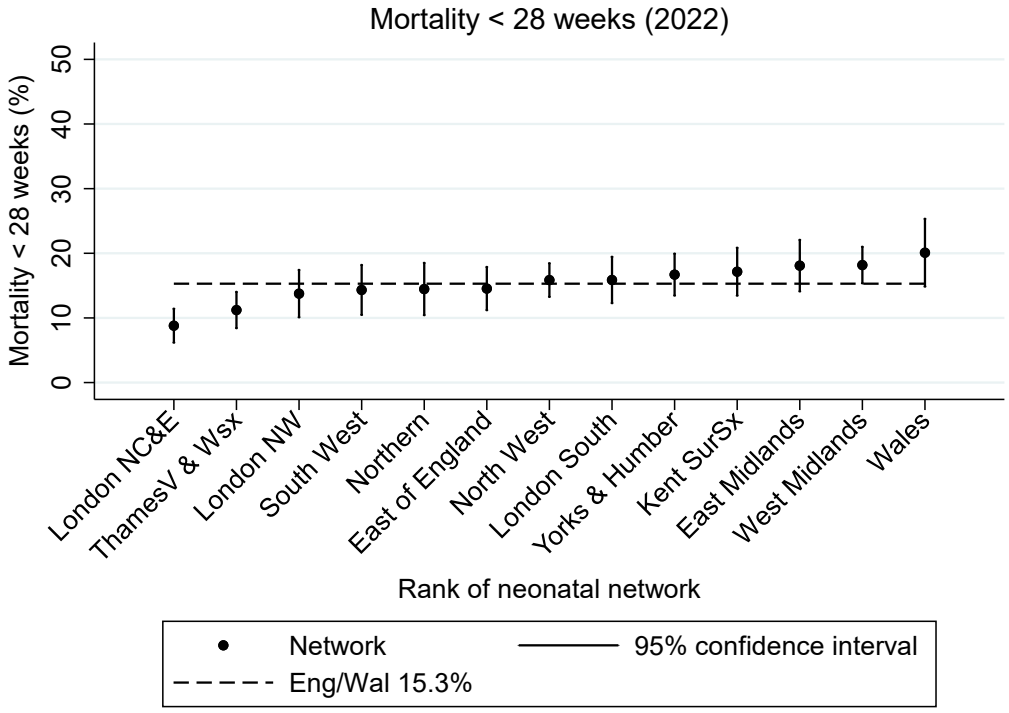
Table 1: Mortality until discharge (or 44 weeks PMA) in babies born at less than 32 weeks gestational age, by neonatal network.

Neonatal network	Eligible babies	With outcome	Survived	Died prior to discharge/44 weeks PMA	Missing	Treatment effect % (St. error)
East Midlands ODN	1,408	1,408	1,304	104 (7.4%)	0 (0%)	1.44 (1.02)
East of England Perinatal ODN	1,766	1,766	1,664	102 (5.8%)	0 (0%)	-0.25 (0.96)
Kent, Surrey, Sussex ODN	1,413	1,413	1,319	94 (6.7%)	0 (0%)	0.41 (1.05)
London ODN - North Central & East	1,532	1,528	1,452	76 (5%)	4 (.3%)	-1.3 (1.19)
London ODN - North West	991	991	918	73 (7.4%)	0 (0%)	0.14 (1.21)
London ODN - South	1,221	1,220	1,132	88 (7.2%)	1 (.1%)	0.57 (1.18)
North West ODN	2,582	2,582	2,404	178 (6.9%)	0 (0%)	0.07 (0.91)
Northern ODN	977	977	916	61 (6.2%)	0 (0%)	-0.86 (1.16)
South West ODN	1,266	1,266	1,200	66 (5.2%)	0 (0%)	-0.81 (1.03)
Thames Valley & Wessex ODN	1,619	1,619	1,542	77 (4.8%)	0 (0%)	-1.81 (0.97)
Wales	861	861	794	67 (7.8%)	0 (0%)	1.05 (1.34)
West Midlands ODN	2,326	2,323	2,136	187 (8%)	3 (.1%)	1.11 (0.97)
Yorkshire & Humber ODN	1,975	1,975	1,843	132 (6.7%)	0 (0%)	0.18 (0.97)
Other*	58	58	54	4 (6.9%)	0 (0%)	NA
England & Wales only	**19,995**	**19,987**	**18,678**	**1,309 (6.5%)**	**8 (0%)**	**NA**

**'Other' networks are those that are in locations not associated with an NNAP neonatal network or are unknown. Home and Transit locations are updated to match their first provider of care for all networks and for units at most place of birth measures.*

Figure 3. Caterpillar plot of observed proportion of mortality until discharge in babies born at less than 28 weeks gestational age (top) and mortality treatment effect (bottom), by neonatal network or operational delivery network (ODN).

Network proportions are represented by dots. The 95% confidence intervals for a network are shown by a vertical line with each dot. Full results are available on NNAP Online.



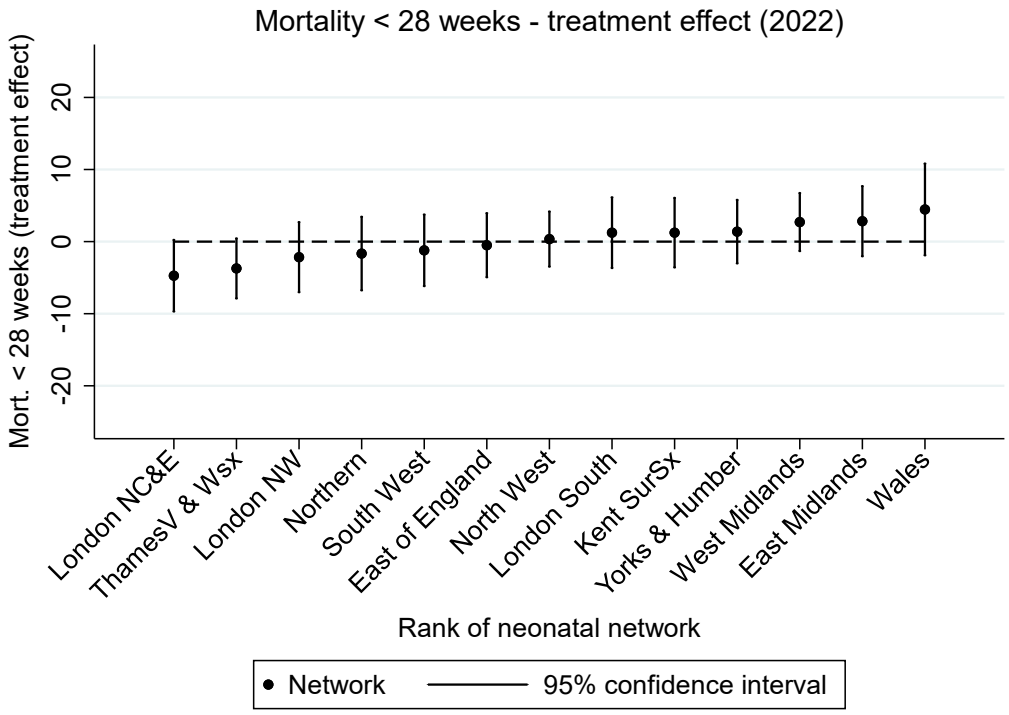


Table 2: Mortality until discharge (or 44 weeks PMA) in babies born at less than 28 weeks gestational age, by neonatal network.

Neonatal network	Eligible babies	With outcome	Survived	Died prior to discharge/44 weeks PMA	Missing	Treatment effect % (St. error)
East Midlands ODN	376	376	308	68 (18.1%)	0 (0%)	2.83% (2.43)
East of England Perinatal ODN	447	447	382	65 (14.5%)	0 (0%)	-0.5% (2.22)
Kent, Surrey, Sussex ODN	414	414	343	71 (17.1%)	0 (0%)	1.24% (2.41)
London ODN – North Central & East	466	466	425	41 (8.8%)	0 (0%)	-4.73% (2.48)
London ODN - North West	356	356	307	49 (13.8%)	0 (0%)	-2.16% (2.43)
London ODN - South	416	416	350	66 (15.9%)	0 (0%)	1.24% (2.45)
North West ODN	788	788	663	125 (15.9%)	0 (0%)	0.35% (1.91%)
Northern ODN	304	304	260	44 (14.5%)	0 (0%)	-1.66% (2.55)
South West ODN	328	328	281	47 (14.3%)	0 (0%)	-1.21% (2.48)
Thames Valley & Wessex ODN	508	508	451	57 (11.2%)	0 (0%)	-3.72% (2.08)
Wales	234	234	187	47 (20.1%)	0 (0%)	4.46% (3.18)
West Midlands ODN	750	748	612	136 (18.2%)	2 (.3%)	2.71% (2.01)
Yorkshire & Humber ODN	527	527	439	88 (16.7%)	0 (0%)	1.38% (2.2)
Other*	25	25	21	4 (16%)	0 (0%)	NA
England and Wales only	**5,939**	**5,937**	**5,029**	**908 (15.3%)**	**2 (0%)**	NA

**'Other' networks are those that are in locations not associated with an NNAP neonatal network or are unknown. Home and Transit locations are updated to match their first provider of care for all networks and for units at most place of birth measures.*

Table 3: Observed mortality until discharge home from neonatal care, by 3-year reporting period.

3-year reporting period*	Babies	With data entered	Survived to 44 weeks PMA or discharge home	Died before 44 weeks PMA (%)	Missing data (%)
July 2015-June 2018†	22,937	22,607	21,069	1,538 (6.8%)	330 (1.4%)
July 2016-June 2019†	23,906	23,767	22,200	1,567 (6.6%)	139 (0.6%)
July 2017-June 2020	21,304	21,289	19,944	1,345 (6.3%)	15 (0.1%)
July 2018-June 2021	20,208	20,200	18,914	1,286 (6.4%)	8 (0.04%)
July 2019-June 2022	19,995	19,987	18,678	1,309 (6.5%)	8 (0%)

** Cohorts are reported with a 6-month delay to allow for a final outcome to be known. For example, the 3-year period reported in 2022 includes babies born between July 2019 and June 2022.*

†Includes Scotland.

Figure 4: Observed mortality until discharge home from neonatal care, by 3-year reporting period.

Notes for interpretation:

- *Cohorts are reported with a 6-month delay to allow for a final outcome to be known. For example, the 3-year period reported in 2022 includes babies born between July 2019 and June 2022.*
- *Years 2017-2020, 2018-2021, and 2019-2022 do not include Scotland.*
- *A two-sample test for difference in mortality proportions between Scotland, and England & Wales (combined) in 2016-2019 indicates no significant difference (p=0.6), therefore it is not expected that the absence of Scottish data has caused a disruption to the ability to compare proportions between years.*

Table 4: Number and proportion of babies born at 22 and 23 weeks GA and admitted to neonatal care, and surviving to 44 weeks PMA, by year (England and Wales only).

Reporting period	Number of babies admitted born at 23 weeks GA	Survived to 44 weeks PMA (%)*	Number of babies admitted born at 22 weeks GA	Survived to 44 weeks PMA (%)*
July 2017 - June 2018	238	106 (44.5%)	15	4 (26.7%)
July 2018 - June 2019	248	119 (48.0%)	13	5 (38.5%)
July 2019 - June 2020	255	120 (47.1%)	47	14 (29.8%)
July 2020 - June 2021	221	109 (49.3%)	74	21 (28.4%)
July 2021 - June 2022	267	131 (49.1%)	90	21 (23.3%)
Overall	**1,229**	**585 (47.6%)**	**239**	**65 (27.2%)**

**Proportions should be interpreted with caution due to the increased variability associated with smaller denominators.*

Summary of findings

- The proportion of babies born between July 2019 and June 2022 at 24 to 31 weeks gestational age who died before discharge/44 weeks postmenstrual age (PMA) is 6.5% (1,309 of 19,987). In 2018-2021, the proportion was 6.4% *(Table 3)*.

- Across networks, the observed proportion ranges from 4.8% (Thames Valley and Wessex ODN) to 8% (West Midlands ODN) (*Figure 2, NNAP Online*). In 2018-2021, the observed proportion ranged from 4% (London ODN – North Central & East) to 8% (West Midlands ODN). There remains wide variation in mortality between neonatal networks; an important challenge to the neonatal professional community.

- Treatment effect ranges from -1.81% to 1.44%; indicating that the variation in mortality between networks is probably not fully explained by differences in case mix (*Figure 2*). Treatment effect results indicate that babies admitted to the network with the highest treatment effect might be at 3.5% additional risk of death compared to the network with the lowest treatment effect (Thames Valley & Wessex ODN).

- Considering babies born between 24 and 27 weeks' gestational age only, the overall mortality rate is 15.3%, ranging from 8.8% (London ODN – North Central & East) to 20.1% (Wales) across networks (Figure 3). In 2021, mortality at these lower gestational ages ranged from 7.8% to 19.3% across networks.

- The NNAP report the number of babies born at 22 and 23 weeks gestational age admitted to neonatal care across England and Wales, and the proportion of those babies who survive to 44 weeks post menstrual age (PMA). The number of babies born at 23 weeks GA and admitted has remained relatively consistent over the last five

years, ranging from 221 to 267. There is some evidence of a small increase in survival rates over that period; in 2017/2018, 44.5% of admitted babies survived to 44 weeks PMA, and in 2021/2022, 49.1% survived (*Table 4*).

- There has been a six-fold increase in the number of babies born at 22 weeks gestational age and admitted to neonatal care between 2017/2018 (15 babies) and 2021/2022 (90 babies). The number of babies born at this gestational age and surviving to 44 weeks PMA has increased from 4 in 2017/2018 to 21 in 2021/2022 (*Table 4*).
- New guidance recommending active life sustaining treatment, based on a risk assessment, at the lower gestational ages was published by BAPM in October 2019[4]. The proportion of admitted babies currently surviving to 44 weeks is lower than may be anticipated by parents reading BAPM guidance.

[4] BAPM. Perinatal Management of Extreme Preterm Birth before 27 weeks of gestation: A Framework for Practice. October 2019. Available at: https://hubble-live-assets.s3.amazonaws.com/bapm/file_asset/file/30/Extreme_Preterm_28-11-19_FINAL.pdf

2.2. Bronchopulmonary dysplasia (BPD)

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

Babies born very preterm typically have incompletely developed lungs and typically need support with their breathing. 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) and is sometimes called chronic lung disease. The NNAP reports on the proportion of babies born very preterm who are receiving help with their breathing or extra oxygen four weeks before their term due date, for a three-year cohort of babies discharged from neonatal care between 1 January 2020 and 31 December 2022. Only babies who survive their early course can develop BPD, and therefore it is important that we consider rates of BPD alongside rates of death before 36 weeks postmenstrual age. For this reason, we report the combined outcome of 'BPD or death'.

Differing proportions of BPD or death between units and networks could be the result of differing treatments or might partially result from differences in the readiness of clinicians to administer oxygen to very preterm infants, although a recent paper shows no evidence of such a phenomenon[5].

In reporting BPD or death, the NNAP describes the observed number of infants who had BPD or died, and a "balanced proportion", which is the proportion of BPD or death in a matched group of babies with similar baseline characteristics to those in the network of interest. Comparing the balanced proportion to the observed proportion allows calculation of a "treatment effect".

Treatment effect is the difference in the observed and balanced proportion. A negative treatment effect suggests that the babies fared better in the network than they would have done elsewhere in the country, and a positive treatment effect suggests that the babies would have fared better had they been treated elsewhere.

The baseline characteristics used in the balancing analysis are; mother's ethnicity, smoking status, mother's age, number of previous pregnancies, multiplicity, type of

[5] Burgess-Shannon J, Briggs S, Oddie S, Mactier H. Variation in use of extended pulse oximetry testing to guide decisions around home oxygen provision for ex-preterm infants; A nationwide survey of UK neonatal units. Respir Med Res. 2023 Apr 7;83:101005. doi: 10.1016/j.resmer.2023.101005. Epub ahead of print. PMID: 37031570.

labour, problems in pregnancy, baby's sex, month and year of birth, weight, gestational age, and deprivation quintile.

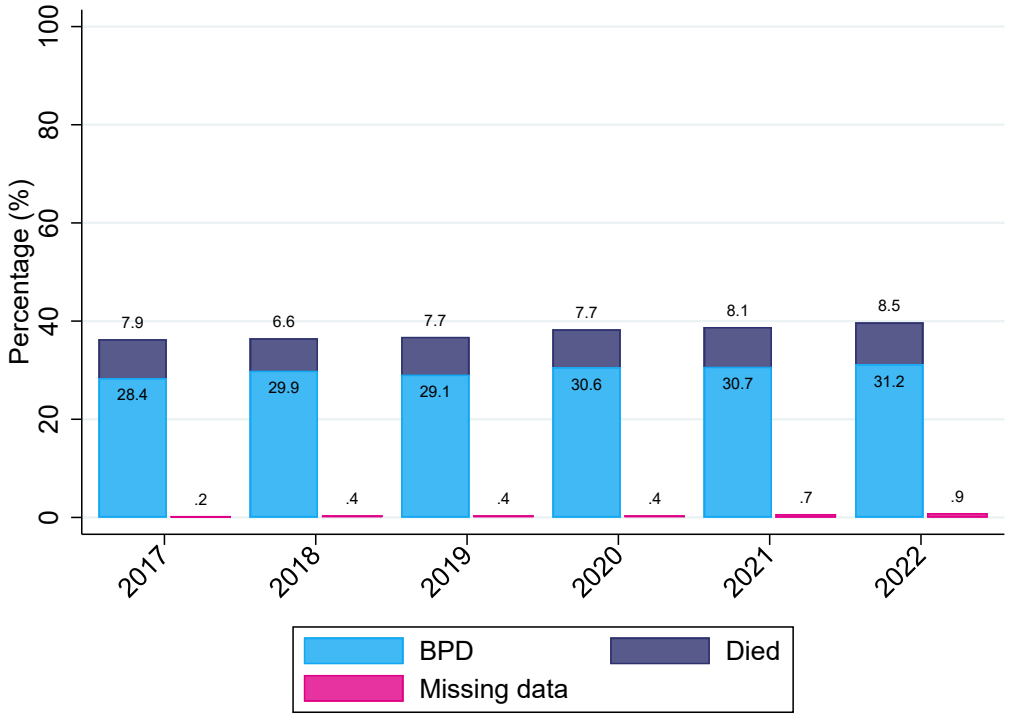
In this year's report we have described the rates of this outcome for babies born in SCUs, for the first time.

Full details of this measure can be found in the NNAP 2022 audit measures guide: https://www.rcpch.ac.uk/work-we-do/clinical-audits/nnap/measures.

For a full description of the NNAP methodology and statistical analysis plan, see: https://www.rcpch.ac.uk/nnap-data-flow-methodology.

Results

Figure 5: BPD and death, by NNAP 3-year reporting period (2013-2022).



Notes for interpretation:

- *Published results prior to 2020 excluded "other" from the headline proportion - results have been recalculated to include "other", in line with the latest methodology.*
- *Years 2018-2020, 2019-2021 and 2020-2022 do not include Scotland.*
- *A two-sample test for difference in proportions between Scotland, and England & Wales (combined) BPD or death proportions in 2017-2019 indicates no significant difference (p=0.1), therefore it is not expected that the absence of Scottish data has caused a significant disruption to the ability to compare proportions between years.*

Figure 6. Caterpillar plot of the proportions of BPD or death (2020-2022) (top) and treatment effect (bottom), by neonatal network or operational delivery network (ODN) – all units.

Network proportions are represented by dots. The 95% confidence intervals for a network are shown by a vertical line with each dot. Full results are available on NNAP Online.

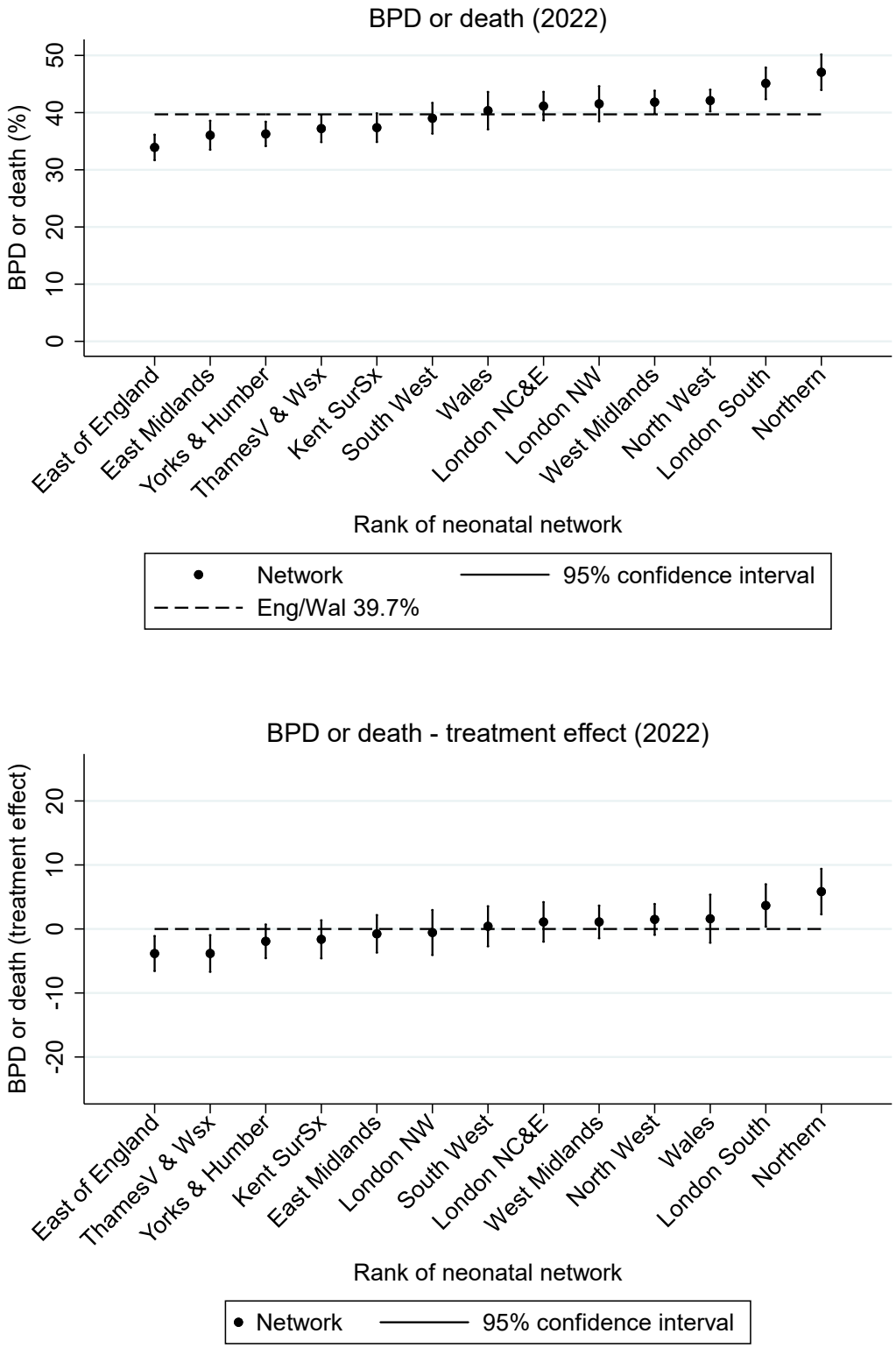
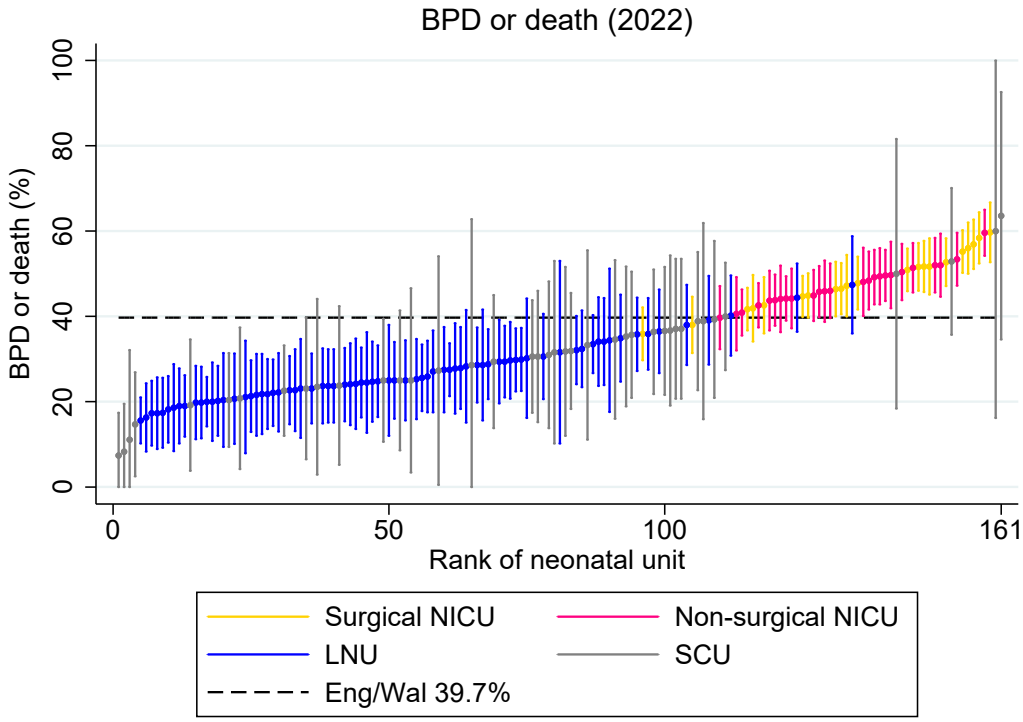


Figure 7. Caterpillar plot of observed proportion of BPD or death (2020-2022): neonatal units (top) and treatment effect (bottom).

Unit proportions are represented by dots. The 95% confidence intervals for a unit are shown by a vertical line with each dot. Neonatal units can be identified on NNAP Online



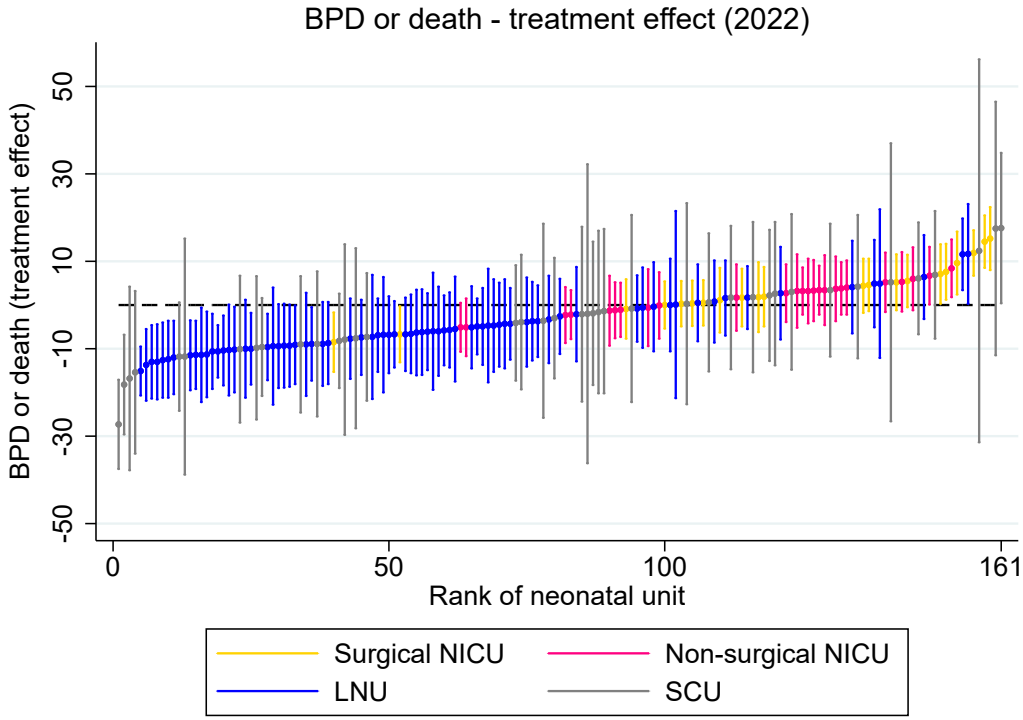


Table 5: BPD and death, by level of neonatal unit (2020-2022)

Unit level	Eligible babies	With outcome	BPD	Died	BPD or death	Missing
Other*	347	342	92	67	159 (46.5%)	5 (1.4%)
SCU	1,178	1,166	285	73	358 (30.7%)	12 (1%)
LNU	7,170	7,099	1,501	394	1,895 (26.7%)	71 (1%)
NICU	12,087	11,988	4,557	1209	5,766 (48.1%)	99 (0.8%)
England & Wales	**20,782**	**20,595**	**6,435**	**1,743**	**8,178 (39.7%)**	**187 (0.9%)**

**'Other' units are those that are hospital or healthcare locations not associated with an NNAP neonatal unit, NNAP units that have closed before the start of this audit year, or location records that are unknown.*

Summary of findings

- The proportion of babies born between 2020 and 2022 at less than 32 weeks gestational age who had BPD or died was 39.7% (8,178 of 20,595) (*Figure 5*) and shows a statistically significant upward trend (2015-2017 – 36.3%), rather than a desired decrease over time[6].

- Among networks, the observed proportion of babies with a combined outcome of BPD or death ranges from 33.9% (East of England ODN) to 47.1% (Northern ODN). Treatment effect ranges from -3.84% to 5.84%. This indicates that variation between networks is probably not fully explained by differences in case mix and that opportunity may exist for a reduction in this adverse outcome of prematurity (*Figure 6*).

- Across neonatal units (SCUs, LNUs and NICUs), observed proportions of BPD or death range from 7.4%% to 63.6%, and treatment effect ranges from -27.3% to 17.6% (*Figure 7*). This suggests that variation in rates of BPD is probably not explained by differences in case mix and therefore unit level opportunities likely exist to reduce the overall incidence of BPD.

- Proportions of BPD (or death) differ with unit level designation; SCU – 30.7% (358 of 1,166), LNU – 26.7% (1,895 of 7,099), NICU – 48.1% (5,766 of 11,988). It is possible that the higher rates of BPD in babies born in units with an onsite SCU than an onsite LNU are explained by differing case characteristics of babies that are not described in the balancing analysis. This is because such deliveries at a unit with an onsite SCU are typically unplanned.

[6] Cochran-Armitage test for trend, $p < 0.001$.

2.3. Necrotising enterocolitis (NEC)

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?

Necrotising enterocolitis (NEC) is a serious condition which can follow preterm birth. Bowel inflammation prevents milk feeding and surgery may be needed. Babies who develop NEC tend to stay in hospital for a long time. Rates of mortality in babies with NEC are high, at over 20%[7]. Babies who survive NEC can have developmental as well as long-term feeding and bowel problems. Reporting of NEC is based on a surveillance definition, and cases are attributed to the unit at which the baby is nursed at 48 hours.

A balancing analysis has been conducted at neonatal network level which includes all units, regardless of whether they validated their data. This balancing analysis uses the full set of matching variables as described in the NNAP methodology and statistical analysis plan: https://www.rcpch.ac.uk/nnap-data-flow-methodology.

A balancing analysis has also been conducted for local neonatal units and neonatal intensive care units (surgical and non-surgical). This analysis only includes units which provided assurance of the accuracy of their data. A neonatal unit is balanced within the sub-domain of unit level, and balancing is applied for gestational age. This means that neonatal units are only compared to similar units for the purposes of determining treatment effect and outlier identification. This simple method of balancing is used because many units have only a few (and some no) cases of NEC. Balancing on gestational age and type of unit is essential; the rates of both conditions decrease with gestational age and are higher in NICUs.

Only units providing assurance and for whom matching analysis is carried out are included in outlier identification.

The balanced proportion is the proportion of NEC in a set of babies in the dataset like those cared for by the network or unit. Treatment effect is the difference in the observed and balanced proportion; and therefore, a negative treatment effect indicates that the babies fared better in the unit or network than they would have done elsewhere in the

[7] Jones IH, Hall NJ. Contemporary Outcomes for Infants with Necrotizing Enterocolitis-A Systematic Review. J Pediatr. 2020 May;220:86-92.e3. doi: 10.1016/j.jpeds.2019.11.011. Epub 2020 Jan 22. PMID: 31982088. Available at: https://pubmed.ncbi.nlm.nih.gov/31982088/

country, and a positive treatment effect indicated that the babies would have fared better had they been treated elsewhere.

The NEC outcome of a baby is determined by looking at the NEC data from all their episodes. In 2022, a methodological improvement was made to the way missing data are treated in the calculation of the proportion of NEC, so that if an episode has only missing and no NEC statuses across all episodes they will be classified as missing. In previous years these cases would have been classified as no NEC. This change has results in a small change in the proportion of babies reported as having NEC, for example, in 2021 the reported proportion was 5.8%. Using this new method, the proportion would have been 6.1%.

Full details of this measure can be found in the NNAP 2022 audit measures guide: https://www.rcpch.ac.uk/work-we-do/clinical-audits/nnap/measures.

Results

NNAP clinical leads are asked to provide assurance of the accuracy of their NEC data. 82.5% (146/177) of units gave assurance (in 2021, the proportion was 79.1%, England & Wales only). NEC results are presented below based on all units' data and on data from those providing assurance. An indication of whether a unit provided assurance is given alongside unit level NEC results on NNAP Online. Units which did not assure their data are omitted from the treatment effect analysis. Data were missing for 6.9% of eligible cases – this varied by unit from 0 to 100%.

Table 6: Proportions of NEC by neonatal unit level - all units.

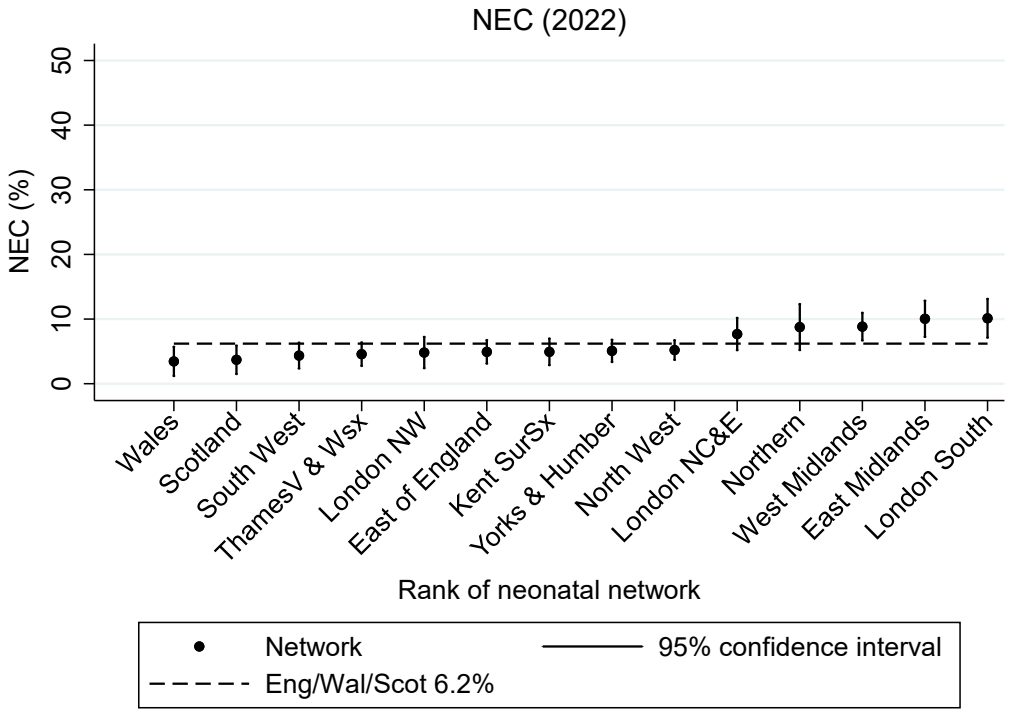
Unit level	Eligible babies	With outcome	NEC (%)	Missing (%)
SCU	136	122	2 (1.6%)	14 (10.3%)
LNU	2,147	2,036	53 (2.6%)	111 (5.2%)
Non-surgical NICU	2,440	2,249	156 (6.9%)	191 (7.8%)
Surgical NICU	2,353	2,181	199 (9.1%)	172 (7.3%)
Eng/Wal/Scot	**7,076**	**6,588**	**410 (6.2%)**	**488 (6.9%)**

Table 7: Proportions of NEC by neonatal unit level - units who have assured their NEC data only.

Unit level	Eligible babies	With outcome	NEC (%)	Missing (%)
SCU	101	95	2 (2.1%)	6 (5.9%)
LNU	1,613	1,544	37 (2.4%)	69 (4.3%)
Non-surgical NICU	2,031	1,882	126 (6.7%)	149 (7.3%)
Surgical NICU	1,961	1,825	165 (9.0%)	136 (6.9%)
Eng/Wal/Scot	**5,706**	**5,346**	**330 (6.2%)**	**360 (6.3%)**

Figure 8: Caterpillar plot of proportions of NEC (top) and treatment effect (bottom), by neonatal network.

Network proportions are represented by dots. The 95% confidence intervals for a network are shown by a vertical line with each dot. Full results are available on NNAP Online.



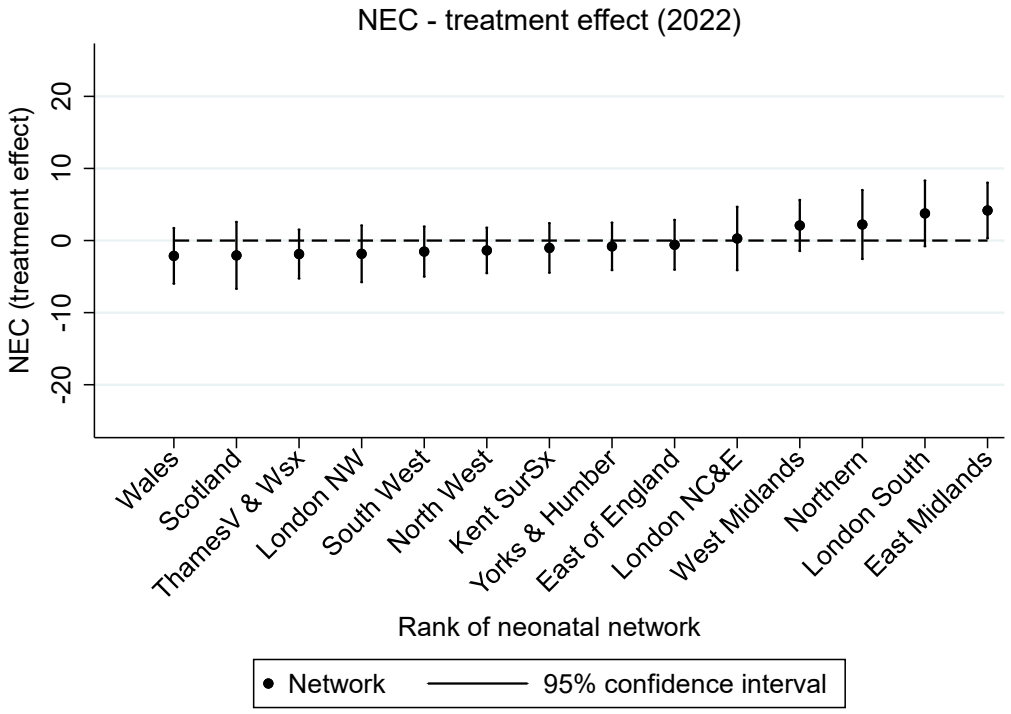
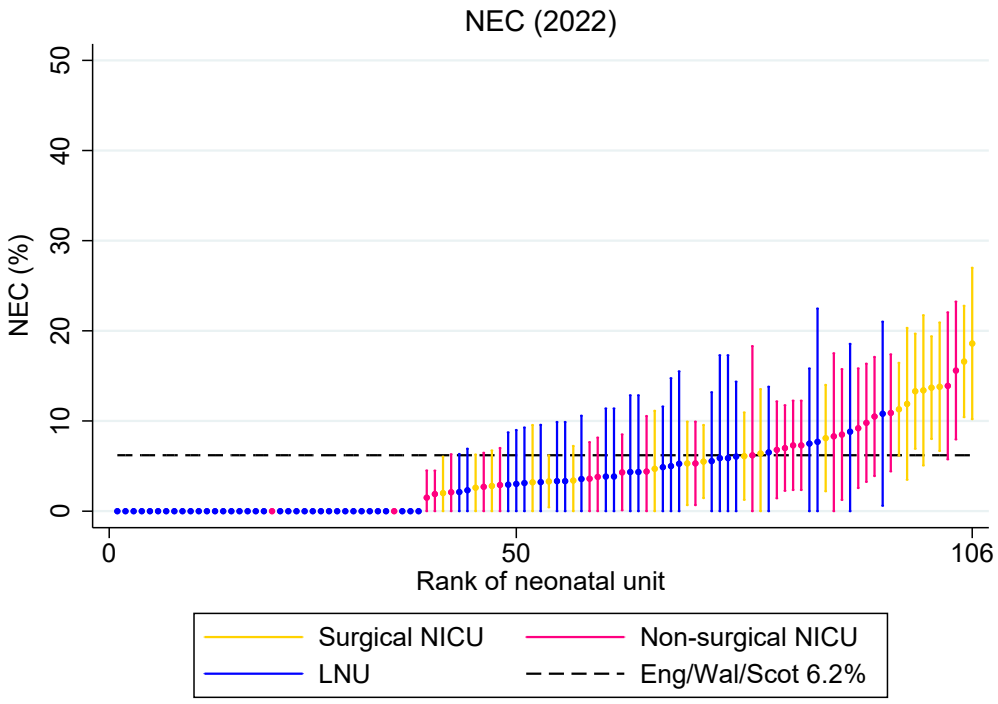


Figure 9. Caterpillar plot of proportions of NEC (top) and treatment effect (bottom), by LNU, surgical NICU and non-surgical NICU - units who provided assurance that their NEC diagnosis data was complete only.

Unit proportions are represented by dots. The 95% confidence intervals for a unit are shown by a vertical line with each dot. Neonatal units can be identified on NNAP Online. Note that the balancing analysis used to determine treatment effect balances a neonatal unit within the sub-domain of unit level, and balancing is applied for gestational age. This means that neonatal units are only compared to similar units for the purposes of determining treatment effect and outlier identification.



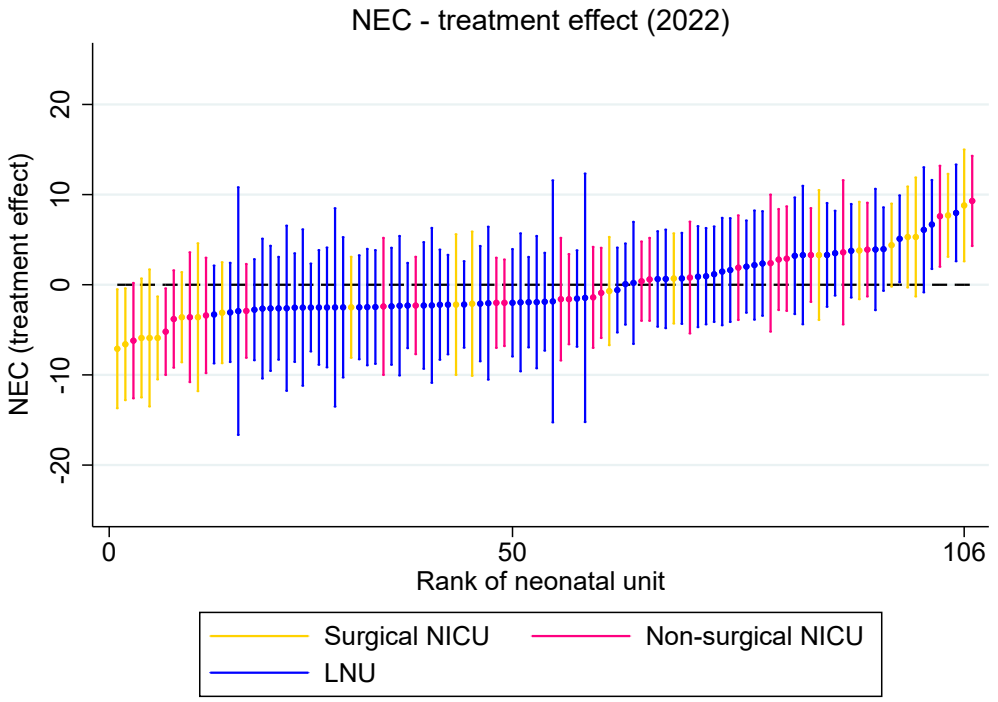
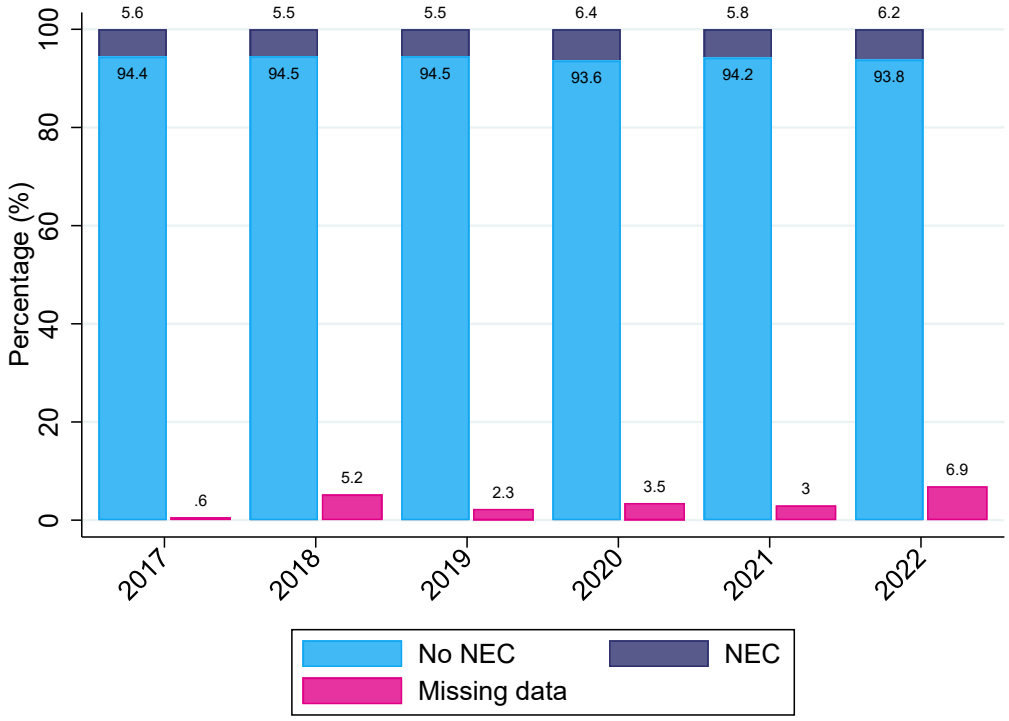


Figure 10: NEC status, according to the contemporaneous NNAP measurement criteria, by NNAP reporting year (2017-2022) – all units.



Notes for interpretation:

- *In 2022, categorisation priority ordering of neonatal episodes changed from NEC > No NEC > Missing, to NEC > Missing > No NEC. Prior to 2022, "No NEC" was prioritised over "Missing".*

Summary of findings

- In 2022, 6.2% (410 of 6,588) of babies born at less than 32 weeks gestational age met the NNAP surveillance definition of NEC (*Table 6*). In 2021, the proportion was 5.8% (*Figure 9*), however a change in the way missing data is handled in the derivation of the measure in 2022[8] means that the comparable rate for 2021 would have been 6.1%. The small apparent change of the proportion of babies with NEC between 2021 and 2022 is mostly explained by this change.

- Among the 81.9% of units who provided assurance of the accuracy of their NEC data, the proportion of babies with NEC was also 6.2% (326 of 5,294) (*Table 7*).

- Considering units with validated data only, as expected on basis of case mix, the rate of NEC was highest in those babies cared for in surgical NICUs (9.0%), compared to non-surgical NICUs (6.7%), LNUs (2.4%) and SCUs (2.1%) (*Table 7*). This higher rate of

[8] NNAP: A guide to the 2023 audit measures. January 2023. Available at: https://www.rcpch.ac.uk/work-we-do/clinical-audits/nnap/measures

NEC in babies initially managed in surgical NICUs may be explained either by differences in case mix unaccounted for in our analysis, by different diagnostic thresholds in such units, or by differences in management in these units which result in higher rates of NEC. The probability that either of the latter two of these possibilities is the case is enhanced by the variation between rates of NEC among surgical NICUs. This, taken together with the scale of 'treatment effects' observed (-7.1 to 9.4%), suggests that this important pathology might possibly be reduced by addressing unit variations in practice.

- Among networks (with results from all units included), the observed proportion of babies with NEC ranges from 3.4% to 10.1%. Treatment effect ranges from -2.1% to 4.2% (*Figure 8*). This suggests that the baseline characteristics of babies within different networks do not explain the variation in rates of NEC, and that network rates of NEC may be influenced by the treatment received.

2.4. Late onset bloodstream infection

Does an admitted baby who was born at less than 32 weeks gestational age, have one or more episodes of bloodstream infection, characterised by one or more positive blood cultures taken, after 72 hours of age?

Sick and premature babies are prone to infection by a variety of germs, including some that are normally harmless to healthy people. Infections increase the risk of death, can lengthen the stay in the neonatal unit and may worsen the long-term developmental outlook for babies.[9] Neonatal unit staff and parents can reduce the risk of infection by following good infection prevention and control practice.

To look for infection in babies, neonatal staff usually take blood cultures to check whether bacteria or other organisms are present in their blood. Units are encouraged to report all positive blood cultures: that negative blood cultures are underreported is accepted as likely, or even inevitable. The NNAP reports the proportion of blood cultures positive for a pure growth of bacteria, fungi or yeasts.

In this report, we focus only on very preterm infants (those born at less than 32 weeks gestation) because these are the babies at highest risk of infection and because bloodstream infections in more mature babies may occur more in some units than others depending on the case mix of babies cared for.

A balancing analysis has been conducted at neonatal network level which includes all units, regardless of whether they validated their data. This balancing analysis uses the full set of matching variables as described in the NNAP methodology and statistical analysis plan: https://www.rcpch.ac.uk/nnap-data-flow-methodology.

A balancing analysis has also been conducted for local neonatal units and neonatal intensive care units (surgical and non-surgical). This analysis only includes units which provided assurance of the accuracy of their data. A neonatal unit is balanced within the sub-domain of unit level, and balancing is applied for gestational age. This means that neonatal units are only compared to similar units for the purposes of determining treatment effect and outlier identification. This simple method of balancing is used because many units have only a few (and some no) cases of NEC. Balancing on

[9] Stoll B.J., *et al*. Neurodevelopmental and Growth Impairment Among Extremely Low-Birth-Weight Infants With Neonatal Infection. *JAMA* 2004; 292(19): 2357–2365. doi:10.1001/jama.292.19.2357. Available at: https://www.ncbi.nlm.nih.gov/pubmed/15547163

gestational age and type of unit is essential; the rates of both conditions decrease with gestational age and are higher in NICUs.

Only units providing assurance and for whom balancing analysis is carried out are included in outlier identification.

Treatment effect is the difference in the observed and balanced proportion. Therefore, a negative treatment effect indicates that the babies fared better in the network than they would have done elsewhere in the country, A positive treatment effect indicates that the babies would have fared better had they been treated elsewhere.

Full details of this measure can be found in the NNAP 2022 audit measures guide: https://www.rcpch.ac.uk/work-we-do/clinical-audits/nnap/measures.

Results

Some organisms grown may either represent true bloodstream infection or contamination of the blood culture sample with skin organisms. For this reason, results for bloodstream infection are presented in two columns. One column presents the number of babies for whom any culture grew any organism. The other column presents the number of babies for whom one or more culture grew an organism of clear pathogenicity. Clearly pathogenic organisms were those of which a pure growth indicates a significant infection with or without the presence of clinical confirmation (a true infection). A list of such organisms is provided in section 9.

412 babies had one or more blood cultures positive for a clearly pathogenic organism of whom 38 babies had a mixed growth which included an organism which would be deemed clearly pathogenic if it were a pure growth. Therefore 374 very preterm babies had a pure growth of a clearly pathogenic organism. Babies contribute to the denominator for this measure for all units to which they were admitted, therefore babies can be counted twice in the analysis conducted for units and networks (if cared for in more than one unit or network). At an overall audit level, babies are only counted once.

NNAP clinical leads were asked to provide assurance that all their positive blood cultures had been entered. 78% (138/177) provided this validation of their infection data (73.6% in 2021 – England and Wales only).

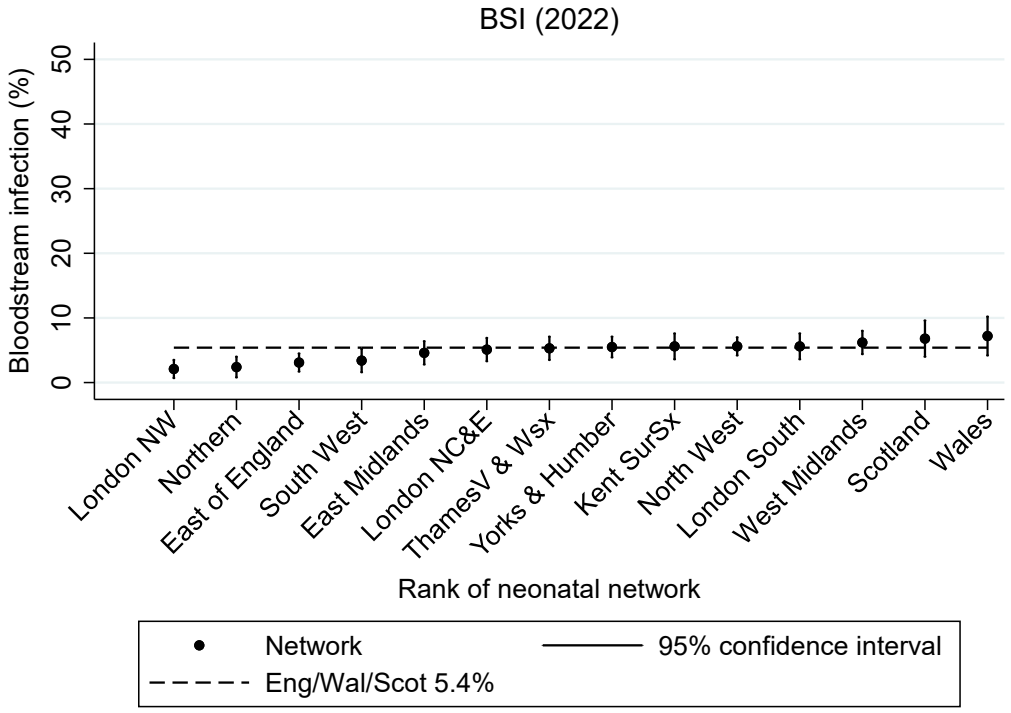
Table 8. Positive blood cultures in babies born at less than 32 weeks, by assurance status.

Assurance status	No. units	Eligible babies	Number of babies with any positive blood culture	Number (%) of babies with growth of any clearly pathogenic organism*
All units	177	7,041	1,217	379 (5.4%)
Units confirming all positive blood cultures entered	138 (78%)	5,462	1,006	320 (5.9%)

**Pure organisms only*

Figure 11: Caterpillar plot of proportion (TOP) and treatment effect (BOTTOM) of admitted babies (born at less than 32 weeks gestational age) who experienced one or more positive blood cultures with a clearly pathogenic organism, by neonatal network or operational delivery network.

Network proportions are represented by dots. The 95% confidence intervals for a network are shown by a vertical line with each dot. Full results are available on NNAP Online.



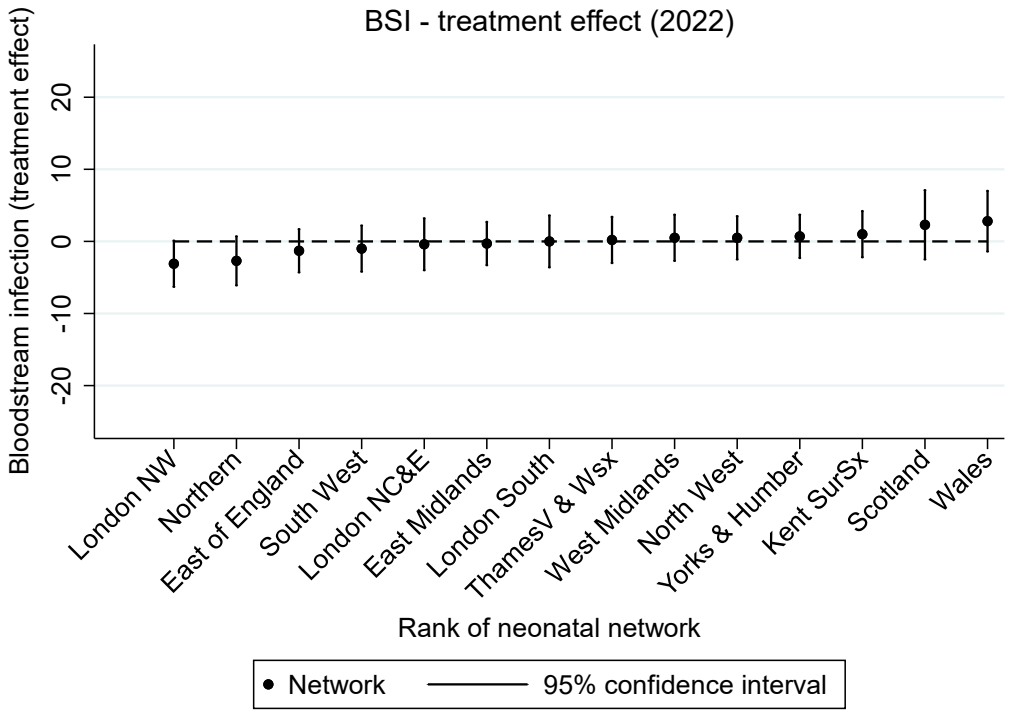
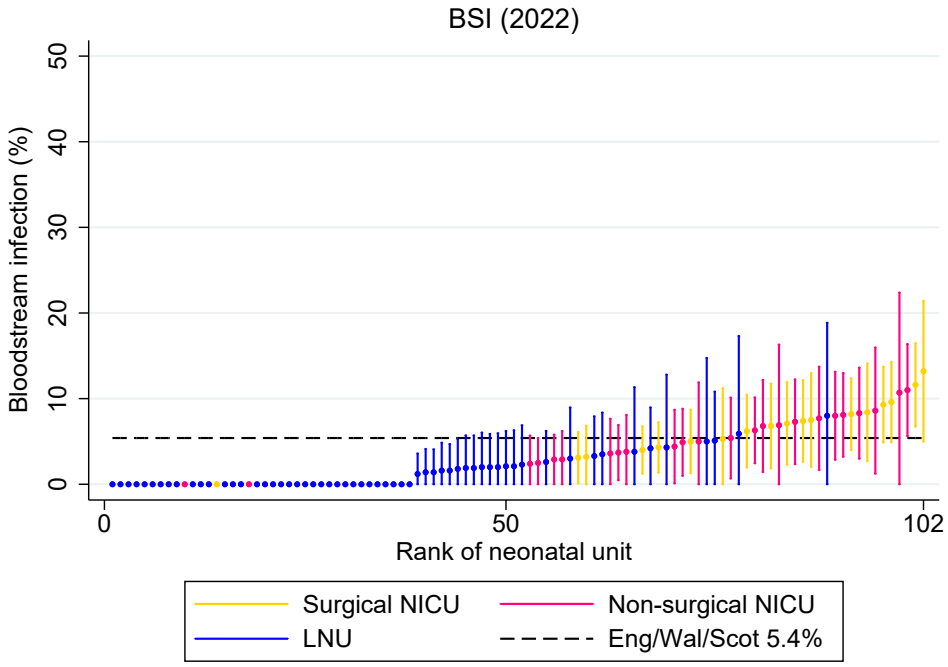
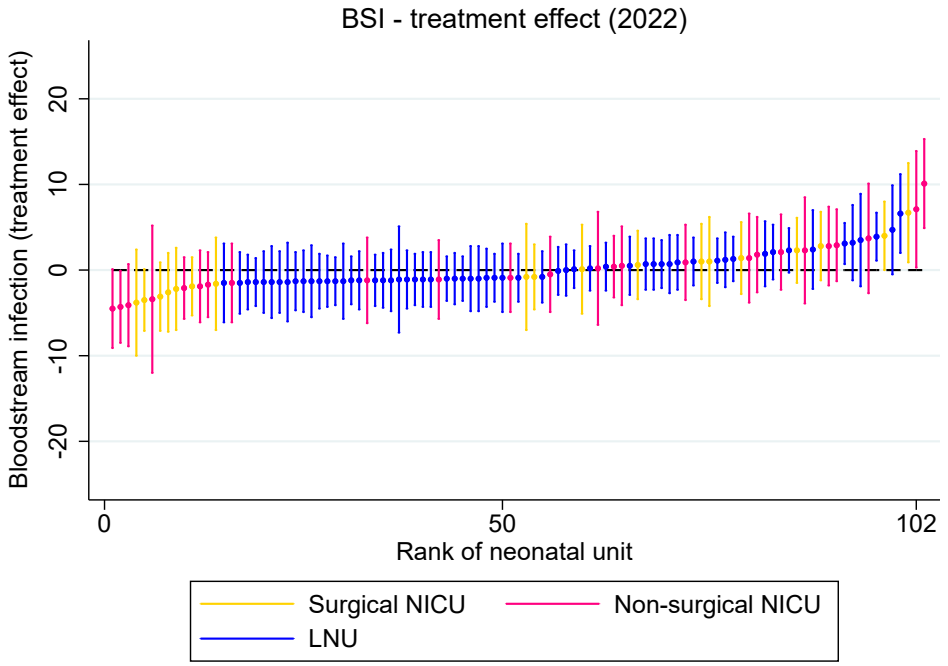


Figure 12. Caterpillar plot of proportion (top), and treatment effect (bottom), of admitted babies who experienced one or more positive blood cultures with a clearly pathogenic organism (born at <32 weeks gestational age), by LNU, surgical NICU and non-surgical NICU - units who provided assurance that all positive blood cultures were entered.

Unit proportions are represented by dots. The 95% confidence intervals for a unit are shown by a vertical line with each dot. Neonatal units can be identified on NNAP Online. Note that the balancing analysis used to determine treatment effect balances a neonatal unit within the sub-domain of unit level, and balancing is applied for gestational age. This means that neonatal units are only compared to similar units for the purposes of determining treatment effect and outlier identification.





Summary of findings

- The proportion of babies born at less than 32 weeks gestational age with growth of any clearly pathogenic organism was 5.4% (379 of 7,041). Among the 77.4% of units that were able to provide assurance, the rate was marginally higher than in all units – 5.9% (320 of 5,462) (*Table 8*).
- Across neonatal networks, the observed proportion of babies born at less than 32 weeks with growth of a clearly pathogenic organism ranges from 2.1% (London ODN – North West) to 7.2% (Wales) (*Figure 11*). This variation appears to be clinically significant and suggests that there may be opportunities for quality improvement. The balanced proportion is the proportion of infection in a set of babies similar to those cared for by the network. Treatment effect (the difference between observed proportion and balanced proportion) ranges from -3.1% (London ODN – North West) to 2.8% (Wales); indicating that not all variation between networks is explained by differences in case mix.
- Considering only LNU and NICUs that have validated their data, observed proportions of bloodstream infection are higher in NICUs (7.2%, 283 of 3,944) than LNUs (1.3%, 33 of 2,617). Treatment effect among NICUs and LNUs with validated data ranges from -4.5% to 10.1%. Among NICUs, proportions of bloodstream infection vary in a way that is not explained by the gestational age mix of the admitted babies. This suggests that there may be opportunities to reduce proportions of infection through changes in practice.

2.5. Preterm brain injury

1. *Does a baby born at less than 32 weeks gestational age experience germinal matrix/ intraventricular haemorrhage (IVH)*
2. *Does a baby born at less than 32 weeks gestational age experience cystic periventricular leukomalacia (cPVL)*

The NNAP reports proportions of the more serious grades of intraventricular/ periventricular brain injury and proportions of cystic periventricular leukomalacia (cPVL).

Very preterm infants may experience brain injury, either from bleeding or consequent to cyctic periventricular leukomalacia. The consequences of such injury vary, in part depending on the severity of the injury. In the NNAP, we assess the proportion of babies in whom these types of brain injury occur. For intraventricular haemorrhage (IVH), we concentrate only on the more severe grades of injury. We appreciate that within these grade 3 and 4 haemorrhages the clinical sequallae may vary sigificantly depending on the laterality and size of injury. However, where the surveillance case definition, as set out in the NNAP measures guide, is consistently applied by neonatal units, we believe it will form the basis for appropriate comparisons of rates of adverse outcome between neonatal services.

The NNAP is also reporting proportions of cystic periventricular leukomalaicia (cPVL) based on the published surveillance case definition. Similarly to IVH, cases identified with cPVL will experience heterogenous outcome, but one that on average is much more likely to be characterised by disability than in babies without cPVL. It is not the case that all IVH or cPVL outcomes are known to be, or likely to be, preventable. However, these forms of brain injury are reasonably common and regarded as clinically important, with increased risk of adverse neurodevelopmental outcomes[10]. Care bundles targetting reduction in their incidence are described, which may be of interest to units experiencing high rates of preterm brain injury[11],[12].

Full details of this measure can be found in the NNAP 2022 audit measures guide: https://www.rcpch.ac.uk/work-we-do/clinical-audits/nnap/measures.

[10] Rees et. Al., Preterm Brain Injury and Neurodevelopmental Outcomes: A Meta-analysis. *Pediatrics* December 2022; 150 (6): e2022057442. 10.1542/peds.2022-057442. Available at: https://doi.org/10.1542/peds.2022-057442.
[11] Murthy et. Al., Neuroprotection Care Bundle Implementation to Decrease Acute Brain Injury in Preterm Infants. Pediatr Neurol. 2020 Sep;110:42-48. Available at: https://pubmed.ncbi.nlm.nih.gov/32473764/
[12] Gross et. Al., Evaluating the Effect of a Neonatal Care Bundle for the Prevention of Intraventricular Hemorrhage in Preterm Infants. Children (Basel). 2021 Mar 25;8(4):257. Available at: https://pubmed.ncbi.nlm.nih.gov/33806111/

Results

NNAP clinical leads were asked to provide assurance that all their scan data had been entered. In England and Wales, 71.8% (127/177) provided this validation of their preterm brain injury data; in 2021, 66.3% of units were able to do so.

The NNAP also collects data relating to post-haemorrhagic ventricular dilatation (PHVD), with an observed overall proportion of PHVD or death of 11.3% in 2022, however we do not yet present those results in detail, choosing initially to focus on improving the overall completeness of scan data and improving recorded diagnostic information relating to IVH 3 and 4 and cPVL.

1. Intraventricular haemorrhage (IVH 3 and 4)

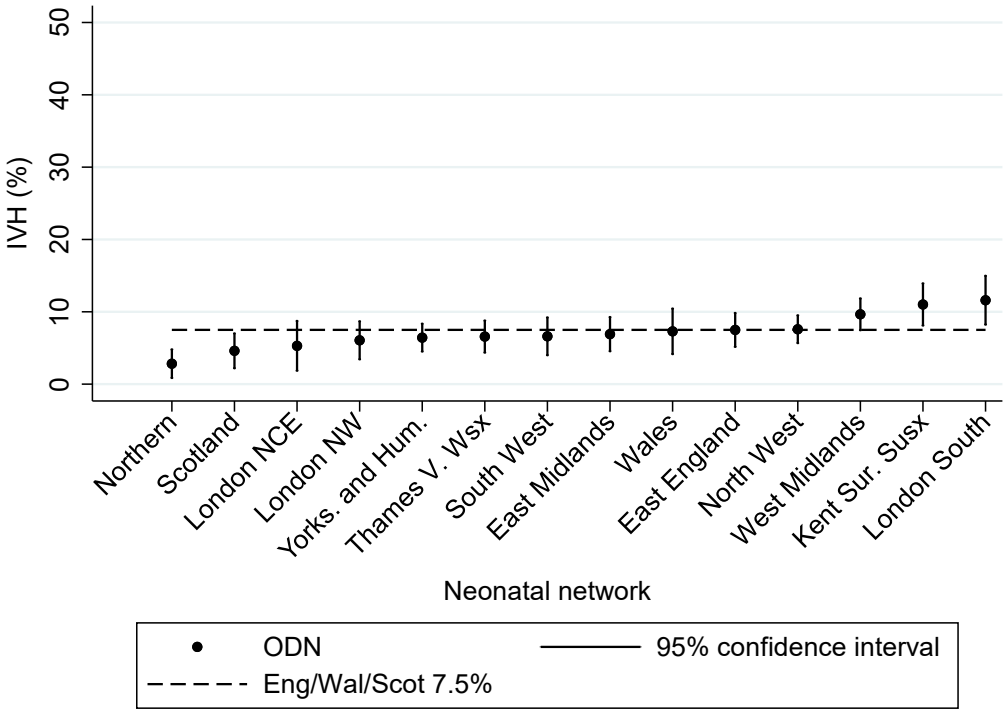
Table 9: Proportions of IVH 3 or 4, IVH 3 or 4 or death, and missing data, by network of birth.

Network of birth	Eligible babies	With IVH outcome	IVH 3 or 4 (%)	IVH 3 or 4, or death by discharge (%)	Missing data (%)
East Midlands ODN	517	463	32 (6.9%)	68 (14.7%)	54 (10.4%)
East of England Perinatal ODN	636	507	38 (7.5%)	70 (13.8%)	129 (20.3%)
Kent, Surrey, Sussex ODN	518	463	51 (11%)	75 (16.2%)	55 (10.6%)
London ODN - North C & E	399	170	9 (5.3%)	24 (14.1%)	229 (57.4%)
London ODN - North West	351	330	20 (6.1%)	46 (13.9%)	21 (6%)
London ODN - South	427	362	42 (11.6%)	69 (19.1%)	65 (15.2%)
North West ODN	932	764	58 (7.6%)	121 (15.8%)	168 (18%)
Northern ODN	341	283	8 (2.8%)	37 (13.1%)	58 (17%)
Scotland	310	304	14 (4.6%)	38 (12.5%)	6 (1.9%)
South West ODN	439	363	24 (6.6%)	43 (11.8%)	76 (17.3%)
Thames Valley & Wessex ODN	557	502	33 (6.6%)	57 (11.4%)	55 (9.9%)
Wales	282	274	20 (7.3%)	32 (11.7%)	8 (2.8%)
West Midlands ODN	751	725	70 (9.7%)	122 (16.8%)	26 (3.5%)
Yorkshire & Humber ODN	693	653	42 (6.4%)	99 (15.2%)	40 (5.8%)
Other*	28	19	3 (15.8%)	5 (26.3%)	9 (32.1%)
Eng/Wal/Scot	**7,181**	**6,182**	**464 (7.5%)**	**906 (14.7%)**	**999 (13.9%)**

*'Other' networks are those that are in locations not associated with an NNAP neonatal network or are unknown. Home and Transit locations are updated to match their first provider of care for all networks and for units at most place of birth measures.

Figure 13. Caterpillar plot of proportion of IVH 3 or 4 (TOP), and IVH 3 or 4 or death (BOTTOM), by neonatal network.

Network proportions are represented by dots. The 95% confidence intervals for a network are shown by a vertical line with each dot. Full results are available on NNAP Online.



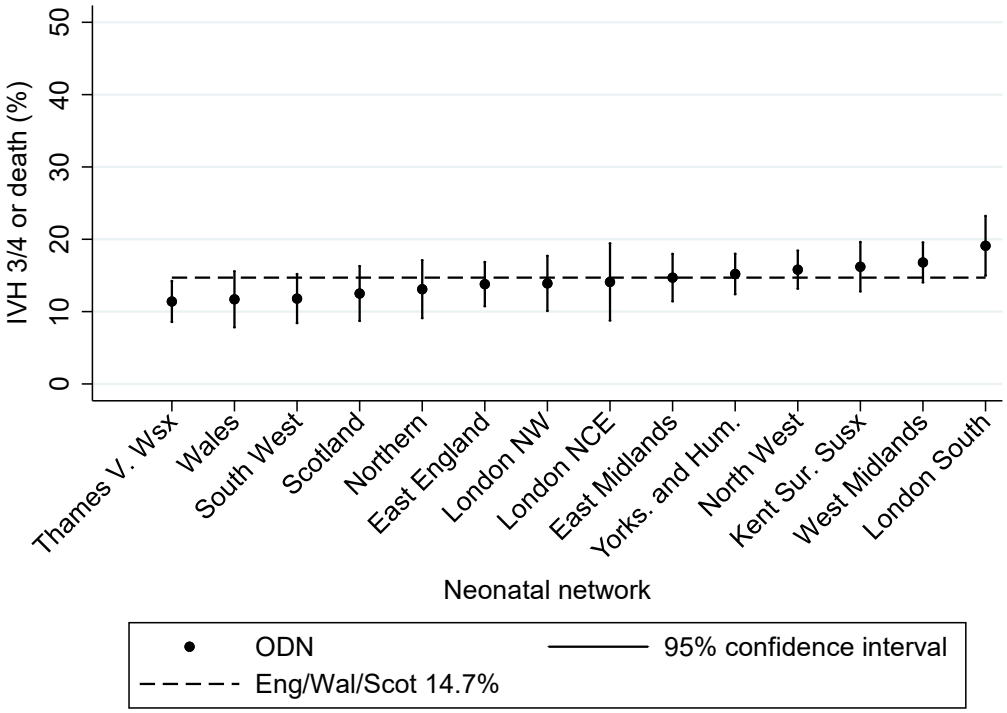
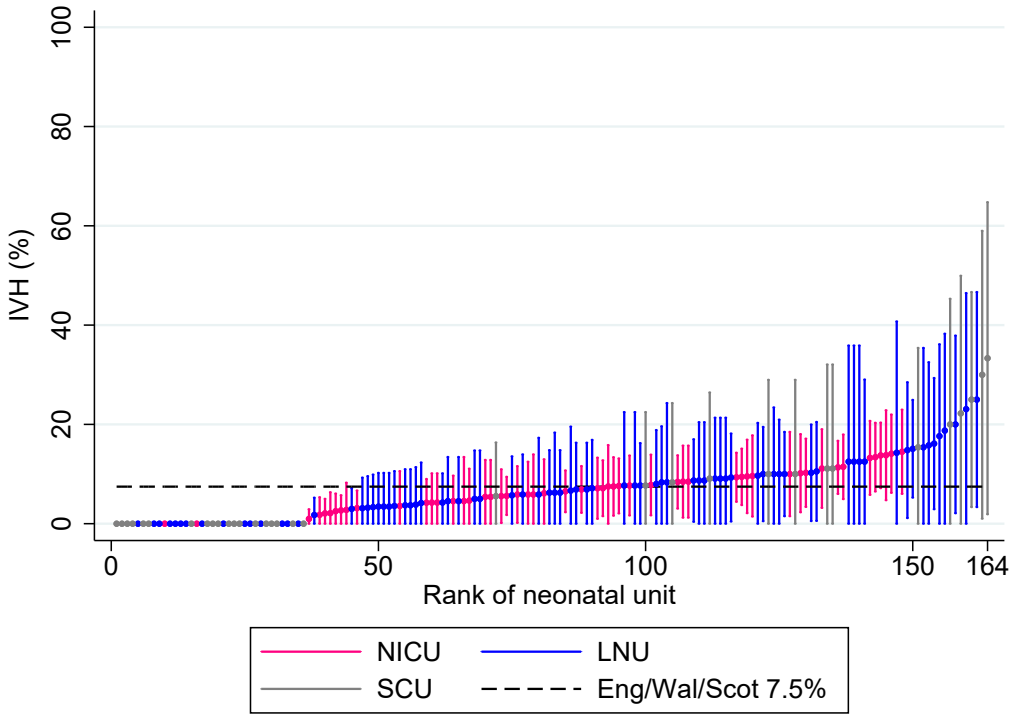
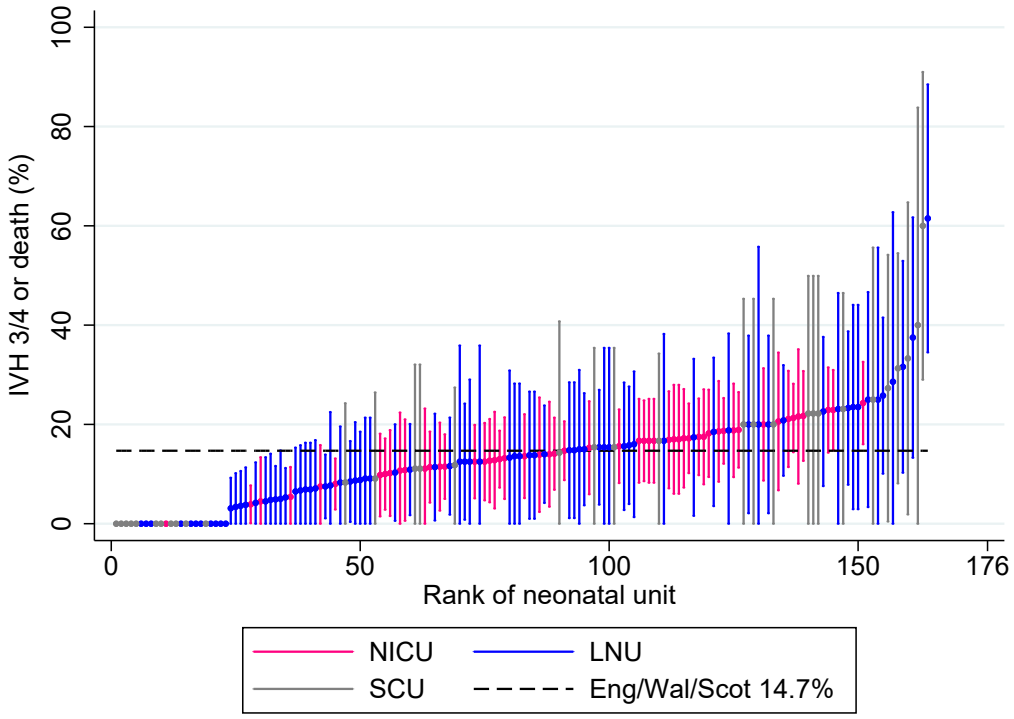


Figure 14. Caterpillar plot of proportion of intraventricular haemorrhage (IVH) 3 or 4 (TOP), and IVH 3 or 4 or death (BOTTOM), by neonatal unit.

Unit proportions are represented by dots. The 95% confidence intervals for a unit are shown by a vertical line with each dot. Neonatal units can be identified on NNAP Online. Units with < 3 eligible babies with an outcome are not included.





Summary of findings - IVH

- The proportion of babies born at less than 32 weeks gestational age with intraventricular haemorrhage grades 3 or 4 (IVH 3 or 4) was 7.5% (464 of 6182) and the proportion with a combined outcome of IVH 3, 4 or death was 14.7% (906 of 6182). In 2021, the proportion of babies with IVH3/4 was 6.1%, and the proportion with a combined outcome of IVH3/4 or death was 14.7%. Among the 71.8% of units who gave assurance that their scan data was complete, the proportion with a combined outcome of IVH 3,4 or death was 13.7% (620 of 4,534).

- Among networks the proportion of babies who experienced IVH 3-4 varied from 2.8-11.6%. Proportions of haemorrhage are not obviously associated with proportions of missing data. Among networks, the proportion of babies experiencing either IVH 3 4 or death ranges from 11.4% (Thames Valley and Wessex ODN) to 19.1% (London ODN – South) (*Figure 13*).

- Overall, 13.9% (999 of 7,181) of eligible babies were missing data for IVH, with proportions of missing data ranging from 1.9% to 57.4% between networks (*Table 9*). One network has a missing data proportion of around ten times that of one of its neighbouring networks. Scotland, who re-joined the NNAP in 2021 have the lowest proportion of missing IVH data at 1.9%.

- Taken together, the proportions of missing data and variation in recorded outcomes suggest that this second year of data presentation requires neonatal units, networks and LMNS (or their equivalent in devolved nations) to focus both on completeness and quality of data on proportions of brain injury using the NNAP consensus definition and other available resources such as the NNAP measures guide and the badger clinical information system.

- This action on missing data, and data quality, is important because of the apparent variation in outcomes for brain injury between networks and units that these results suggest.

2. Cystic periventricular leukomalacia (cPVL)

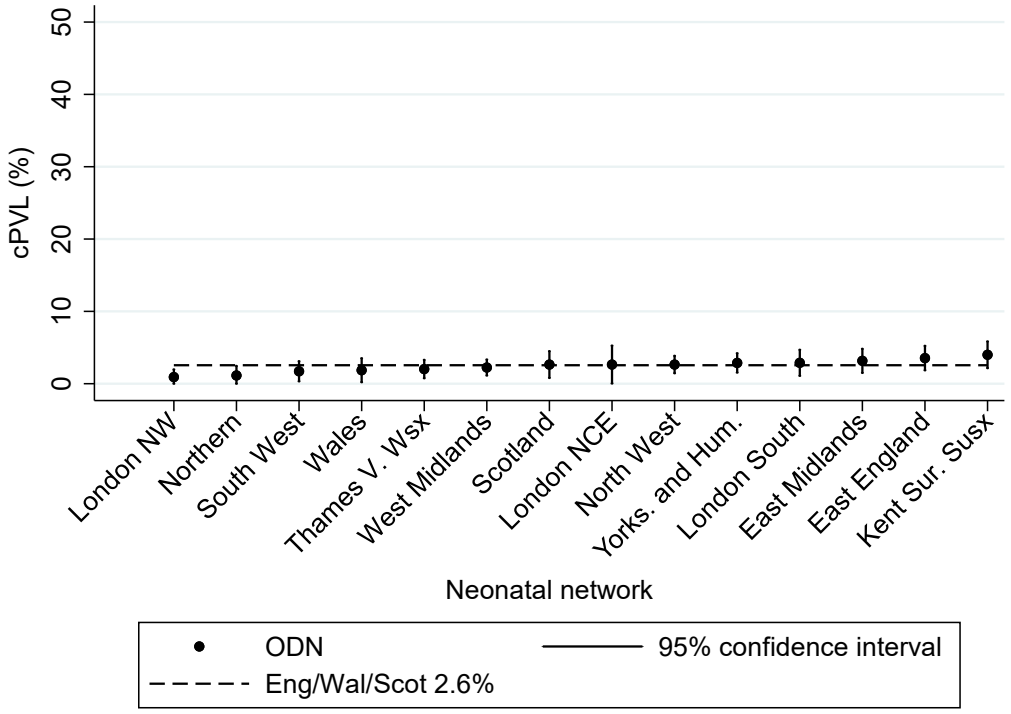
Table 10: Proportions of cPVL, cPVL or death, and missing data, by network of birth.

Network of birth	Eligible babies	With cPVL outcome	cPVL (%)	cPVL or death by discharge (%)	Missing data (%)
East Midlands ODN	517	443	14 (3.2%)	45 (10.2%)	74 (14.3%)
East of England Perinatal ODN	636	480	17 (3.5%)	45 (9.4%)	156 (24.5%)
Kent, Surrey, Sussex ODN	518	450	18 (4%)	51 (11.3%)	68 (13.1%)
London ODN - North C & E	399	151	4 (2.6%)	10 (6.6%)	248 (62.2%)
London ODN - North West	351	327	3 (0.9%)	35 (10.7%)	24 (6.8%)
London ODN - South	427	346	10 (2.9%)	46 (13.3%)	81 (19%)
North West ODN	932	717	19 (2.6%)	69 (9.6%)	215 (23.1%)
Northern ODN	341	263	3 (1.1%)	16 (6.1%)	78 (22.9%)
Scotland	310	302	8 (2.6%)	33 (10.9%)	8 (2.6%)
South West ODN	439	349	6 (1.7%)	21 (6%)	90 (20.5%)
Thames Valley & Wessex ODN	557	494	10 (2%)	38 (7.7%)	63 (11.3%)
Wales	282	268	5 (1.9%)	22 (8.2%)	14 (5%)
West Midlands ODN	751	715	16 (2.2%)	92 (12.9%)	36 (4.8%)
Yorkshire & Humber ODN	693	626	18 (2.9%)	72 (11.5%)	67 (9.7%)
Other*	28	18	1 (5.6%)	3 (16.7%)	10 (35.7%)
Eng/Wal/Scot	**7,181**	**5,949**	**152 (2.6%)**	**598 (10.1%)**	**1,232 (17.2%)**

**'Other' networks are those that are in locations not associated with an NNAP neonatal network or are unknown. Home and Transit locations are updated to match their first provider of care for all networks and for units at most place of birth measures.*

Figure 15. Caterpillar plot of proportion of cPVL (TOP), and cPVL or death (BOTTOM), by neonatal network.

Network proportions are represented by dots. The 95% confidence intervals for a network are shown by a vertical line with each dot. Full results are available on NNAP Online.



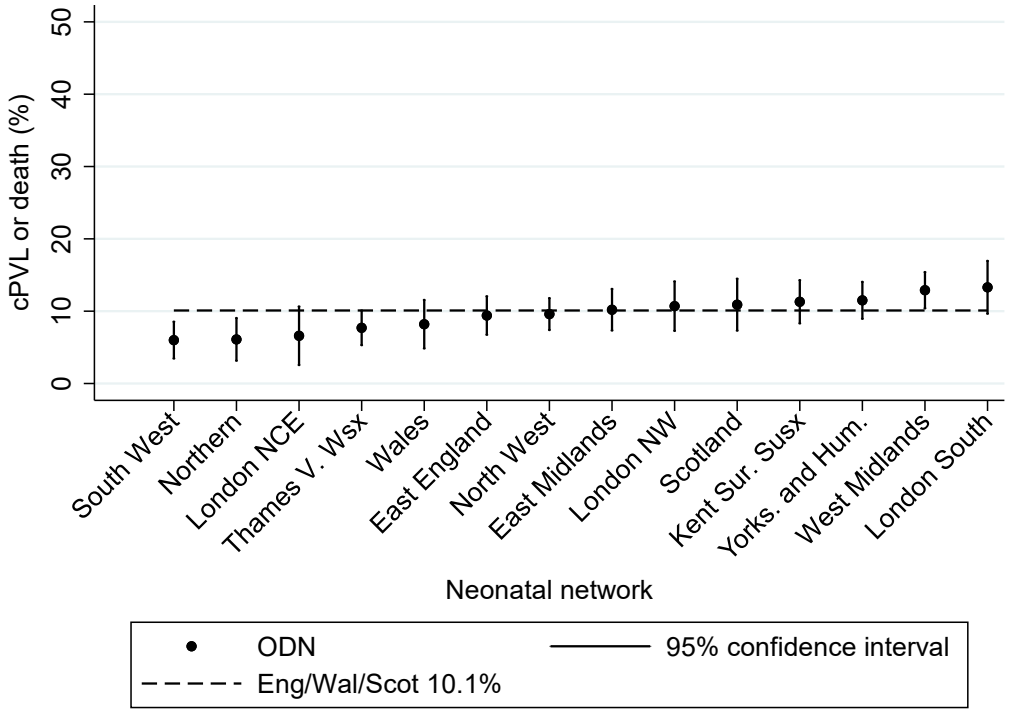
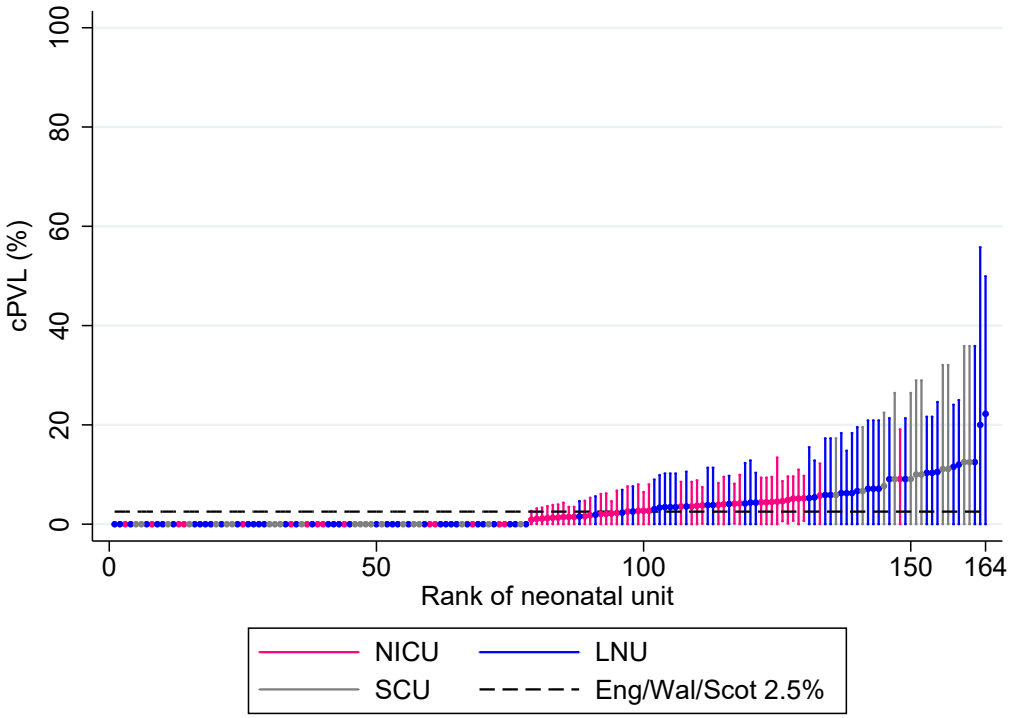
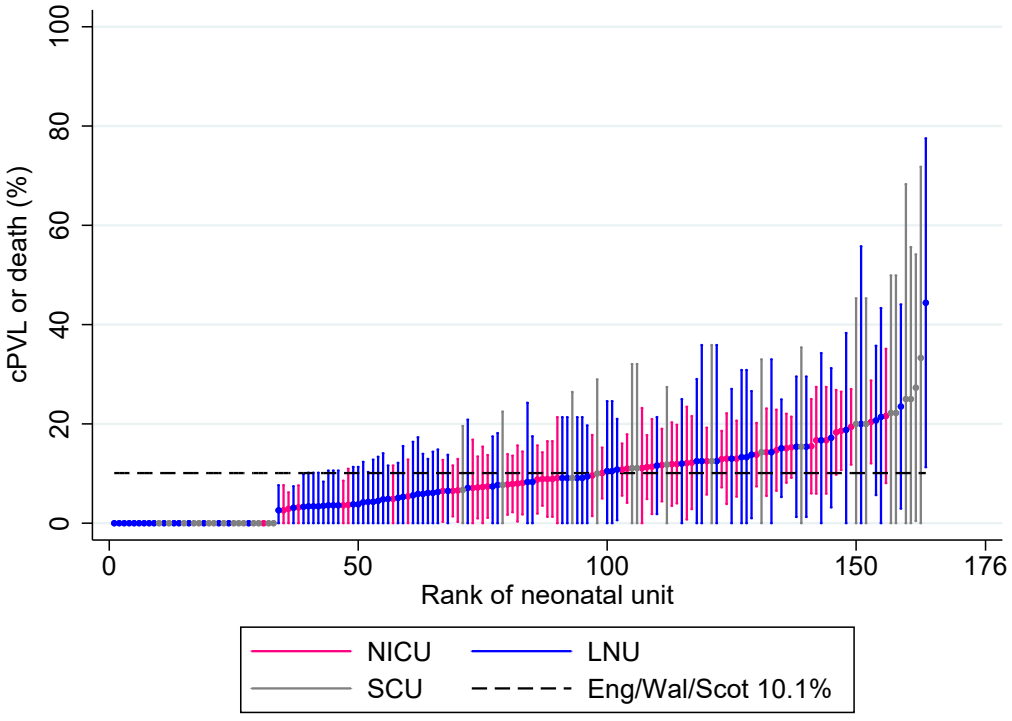


Figure 16. Caterpillar plot of proportion of cystic periventricular leukomalacia (cPVL) (TOP) and cPVL or death (BOTTOM), by neonatal unit.

Unit proportions are represented by dots. The 95% confidence intervals for a unit are shown by a vertical line with each dot. Neonatal units can be identified on NNAP Online. Units with < 3 eligible babies with an outcome are not included.





Summary of findings - cPVL

- The proportion of babies born at less than 32 weeks gestational age with cystic periventricular leukomalacia (cPVL) was 2.6% (152 of 5949) and the proportion with a combined outcome of cPVL or death was 10.1% (598 of 5949). In 2021, the proportion of babies with cPVL was 2.3%, and the proportion with a combined outcome of cPVL or death was 9.6%.
- Among networks the proportion of babies with cPVL varies from 0.9 - 4%. Among networks, the proportion of cPVL or death ranges from 6% (South West ODN) to 13.3% (London ODN – South) (*Figure 15*).
- Overall, 17.2% (1232 of 7181) of eligible babies were missing data, with proportion of missing data ranging from 2.6% to 62.2% between neonatal networks.
- Among the 71.8% of units who gave assurance that their scan data was complete, the proportion with a combined outcome of cPVL or death was 9.5% (420 of 4412).
- Taken together, the proportions of missing data and variation in recorded outcomes suggest that this second year of data presentation requires neonatal units, networks and LMNSs (or their equivalent in devolved nations) to focus both on completeness and quality of data on proportions of brain injury using the NNAP consensus definition and other available resources such as the NNAP measures guide and the badger clinical information system.
- This action on missing data, and data quality, is important because of the apparent variation in outcomes for brain injury between networks and units that these results suggest.

2.6. Key messages, recommendations and actions for improvement

- Mortality varied between neonatal networks; from 4.8% to 8%. The difference in the proportion of babies born between 24 and 31 weeks gestational age who were admitted to a neonatal unit and die before discharge home represents major unwarranted variation. Differences in the measured background characteristics of babies cared for by networks does not fully explain this variation.
- Variation between neonatal units and networks in other adverse outcomes, such as of bronchopulmonary dysplasia (BPD), necrotising enterocolitis (NEC), and bloodstream infection persist from previous years, even when measured background characteristics are accounted for. There is evidence of a significant upward trend in the overall proportion of babies experiencing BPD or death since 2015-2017, rather than the desired decrease over time.
- In 2022, 71.8% (127/177) of NNAP neonatal unit clinical leads were able to assure their NNAP data on preterm brain injury (intraventricular haemorrhage (IVH) grades 3 and 4, cystic periventricular leukomalacia and post-haemorrhagic ventricular dilatation), an increase from 66.3% in 2021. Proportions of missing 2022 data were high; 13.9% for IVH 3 or 4, and 17.2% for cPVL, and were variable between neonatal networks. Enhanced completeness and quality of data is required so that outcomes of neonatal care can be described more effectively both locally and nationally, and to inform reporting against the national ambition to reduce rates of brain injury during, or soon after, birth.
- The number of babies born at 22 weeks gestation and admitted annually to neonatal care has risen 6-fold between July 2017 and June 2022 (from 15 to 90). The proportion surviving to 44 weeks postmenstrual age (PMA) over this period was 27.2% (65 of 239). New guidance recommending active life sustaining treatment, based on a risk assessment, at the lower gestational ages was published by the British Association of Perinatal Medicine (BAPM) in October 2019[13]. This proportion of 27.2% babies born at 22 weeks gestation admitted to neonatal care and surviving to 44 weeks is lower than the 54% rate of survival to one year of babies admitted to intensive care described in the BAPM 2019 guidance.

[13] BAPM. Perinatal Management of Extreme Preterm Birth before 27 weeks of gestation: A Framework for Practice. October 2019. Available at: https://hubble-live-assets.s3.amazonaws.com/bapm/file_asset/file/30/Extreme_Preterm_28-11-19_FINAL.pdf

The NNAP makes the following national recommendation:

1. **Neonatal networks** should review their rates of adverse outcomes (mortality, BPD, NEC, bloodstream infection and preterm brain injury), and develop locally prioritised action plans to respond to these results with their constituent **neonatal units**, and:
    - share these with **Neonatal Network Boards**, **Local Maternity and Neonatal System (LMNS) Boards** (and devolved nation equivalents), and with **Trust/Health Board Governance Boards** via ward-to-board **Maternity or Neonatal Safety Champions**.
    - work with their constituent **neonatal units** to ensure that all services have a plan in place to validate their data entry for outcomes such as necrotising enterocolitis, bloodstream infection, and preterm brain injury.

Actions for local quality improvement

- **Neonatal units** without assured data entry for outcomes such as NEC, bloodstream infection and preterm brain injury should develop plans, in time for the final deadline for the submission of NNAP 2023 data, to deliver enhanced completeness and quality of data. Neonatal units should use the following resources to support this work:
    - NNAP 2023 audit measures guide
    - NNAP webinar: Checking and validating your NNAP data: What you need to know
    - Gale, C. et. Al. Brain injury occurring during or soon after birth: a report for the national maternity ambition commissioned by the Dept. of Health.
    - Case study: *Snuggle and PEEP – increasing use of non-invasive respiratory support and reducing BPD rates.* Bolton Hospital NHS FT
    - Case study: *Implementing a care bundle to reduce the incidence of severe intraventricular haemorrhages in a UK tertiary neonatal intensive care unit.* University College London Hospitals NHS FT
- **Neonatal units** should ensure there is a named lead for serious incident review with designated time to liaise closely with obstetric and maternity colleagues, in line with the recommendation made in the UK Neonatal Partnership Board report - National Reviews of Maternity and Neonatal Care: Supporting the perinatal team to implement recommendations. This is to ensure that timely and transparent incident investigations occur and result in shared learning.

3. Optimal perinatal care

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

Is a baby:

- *born at less than 27 weeks gestational age, or*
- *less than 800 grams at birth, or*
- *born as a multiple at less than 28 weeks gestational age*

delivered in a maternity service on the same site as a designated NICU?

Babies who are born at less than 27 weeks gestational age are at high risk of death, serious illness, and brain injury. National recommendations in England[14],[15] state that neonatal networks should aim to configure and deliver services to increase the proportion of babies at this gestational age being delivered in a hospital with a neonatal intensive care unit (NICU) on site. This is because there is evidence that outcomes improve if such premature babies are cared for in a NICU from birth. Eighty-five percent (85%) of babies born at less than 27 weeks gestational age, weighing less than 800 grams, or born as a multiple at less than 28 weeks gestational age should be delivered in a maternity service on the same site as a NICU. Prior to 2022, the measure only considered babies born at less than 27 weeks gestational age.

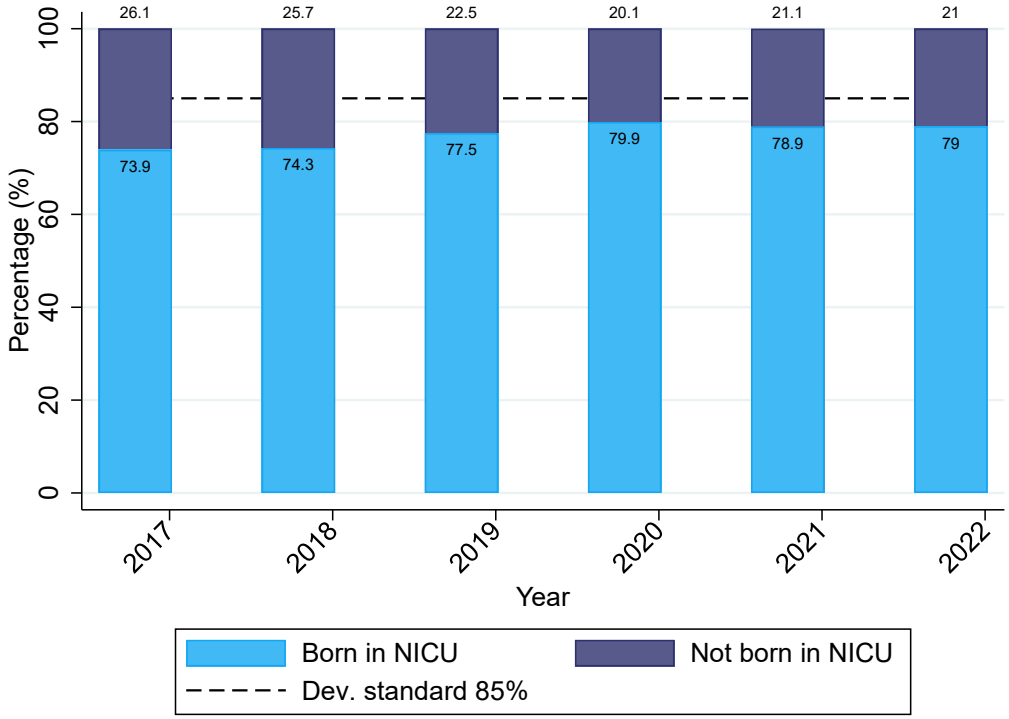
Full details of this measure can be found in the NNAP 2022 audit measures guide: https://www.rcpch.ac.uk/work-we-do/clinical-audits/nnap/measures.

[14] NHS England. *Neonatal Critical Care Service Specification*. 2016. Available from https://www.england.nhs.uk/commissioning/spec-services/npc-crg/group-e/e08/.

[15] NHS England. *Implementing Better Births: Integrating Neonatal Care into Local Maternity System Transformation Plans*. 2017.

Results

Figure 17: Birth in a centre with a NICU, according to the contemporaneous NNAP measurement criteria, by NNAP reporting year, 2017-2022.

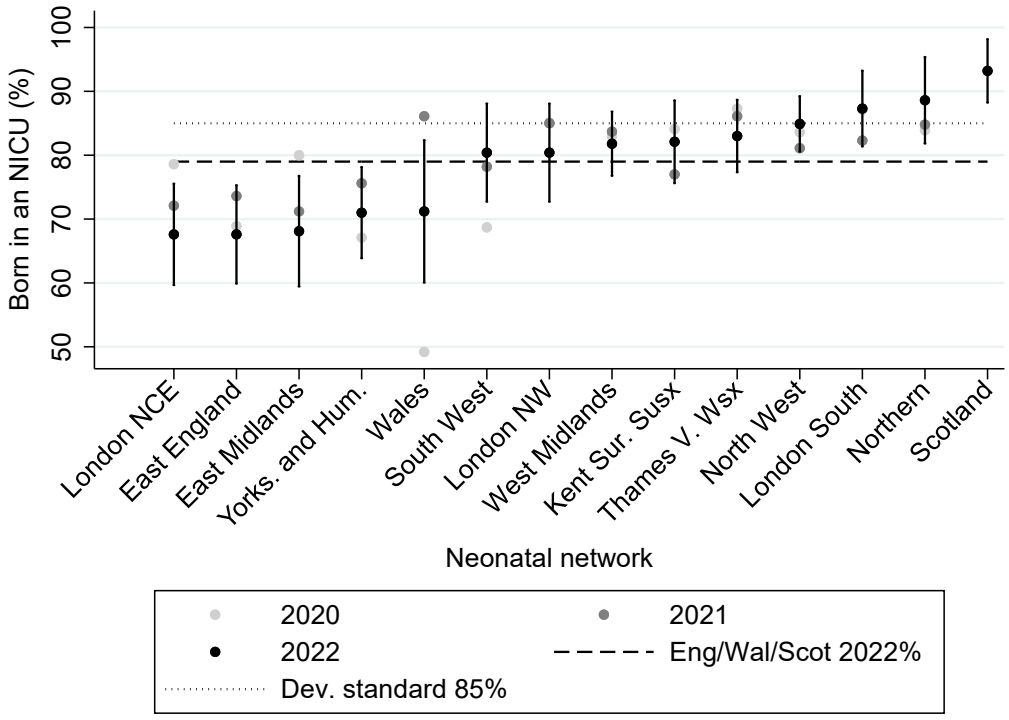


Notes for interpretation:

- *Years 2020 and 2021 do not include Scotland. Excluding Scotland from the 2022 analysis gives a proportion of 78.2%.*
- *In 2022,*
    - *the inclusion criteria were extended to include multiples born at less than 28 weeks, and babies born at less than 800 grams. This change resulted in an increase in the denominator from 1,631 to 1,995, and an increase in the proportion born in a NICU from 78.2% to 79%.*
    - *the cohort changed from babies discharged in the calendar year, to babies first admitted in the calendar year.*

Figure 18. Caterpillar plot of the proportions of birth in a centre with a NICU, by neonatal network or operational delivery network (ODN).

Network proportions are represented by dots. The 95% confidence intervals for a network are shown by a vertical line with each dot. Full results are available on NNAP Online.



Note for interpretation:

- *Results for 2020 and 2021 have been re-analysed using the latest available data and the 2022 measure criteria.*

Summary of findings

- In 2022, 79% (1,576 of 1,995) of babies of less than 27 weeks' gestational age, weighing less than 800 grams or multiples less than 28 weeks' gestational age were born in a maternity unit with a neonatal intensive care unit (NICU). In 2022, the inclusion criteria were extended to include multiples born at less than 28 weeks, and babies born at less than 800 grams. This change resulted in an increase in the denominator from 1,631 to 1,995, and an increase in the proportion born in a NICU from 78.2% to 79%. In 2021, the proportion for England and Wales was 78.9%, an analysis for 2022 without Scotland gives a proportion of 78.2%. However, in 2021, babies weighing less than 800 grams, multiples born at 27 weeks, and episodes affected by NDO were excluded, so a direct comparison is not possible.
- Among networks, the proportion ranges from 67.6% (East of England ODN, London ODN – North Central & East) to 93.2% (Scotland). *Figure 18* compares network results for 2020, 2021, and 2022, using the most recent measure criteria and the latest available data. It the indicates

that 8 of the 13 networks in England and Wales have seen a reduction in the proportion of babies born in an appropriate setting.

3.2. Antenatal steroids

Does a mother who delivers a baby between 22 and 33 weeks gestational age receive a full course of antenatal corticosteroids within one week prior to delivery?

Babies born at less than 34 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. Antenatal steroids help reduce mortality and make other serious complications, such as bleeding into the brain, less likely. The NICE quality standard *Preterm Labour and Birth*[16] details recommendations on the use of antenatal corticosteroids prior to suspected preterm birth.

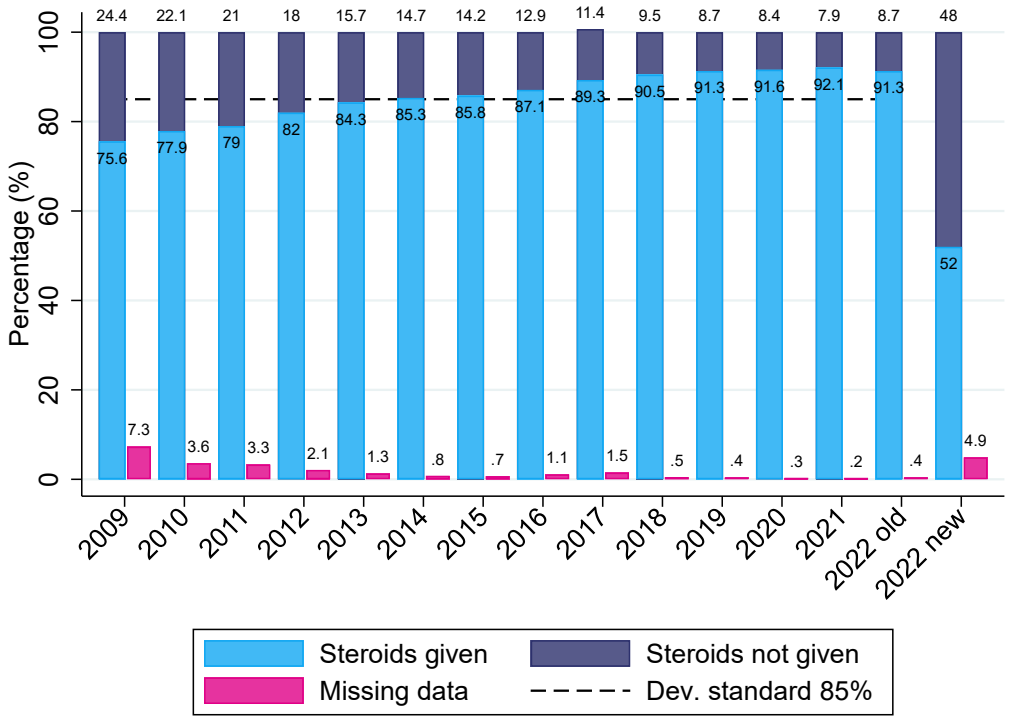
For the first time this year, the NNAP reports the proportion of eligible mothers who received a full course of antenatal corticosteroids within one week of delivery. Previously, the NNAP reported the proportion receiving at least one dose before delivery. On time delivery of a full course of antenatal corticosteroids is challenging to achieve, due to the complexities of accurately predicting preterm birth. This intervention is likely to be more achievable in some groups of mothers and babies, such as planned deliveries due to preeclampsia, compared to others such as delivery for placental abruption.

Full details of this measure can be found in the NNAP 2022 audit measures guide: https://www.rcpch.ac.uk/work-we-do/clinical-audits/nnap/measures.

[16] NICE guideline [NG25]. Preterm labour and birth. Last updated: 10 June 2022. Available at: https://www.nice.org.uk/guidance/ng25

Results

Figure 19. Administration of antenatal steroids, according to the contemporaneous NNAP measurement criteria, by NNAP reporting year (2009 to 2022).



Notes for interpretation:

- *Results for years 2010-2016 are recalculated so that missing data is excluded from the denominator (with outcome), therefore results vary from published results. Otherwise, all results use contemporaneous definitions.*
- *Years 2010-2014, 2020 and 2021 do not include Scotland.*
- *The gestational age inclusion criteria changed in 2018 from 24 to 34 weeks inclusive to 23 to 33 weeks inclusive.*
- *In 2022:*
    - ***the measure question changed to consider whether a mother received a full course of corticosteroids in the week prior to delivery**. Prior to 2021, it looked at whether a mother received at least one dose.*
    - *the lower gestational age cut-off has been extended to included babies born from 22 weeks gestational age, in line with the overall NNAP inclusion criteria.*
    - *babies born at home or in transit are attributed to first unit of care.*
    - *the cohort changed from babies discharged in the calendar year, to babies first admitted in the calendar year.*
    - *results for 2022 are presented using both the old (2022 old) and new (2022 new) measure definitions.*

Figure 20. Caterpillar plot of the proportions of administration of antenatal steroids, by neonatal network or operational delivery network (ODN).

Network proportions are represented by dots. The 95% confidence intervals for a network are shown by a vertical line with each dot. Full results are available on NNAP Online.

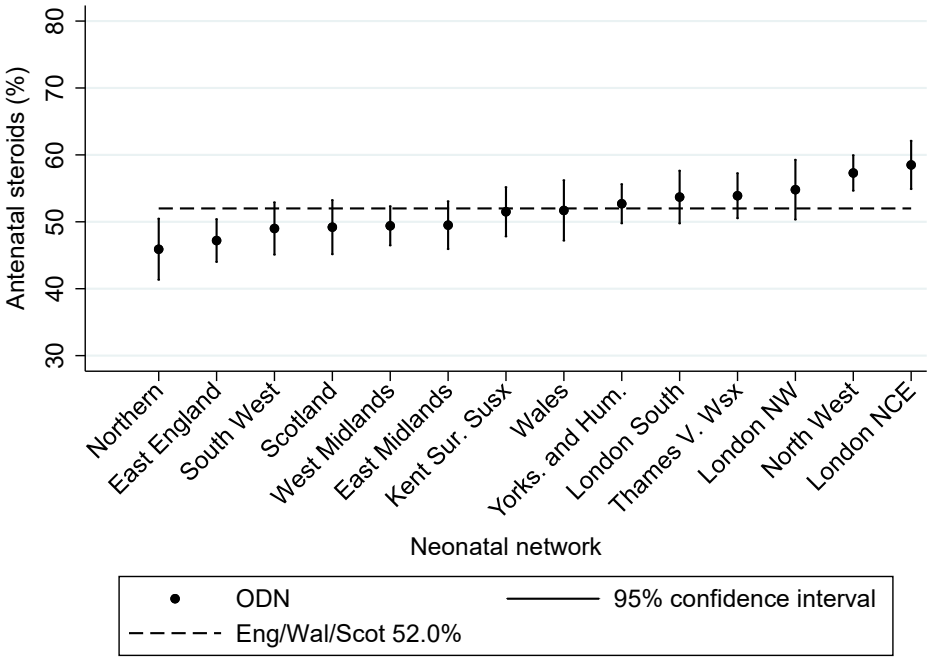


Figure 21. Caterpillar plot of the proportions of administration of antenatal steroids: neonatal units.

Unit proportions are represented by dots. The 95% confidence intervals for a unit are shown by a vertical line with each dot. Neonatal units can be identified on NNAP Online.

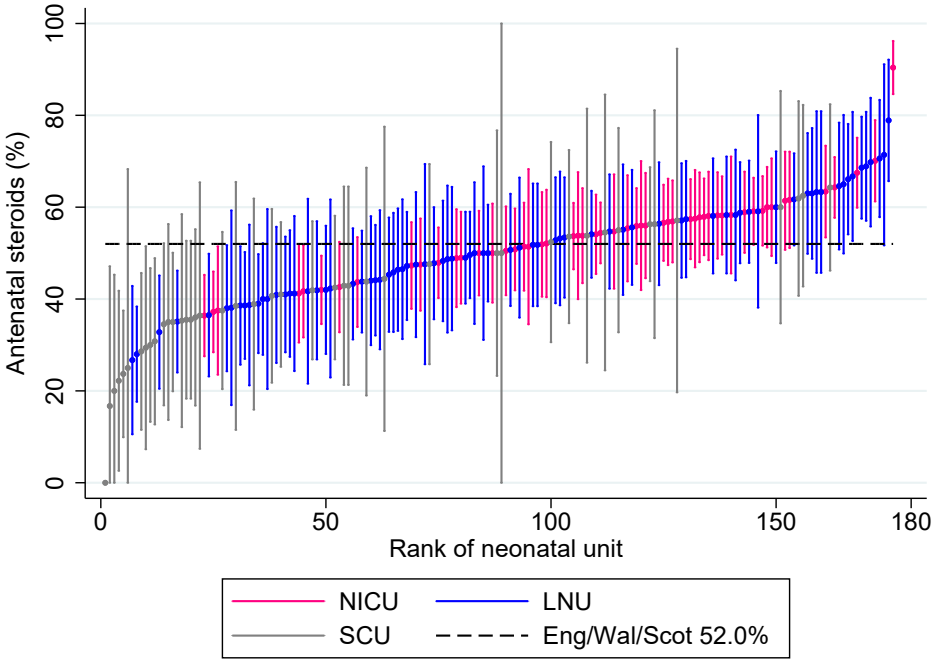
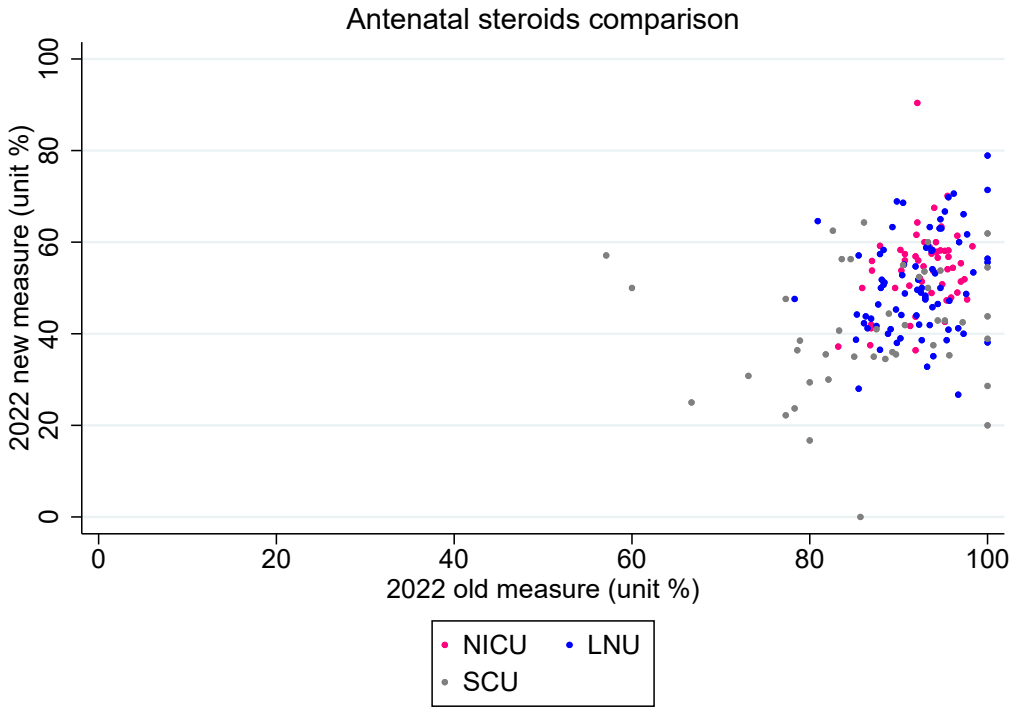


Table 11: Administration of antenatal steroids, by unit level

Unit level	Eligible mothers	With outcome	Antenatal steroids given (%)	Missing (%)
Other*	41	33	13 (19.5%)	8 (39.4%)
SCU	1,061	970	407 (42%)	91 (8.6%)
LNU	4,554	4,258	2,160 (50.7%)	296 (6.5%)
NICU	6,202	6,011	3,281 (54.6%)	191 (3.1%)
Eng/Wal/Scot	**11,858**	**11,272**	**5,861 (52%)**	**586 (4.9%)**

**'Other' units are those that are hospital or healthcare locations not associated with an NNAP neonatal unit, NNAP units that have closed before the start of this audit year, or location records that are unknown.*

Figure 22: Comparison of administration of a full course of antenatal steroids in the week prior to delivery (new measure) and administration of at least one dose of antenatal steroids (old measure), 2022 data by unit.



Summary of findings

- The measure presented here is new in that it considers only timely administration of a full course of corticosteroid as adherent. Adherence to the previous and current standard are only loosely correlated (*Figure 22* – correlation coefficient 0.304*)*, which suggests that the clinical challenges in maximising timely steroid administration differ from those of maximising 'any steroid' administration.

- In 2022, 52% (5,861 of 11,272) of mothers who delivered a baby between 23 and 33 weeks gestational age received a full course of antenatal steroids within one week prior to delivery. Across units, the proportion ranges from 0% to 90.4%. The range of achievement is striking

compared to the generally high rate of adherence to the previous measurement standard (*Figure 21*).

- Achievement is higher in NICUs at 54.6% (3,281 of 6,011), compared to LNUs – 50.7% (2,160 of 4,258), and SCUs – 42% (407 of 970).
- Network achievement ranges from 45.9% (Northern ODN) to 58.5% (London ODN – North Central & East) (*Figure 20*). There is a clear opportunity for improvement towards the level of administration seen in the highest performing networks.

3.3. 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?

Giving magnesium sulphate to women who are at risk of delivering a preterm baby reduces the chance that their baby will develop cerebral palsy by 32%.[17] The NICE quality standard *Preterm Labour and Birth* recommends that all women who may deliver their baby at less than 30 weeks gestational age are offered magnesium sulphate where possible.[18] The NNAP developmental standard is that ninety percent (90%) of eligible mothers should receive antenatal magnesium sulphate.

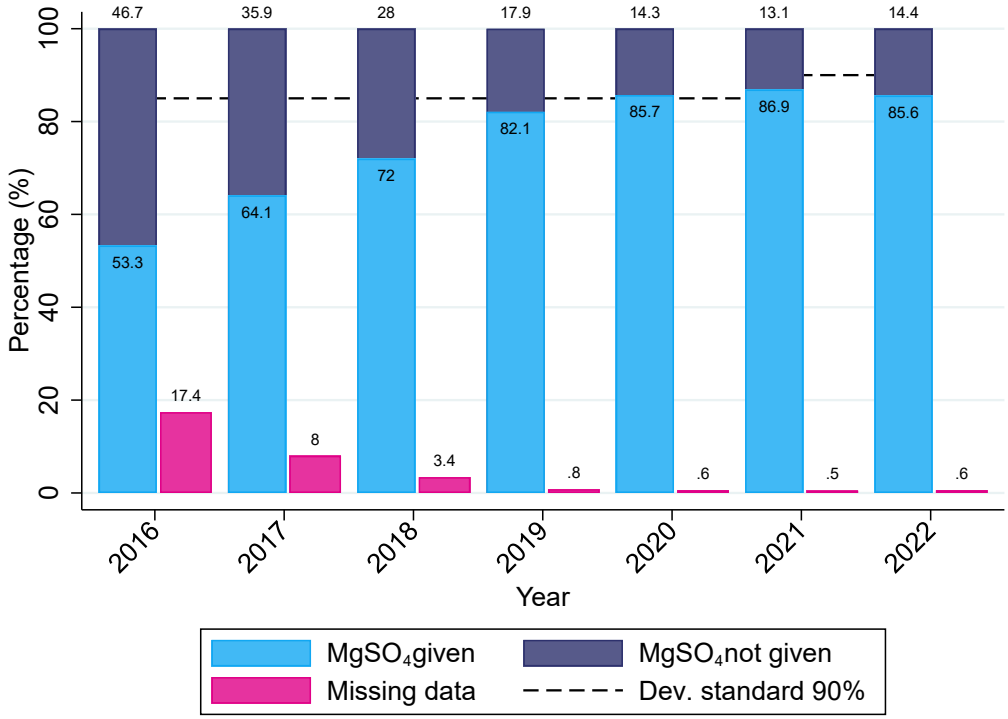
Full details of this measure can be found in the NNAP 2022 audit measures guide: https://www.rcpch.ac.uk/work-we-do/clinical-audits/nnap/measures.

[17] Oddie S., Tuffnell D. J., McGuire W. Antenatal magnesium sulfate: Neuro-protection for preterm infants. *Archives of Disease in Childhood - Fetal and Neonatal Edition* 2015; 100: F553-F557. Available at: https://fn.bmj.com/content/100/6/F553

[18] National Institute for Health and Care Excellence. *Preterm labour and birth. NICE guideline (NG25)* 2015. Available from: https://www.nice.org.uk/guidance/NG25

Results

Figure 23. Administration of magnesium sulphate, according to the contemporaneous NNAP measurement criteria, by reporting year (2016-2022).



Notes for interpretation:

- *Results for 2016 are recalculated so that missing data is excluded from the denominator (with outcome), therefore results vary from published results. Otherwise all results use contemporaneous definitions.*
- *Years 2020 and 2021 do not include Scotland.*
- *A two-sample test for difference in the administration of magnesium sulphate proportions between Scotland, and England & Wales (combined) in 2019 indicates a significant difference (p=<0.05), therefore it is expected that the absence of Scottish data may have caused a disruption to the ability to compare proportions between years.*
- *In 2022:*
    - *babies born at home or in transit are now attributed to first unit of care.*
    - *the cohort changed from babies discharged in the calendar year, to babies first admitted in the calendar year.*

Figure 24. Caterpillar plot of the proportions of administration of magnesium sulphate, by neonatal network or operational delivery network (ODN).

Network proportions are represented by dots. The 95% confidence intervals for a network are shown by a vertical line with each dot. Full results are available on NNAP Online.

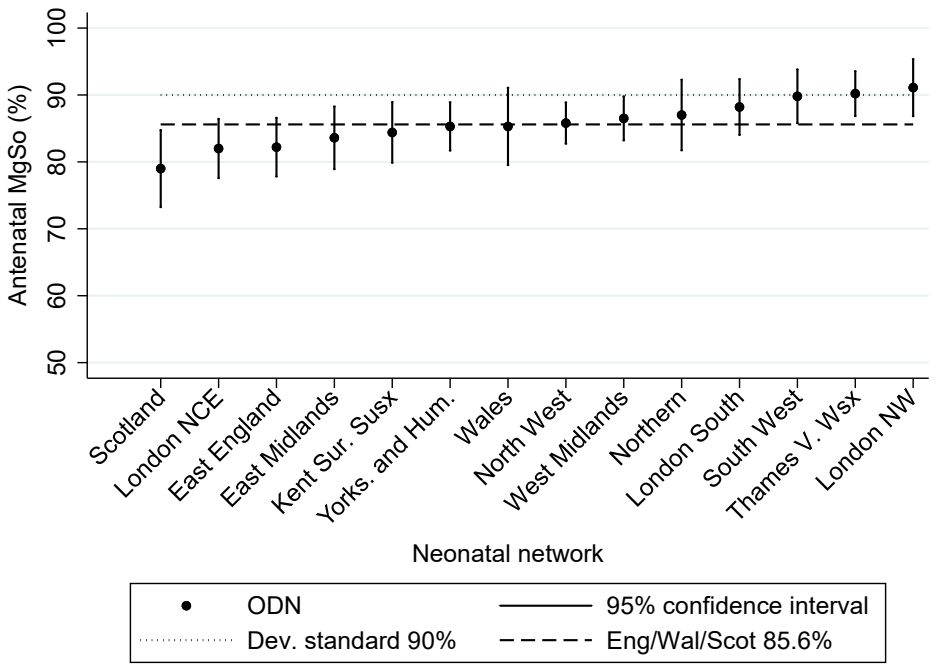


Figure 25. Caterpillar plot of the proportions of administration of magnesium sulphate: neonatal units.

Unit proportions are represented by dots. The 95% confidence intervals for a unit are shown by a vertical line with each dot. Neonatal units can be identified on NNAP Online.

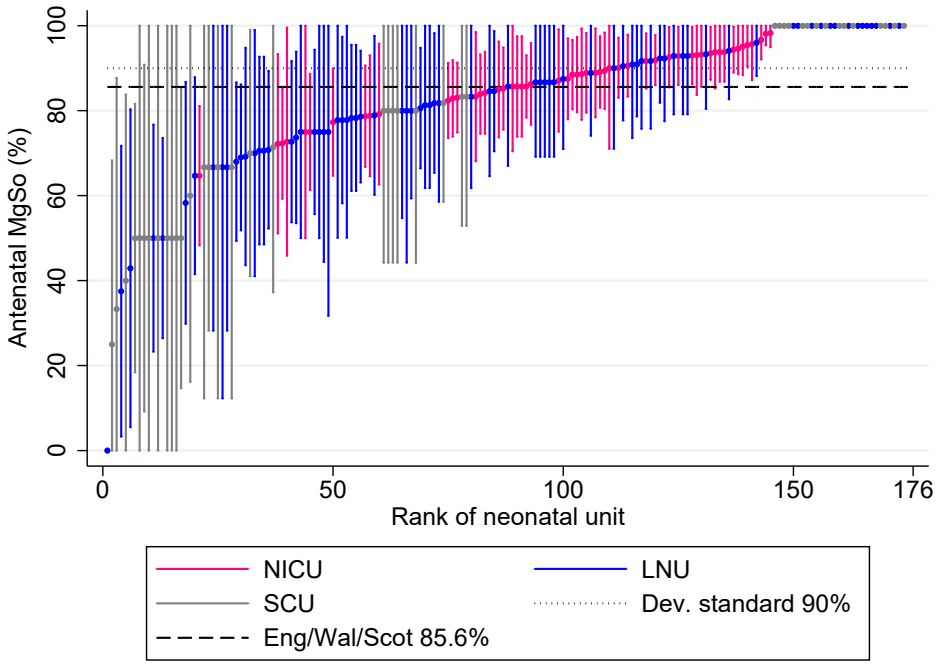


Table 12: Administration of antenatal magnesium sulphate, by unit level

Unit level	Eligible mothers	With outcome	Proportion	Missing
Other*	16	13	7 (53.8%)	3 (18.8%)
SCU	173	170	121 (71.2%)	3 (1.7%)
LNU	1,107	1,100	899 (81.7%)	7 (0.6%)
NICU	2,640	2,630	2,322 (88.3%)	10 (0.4%)
Eng/Wal/Scot	**3,936**	**3,913**	**3,349 (85.6%)**	**23 (0.6%)**

**'Other' units are those that are hospital or healthcare locations not associated with an NNAP neonatal unit, NNAP units that have closed before the start of this audit year, or location records that are unknown.*

Summary of findings

- In 2022, 85.6% (3,349 of 3,913) of mothers who delivered a baby at less than 30 weeks gestational age received antenatal magnesium sulphate. In 2021, the proportion for England and Wales was 86.9%, a comparable analysis for 2022 (England and Wales only) gives a proportion of 85.9%; indicating that there has been a statistically non-significant decrease (p= 0.24) in antenatal magnesium sulphate administration.
- Using the 'number needed to treat' from the literature[19], we can estimate that if proportions of magnesium administration were as good in all networks as they are in the best, there would have been at least four fewer cases of cerebral palsy attributable to prematurity than did occur in 2022.
- Across networks, administration of antenatal magnesium sulphate ranges from 79% (Scotland) to 91.1% (London ODN – North West) (*Figure 24*).
- Across units, administration of antenatal magnesium sulphate varies widely; however 96.6% (169/175) of units administer magnesium sulphate to half or more eligible women, and 37.7% (66/175) meet the NNAP developmental standard of 90% (*Figure 25*, *NNAP Online*).
- Achievement of magnesium sulphate administration is higher in NICUs at 88.3% (2,322 of 2,630), compared to LNUs – 81.7% (899 of 1,100), and SCUs – 71.2% (121 of 170).

[19] Oddie S, Tuffnell DJ, McGuire W. Antenatal magnesium sulfate: Neuro-protection for preterm infants. Arch Dis Child Fetal Neonatal Ed. 2015 Nov;100(6):F553-7. doi: 10.1136/archdischild-2014-307655. Epub 2015 Apr 20. PMID: 25896966. Available at: https://fn.bmj.com/content/100/6/F553

3.4. Deferred cord clamping

Does a baby born at less than 34 weeks gestational age have their cord clamped at or after one minute?

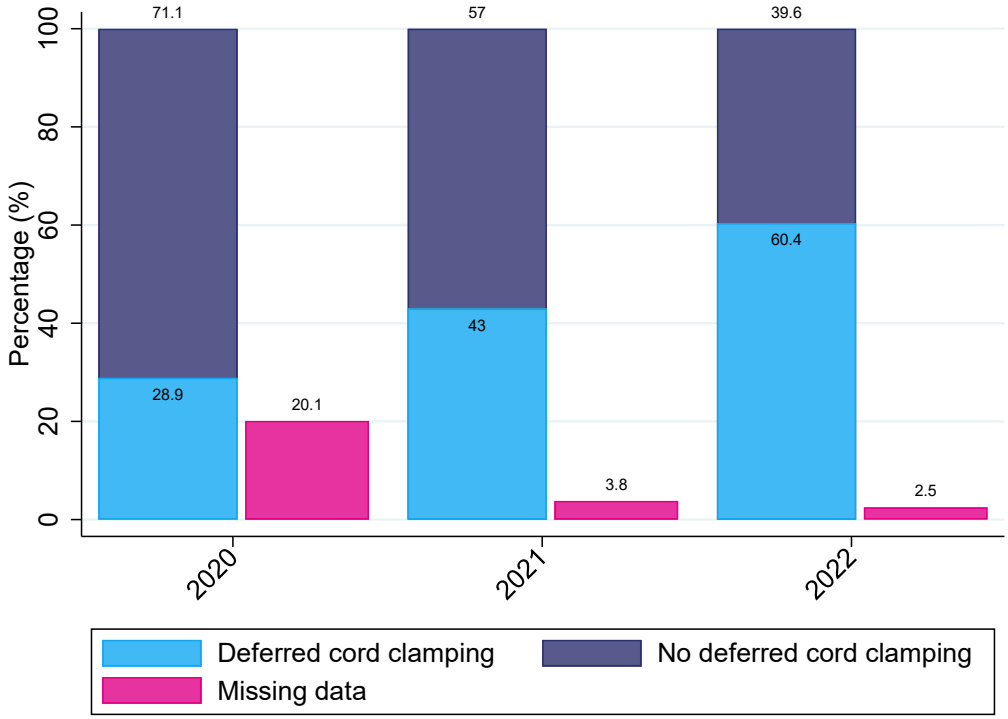
Evidence shows that avoiding immediate cord clamping reduces death in preterm babies by nearly a third.[20] Deferred cord clamping has been shown to be incompletely implemented in the UK and is one of the key perinatal care interventions identified by MatNeoSIP. This year, the measure focusses on very preterm infants born at less than 34 weeks gestational age. Prior to 2022, the measure included babies born at less than 32 weeks gestational age.

Full details of this measure can be found in the NNAP 2022 audit measures guide: https://www.rcpch.ac.uk/work-we-do/clinical-audits/nnap/measures.

[20] Fogarty, M. et al. Delayed vs early umbilical cord clamping for preterm infants: a systematic review and meta-analysis. *Am J Obstet Gynecol.* 2018 Jan;218(1):1-18. doi: 10.1016/j.ajog.2017.10.231. Available at: https://pubmed.ncbi.nlm.nih.gov/29097178/

Results

Figure 26: Deferred cord clamping, according to the contemporaneous NNAP measurement criteria, by NNAP reporting year (2020 to 2022).



Notes for interpretation:

- *In 2021, there was a change to the interpretation of missing data. Prior to 2021, a patient with a completed seconds field but with nothing entered in the minutes field would have been counted as missing.*
- *Years 2020 and 2021 do not include Scotland.*
- *In 2022,*
    - *the upper gestational age limit increased to include babies born at less than 34 weeks gestational age. Prior to 2022, the upper limit was less than 32 weeks gestational age.*
    - *babies born at home or in transit are attributed to first unit of care.*
    - *the cohort changed from babies discharged in the calendar year, to babies first admitted in the calendar year.*

Figure 27: Caterpillar plot of the proportions of deferred cord clamping at less than 34 weeks gestational age; by neonatal network or operational delivery network (ODN).

Network proportions are represented by dots. The 95% confidence intervals for a network are shown by a vertical line with each dot. Full results are available on NNAP Online.

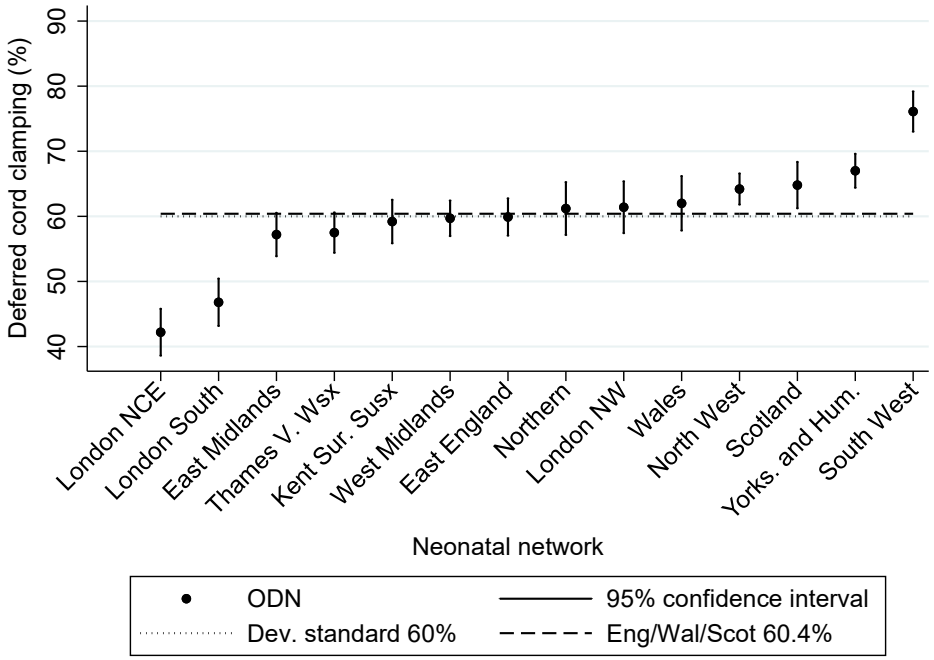


Figure 28: Caterpillar plot of the proportions of deferred cord clamping at less than 34 weeks gestational age; neonatal units.

Unit proportions are represented by dots. The 95% confidence intervals for a unit are shown by a vertical line with each dot. Neonatal units can be identified on NNAP Online.

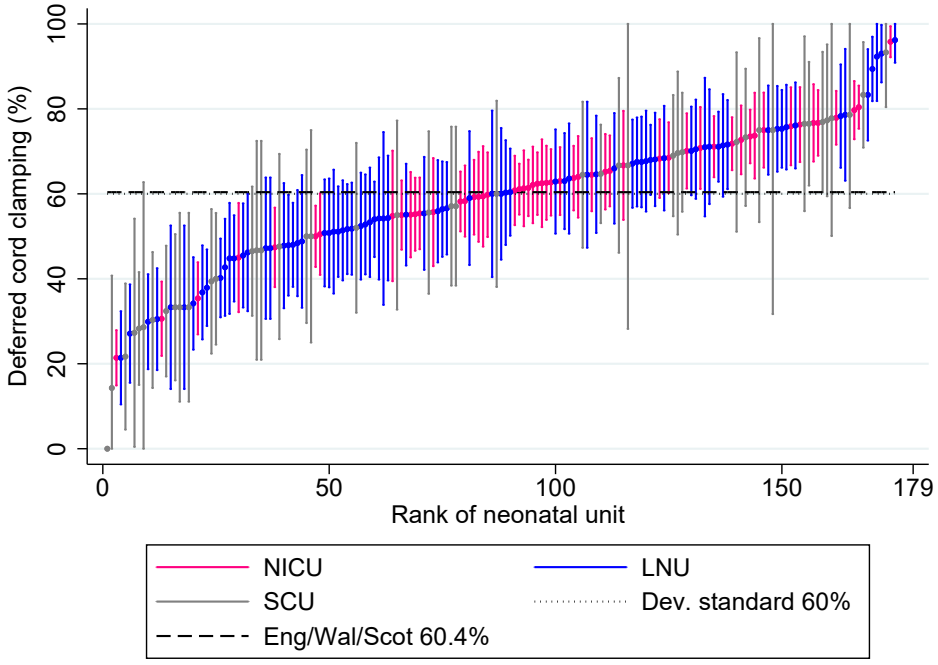


Table 13: Deferred cord clamping at less than 34 weeks gestational age, by neonatal unit level.

Unit level	Eligible babies	With outcome	Deferred cord clamping (%)	Missing (%)
Other*	48	24	11 (45.8%)	24 (50%)
SCU	1,145	1,066	589 (55.3%)	79 (6.9%)
LNU	5,160	5,011	2,898 (57.8%)	149 (2.9%)
NICU	6,852	6,770	4,270 (63.1%)	82 (1.2%)
Eng/Wal/Scot	**13,205**	**12,871**	**7,768 (60.4%)**	**334 (2.5%)**

**'Other' units are those that are hospital or healthcare locations not associated with an NNAP neonatal unit, NNAP units that have closed before the start of this audit year, or location records that are unknown.*

Summary of findings

- In 2022, 60.4% (7,768 of 12,871) of babies born at less than 34 weeks' gestation had deferred cord clamping. In 2021, the proportion was 43%. When 2022 data is analysed only including babies born at less than 32 weeks' gestation, comparable to the 2021 analysis, the proportion is 55.4%; indicating a true 12% improvement in the delivery of deferred cord clamping over the past year.

- Wide variation exists in the achievement of deferred cord clamping across networks, from 42.2% (London ODN – North Central & East) to 76.1% (South West ODN) (*Figure 27*). If the same proportion of babies experienced deferred cord clamping as occurred in the highest achieving network, then 2027 additional babies would have received deferred cord clamping. The published data suggest that this might result in as many as 61 additional neonatal survivors[21].

- Across neonatal units, we report a wide range of achievement of deferred cord clamping. Proportions of babies receiving deferred cord clamping range from 0% to 96.2%, with missing data ranging from 0% to 44.2% (*Figure 28, NNAP Online*). This suggests that further important improvements in the delivery of deferred cord clamping can be achieved.

- Achievement of deferred cord clamping is higher in NICUs at 63.1% (4,270 of 6,770), compared to LNUs – 57.8% (2,898 of 5,011), and SCUs – 55.3% (589 of 1,066) (*Table 13*).

[21] Fogarty et. Al. Delayed vs early umbilical cord clamping for preterm infants: a systematic review and metaanalysis. AJOG, VOLUME 218, ISSUE 1, P1-18, JANUARY 01, 2018. https://doi.org/10.1016/j.ajog.2017.10.231

3.5. Normal temperature on admission

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?

Low admission temperature is associated with an increased risk of illness and death in preterm babies. Low temperature (or hypothermia) is a preventable condition in vulnerable newborn babies.

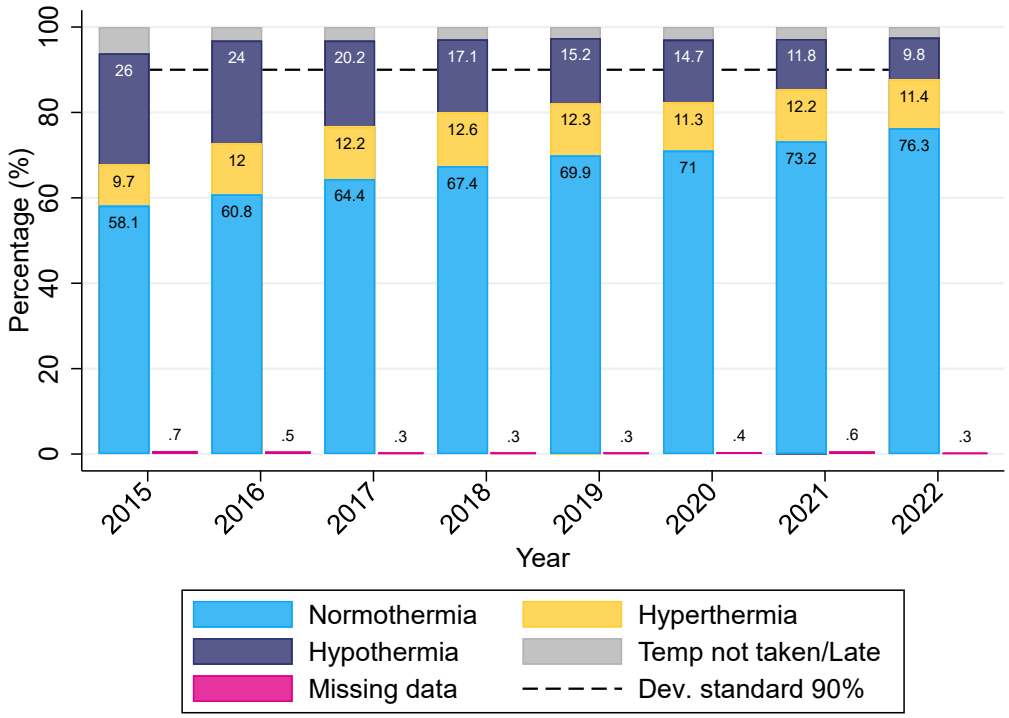
This NNAP measure looks at how successful neonatal units are at achieving a normal first temperature (between 36.5 and 37.5°C) within an hour of birth in very preterm babies. The NNAP developmental standard is that at least 90% of babies should have a temperature taken within an hour of birth and measuring within the normal range.

Full details of this measure can be found in the NNAP 2022 audit measures guide: https://www.rcpch.ac.uk/work-we-do/clinical-audits/nnap/measures.

From 2023, the cohort for this measure will include babies born at 32 and 33 weeks gestational age, in line with MatNeoSIP measurement.

Results

Figure 29. Temperature on time and within normal range, according to the contemporaneous NNAP measurement criteria, by NNAP reporting year (2015-2022).



Notes for interpretation:

- *Results for 2015 and 2016 are recalculated so that missing data is excluded from the denominator (with outcome), therefore results vary from published results. Otherwise, all results use contemporaneous definitions.*
- *Years 2020 and 2021 do not include Scotland.*
- *In 2022,*
    - *babies born at home or in transit are now attributed to first unit of care.*
    - *the cohort changed from babies discharged in the calendar year, to babies first admitted in the calendar year.*

Figure 30. Caterpillar plot of the proportions of temperature taken on time and within normal range, by neonatal network or operational delivery network (ODN).

Network proportions are represented by dots. The 95% confidence intervals for a network are shown by a vertical line with each dot. Full results are available on NNAP Online.

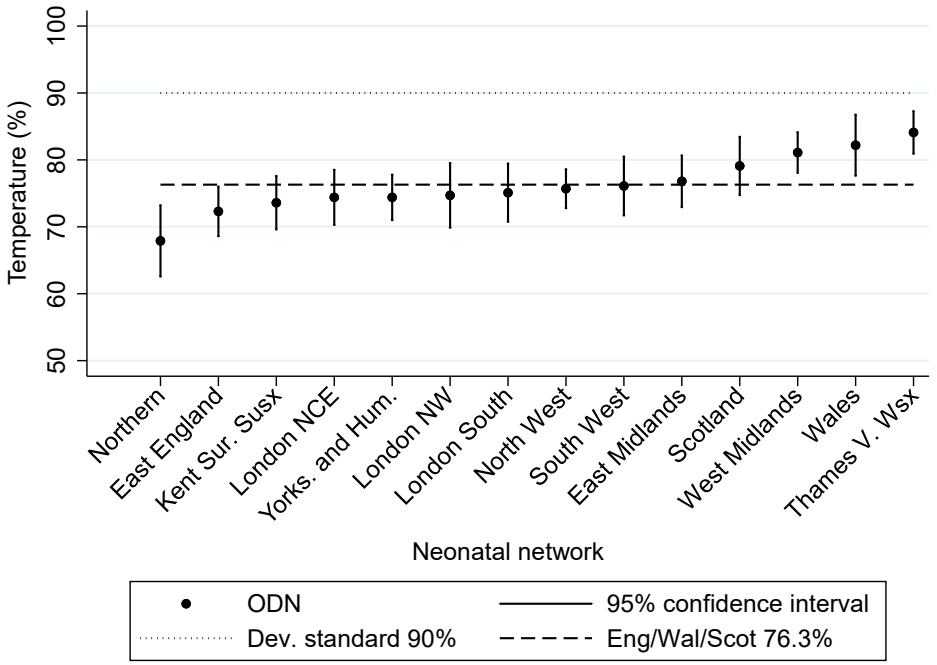


Figure 31. Caterpillar plot of the proportions of temperature taken on time and within normal range: neonatal units.

Unit proportions are represented by dots. The 95% confidence intervals for a unit are shown by a vertical line with each dot. Neonatal units can be identified on NNAP Online.

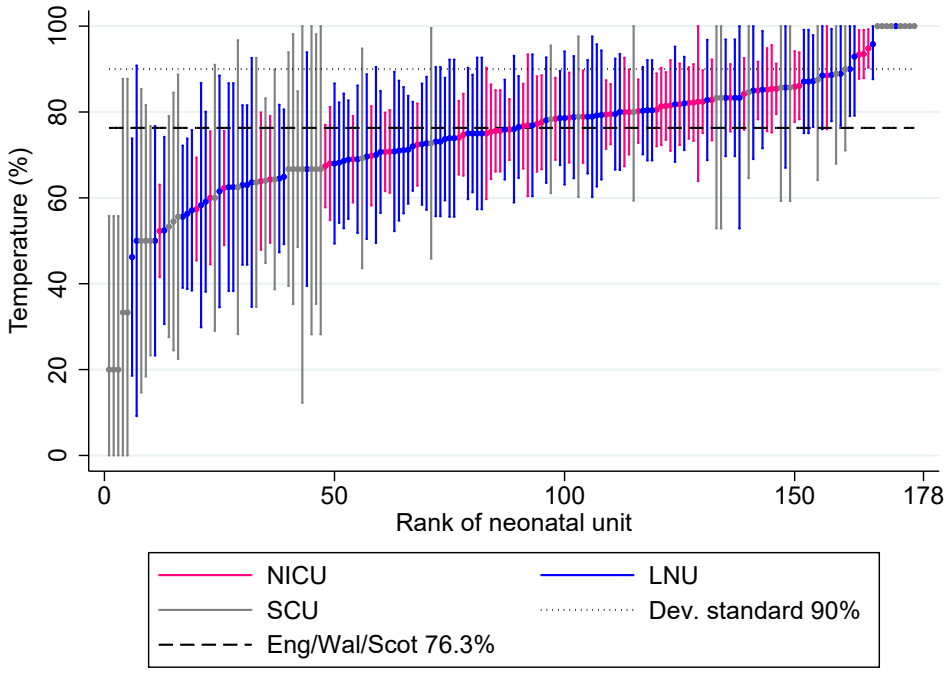


Table 14: Temperature on time and within normal range, by neonatal unit level

Unit level	Eligible babies	With outcome	Temperature measurement							
			On time					After hour	Not taken	Missing data (%)
			< 32°C	32 to 35.9°C	36 to 36.4°C	36.5 to 37.5°C	> 37.5°C			
Other*	10	9	0 (0%)	0 (0%)	0 (0%)	7 (77.8%)	1 (11.1%)	1	0	1 (10%)
SCU	399	397	0 (0%)	10 (2.5%)	63 (15.9%)	272 (68.5%)	30 (7.6%)	20	2	2 (0.5%)
LNU	2,337	2,331	0 (0%)	42 (1.8%)	183 (7.9%)	1,744 (74.8%)	315 (13.5%)	47	0	6 (0.3%)
NICU	4,032	4,018	0 (0%)	69 (1.7%)	294 (7.3%)	3,134 (78%)	427 (10.6%)	94	0	14 (0.3%)
Eng/Wal/Scot	**6,778**	**6,755**	**0 (0%)**	**121 (1.8%)**	**540 (8%)**	**5,157 (76.3%)**	**773 (11.4%)**	**162**	**2**	**23 (0.3%)**

**'Other' units are those that are hospital or healthcare locations not associated with an NNAP neonatal unit, NNAP units that have closed before the start of this audit year, or location records that are unknown.*

Summary of findings

- In 2022, 76.3% of babies had a temperature measured on time and within the normal range. There has been a sustained year on year improvement in the proportion of babies admitted with a normal temperature, from 58.1% in 2015 (*Figure 29*)[22], with no significant increase in the proportion of babies admitted with hyperthermia[23].
- Across networks, acheivement of normal temperature on admission ranges from 67.9% (Northern ODN) to 84.1% (Thames Valley and Wessex ODN). None of the neonatal networks are yet achieving the NNAP developmental standard of 90% of eligible babies with a temperature measured on time and within the normal range (*Figure 30*).
- Across units, achievement of normal temperature on admission ranges from 20% to 100%, with 9.1% (16/176) of units achieving the NNAP developmental standard of 90% of eligible babies with a temperature measured on time and within the normal range (*Figure 31*).
- Achievement is higher in NICUs at 78% (3,134 of 4,018), compared to LNUs – 74.8% (1744 of 2331), and SCUs – 68.5% (272 of 397) (*Table 14*). This suggests that either the differing staffing structure of, or the higher throughput of immature babies, typically seen in NICUs favours adherence and suggests that specific measures to continue improvements in stabilisation clinical practices outside NICUs may be needed.

[22] Cochran-Armitage test for trend, P <0.001
[23] Cochran-Armitage test for trend, P=0.06

3.6. Key messages, recommendations and actions for improvement

- Adherence to timely administration of a full course of antenatal steroids is highly variable, ranging from 45.9% to 58.5% across neonatal networks. Overall, 52% (5,861 of 11,272) of mothers who delivered a baby between 23 and 33 weeks gestational age received a full course of antenatal steroids within one week prior to delivery. This reflects the challenge of delivering antenatal steroids in a timely fashion to maximise clinical benefit. It also illustrates the challenges of measuring timely administration of steroids without concurrent description of the number of women treated with antenatal steroids through maternity data.
- In 2022, 76.3% (5,157 of 6,755) of babies had a temperature within the normal range that was measured on time. There has been a sustained year on year improvement in the proportion of babies admitted with a normal temperature, from 58.1% in 2015. There has been no significant increase in the proportion of babies admitted with hyperthermia.
- In 2022, 60.4% (7,768 of 12,871) of babies born at less than 34 weeks gestation had deferred cord clamping (DCC). In 2021 the proportion was 43%, although the 2021 DCC measure only included babies at less than 32 weeks' gestation. When 2022 data is analysed only including babies born at less than 32 weeks' gestation in line with the 2021 analysis, the proportion for 2022 is 55.4% compared to 43% in 2021; indicating a 12% improvement in the delivery of DCC over the past year. Variation between neonatal networks remains wide – from 42.2% to 76.1%.

The NNAP makes the following national recommendations:

2. **NHS England, Scottish and Welsh Governments** should ensure that pre-term birth is optimally managed by a multidisciplinary team by:
    - ensuring that preterm birth lead teams (including an obstetrician, neonatologist, neonatal nurse and midwife) are commissioned at all neonatal services,
    - requiring that **Integrated Care Systems (ICS), Health Boards in Scotland and Local Health Boards in Wales**, ensure that all neonatal services take a perinatal team approach to design and delivery of care that includes parents with diverse backgrounds and diverse experience of neonatal care,

- ensuring that **perinatal teams** conduct reviews of preterm birth cases to identify opportunities for improvement to maximise quality of care, and the delivery of the interventions identified by national improvement initiatives.[24],[25],[26]

3. **NHS England, Scottish and Welsh Governments** should ensure that maternity data flows describe the administration of antenatal steroids, and other perinatal optimisation interventions, and that maternity and perinatal data are linked nationally in order to:
   - understand rates of timely exposure of preterm infants to perinatal optimisation interventions in the context of the number of women treated, regardless of whether they go on to deliver significantly preterm,
   - improve reporting of neonatal outcomes of maternity care, in line with the recommendation made in 'Reading the signals'[27] and to support national improvement initiatives.[24,25,26]

Actions for local quality improvement

- **Preterm birth lead teams** should use new NNAP frequent reporting tools and quality improvement methodology to understand the proportion of babies receiving perinatal care interventions in their service and network, to identify opportunities for improvement to maximise quality of care, and the delivery of interventions identified by national improvement initiatives.[24,25,26]
- **Perinatal teams** should use the following resources to strengthen their multi-disciplinary team working and improve the proportion of babies receiving perinatal care interventions:
  - BAPM toolkits and resources:
    - Building Successful Perinatal Optimisation Teams Toolkit
    - Antenatal Optimisation for Preterm Infants less than 34 weeks: A QI Toolkit
    - Maternal Breastmilk Toolkit
    - Normothermia Toolkit
    - Optimal Cord Management Toolkit
    - Perinatal Optimisation Pathway Resources (BAPM and BICS)
  - West of England Academic Health Sciences Network, PERIPrem
  - The QUiPP App Toolkit
  - Maternity Transformation Programme, Perinatal Culture and Leadership Programme (England only), further information available via login at: https://future.nhs.uk/.

[24] NHS England. Saving Babies Lives Care Bundle version 3 (England).

[25] Scottish Patient Safety Programme, Maternity and Children Quality Improvement Collaborative. Preterm Perinatal Wellbeing Package.

[26] Wales Maternity & Neonatal Network. PERIPrem Cymru.

[27] Kirkup, B. Reading the Signals: Maternity and neonatal services in East Kent – the Report of the Independent Investigation

- The Scottish Patient Safety Programme (SPSP) Maternity and Children Quality Improvement Collaborative (MCQIC) Preterm Perinatal Wellbeing Package
- Case study: *Optimal Timing of Antenatal Corticosteroids to improve outcomes in preterm birth.* Thames Valley & Oxford Academic Health Sciences Network

4. Parental partnership in care

4.1. Breastmilk feeding in the first two days of life

Does a baby born at less than 34 weeks gestational age receive any of their own mother's milk in the first two days of life?

The NNAP is delivering measurement of breastmilk in the first two days of life because currently data describing breastmilk use within 24 hours of birth are insufficiently complete to usefully describe early breastmilk use. Expert opinion suggests that very early breastmilk use is both clinically beneficial and also that high rates of usage in a unit are an indication that early postnatal support to the mothers of preterm babies in expressing breastmilk is successful.

This measure is new for 2022 and will be amended if other data flows become available to better describe the care pathway that is intended to maximise use of maternal breastmilk for feeding of preterm infants.

Full details of this measure can be found in the NNAP 2022 audit measures guide: https://www.rcpch.ac.uk/work-we-do/clinical-audits/nnap/measures.

Results

Figure 32: Caterpillar plot of proportions of any breastmilk feeding in the first two days of life, by neonatal network or operational delivery network (ODN).

Network proportions are represented by dots. The 95% confidence intervals for a network are shown by a vertical line with each dot. Full results are available on NNAP Online.

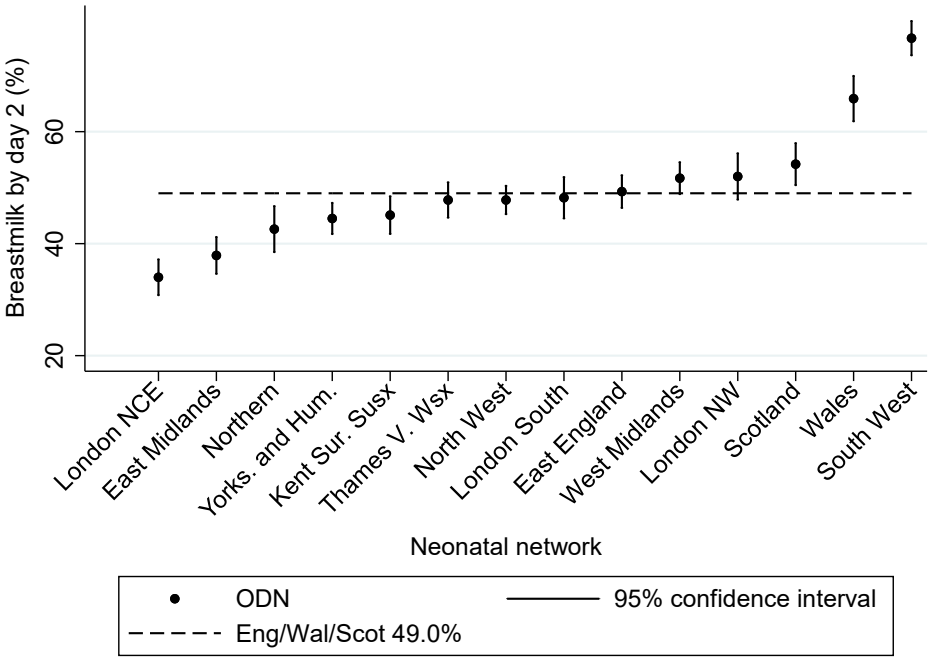


Figure 33: Caterpillar plot of proportions of any breastmilk feeding in the first two days of life, by neonatal unit.

Unit proportions are represented by dots. The 95% confidence intervals for a unit are shown by a vertical line with each dot. Neonatal units can be identified on NNAP Online. Units with < 3 eligible babies with an outcome are not included.

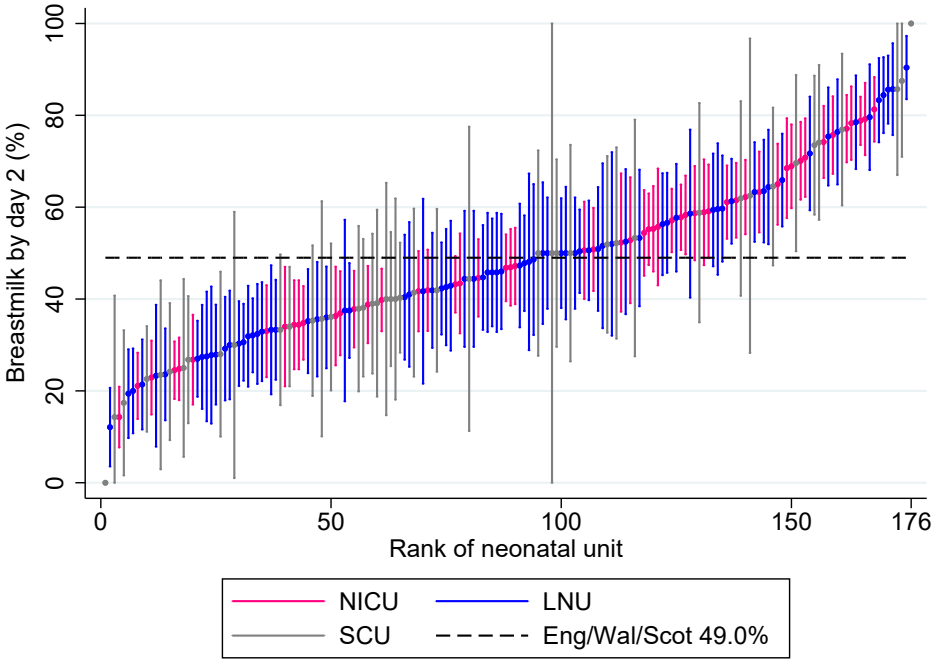


Table 15: Feeding by day 2 of life, by neonatal network.

Network	Eligible babies	With Outcome	Mothers milk only (%)	Mixed feeding (%)	Any mothers milk (%)	Other (%)	Nil by mouth (%)	Missing (%)
East Midlands ODN	899	873	220 (25.2%)	111 (12.7%)	331 (37.9%)	241 (27.6%)	300 (34.4%)	26 (2.9%)
East of England Perinatal ODN	1,185	1,180	314 (26.6%)	268 (22.7%)	582 (49.3%)	363 (30.8%)	234 (19.8%)	5 (0.4%)
Kent, Surrey, Sussex ODN	887	880	171 (19.4%)	226 (25.7%)	397 (45.1%)	307 (34.9%)	176 (20%)	7 (0.8%)
London ODN - North C & E	920	882	197 (22.3%)	103 (11.7%)	300 (34%)	151 (17.1%)	430 (48.8%)	38 (4.1%)
London ODN - North West	592	586	104 (17.7%)	201 (34.3%)	305 (52%)	210 (35.8%)	71 (12.1%)	6 (1%)
London ODN - South	764	735	247 (33.6%)	107 (14.6%)	354 (48.2%)	202 (27.5%)	179 (24.4%)	29 (3.8%)
North West ODN	1,612	1,572	548 (34.9%)	204 (13%)	752 (47.8%)	311 (19.8%)	509 (32.4%)	40 (2.5%)
Northern ODN	585	582	182 (31.3%)	66 (11.3%)	248 (42.6%)	146 (25.1%)	188 (32.3%)	3 (0.5%)
Scotland	728	708	203 (28.7%)	181 (25.6%)	384 (54.2%)	218 (30.8%)	106 (15%)	20 (2.7%)
South West ODN	767	765	403 (52.7%)	184 (24.1%)	587 (76.7%)	102 (13.3%)	76 (9.9%)	2 (0.3%)
Thames Valley & Wessex ODN	1,008	1,004	269 (26.8%)	211 (21%)	480 (47.8%)	271 (27%)	253 (25.2%)	4 (0.4%)
Wales	552	549	253 (46.1%)	109 (19.9%)	362 (65.9%)	117 (21.3%)	70 (12.8%)	3 (0.5%)
West Midlands ODN	1,276	1,236	503 (40.7%)	136 (11%)	639 (51.7%)	266 (21.5%)	331 (26.8%)	40 (3.1%)
Yorkshire & Humber ODN	1,291	1,285	370 (28.8%)	202 (15.7%)	572 (44.5%)	292 (22.7%)	421 (32.8%)	6 (0.5%)
Eng/Wal/Scot	**13,066**	**12,837**	**3,984 (31%)**	**2,309 (18%)**	**6,293 (49%)**	**3,197 (24.9%)**	**3,344 (26%)**	**229 (1.8%)**

Table 16: Feeding by day 2 of life, by neonatal unit level.

Unit level	Count	With outcome	Mothers milk only (%)	Mixed feeding (%)	Any Mothers milk (%)	Other (%)	Nil By Mouth (%)	Missing (%)
SCU	1,119	1,109	245 (22.1%)	236 (21.3%)	481 (43.4%)	345 (31.1%)	283 (25.5%)	10 (0.9%)
LNU	5,078	5,042	1,409 (27.9%)	977 (19.4%)	2,386 (47.3%)	1,373 (27.2%)	1,282 (25.4%)	36 (0.7%)
NICU	6,869	6,686	2,330 (34.8%)	1,096 (16.4%)	3,426 (51.2%)	1,479 (22.1%)	1,779 (26.6%)	183 (2.7%)
Eng/Wal/Scot	**13,066**	**12,837**	**3,984 (31%)**	**2,309 (18%)**	**6,293 (49%)**	**3,197 (24.9%)**	**3,344 (26%)**	**229 (1.8%)**

Summary of findings

- The NNAP report, for the first time this year, the proportion of babies born at less than 34 weeks gestational age who receive any of their own mother's milk in the first two days of life. Overall, 49% (6,293 of 12,837) of babies are receiving their mother's milk during this time. Levels of missing data can be a limiting factor in early reporting, however only 1.8% (229 of 13,066) are missing an outcome for this measure.
- Across networks, proportions of breastmilk feeding in the first two days of life range from 34% (London ODN – North Central & East) to 76.7% (South West ODN) (*Figure 32, Table 15*).
- Among neonatal units, proportions of breastmilk feeding in the first two days of life vary greatly (*Figure 33*). For example, proportions of breastmilk feeding in NICUs range from 14.3% to 81.3%, a finding which is most unlikely to be explained by case mix, and which almost certainly represents an opportunity for at least some units to evolve their practice based on that of other units.
- Achievement is higher in NICUs at 51.2% (3,426 of 6,686), compared to LNUs – 47.3% (2,386 of 5,042), and SCUs – 43.4% (481 of 1,109) (*Table 16*).

4.2. Breastmilk feeding at day 14

Does a baby born at less than 34 weeks gestational age receive any of their own mother's milk on day 14 of age?

For babies to benefit from both early and long term benefits of breastmilk, mothers of very preterm babies have to be successful in establishing expression, and to sustain this expression and intent to breastmilk feed over a long period. This measure is designed to assess the success of initiation of breastmilk expression, to support comparison between units, and quality improvement activities based on this.

For 2022 reporting of breastmilk feeding at day 14 of life, the upper gestational age limit was increased to include babies born at 32 and 33 weeks gestational age. This change was made to increase the relevance and utility of this measure for units caring for fewer babies born at lower gestational ages, and to align with the MatNeoSIP measurement strategy in England.

Full details of this measure can be found in the NNAP 2022 audit measures guide: https://www.rcpch.ac.uk/work-we-do/clinical-audits/nnap/measures.

Results

Figure 34: Caterpillar plot of proportions of any breastmilk feeding on day 14 of life, by neonatal network or operational delivery network (ODN).

Network proportions are represented by dots. The 95% confidence intervals for a network are shown by a vertical line with each dot. Full results are available on NNAP Online.

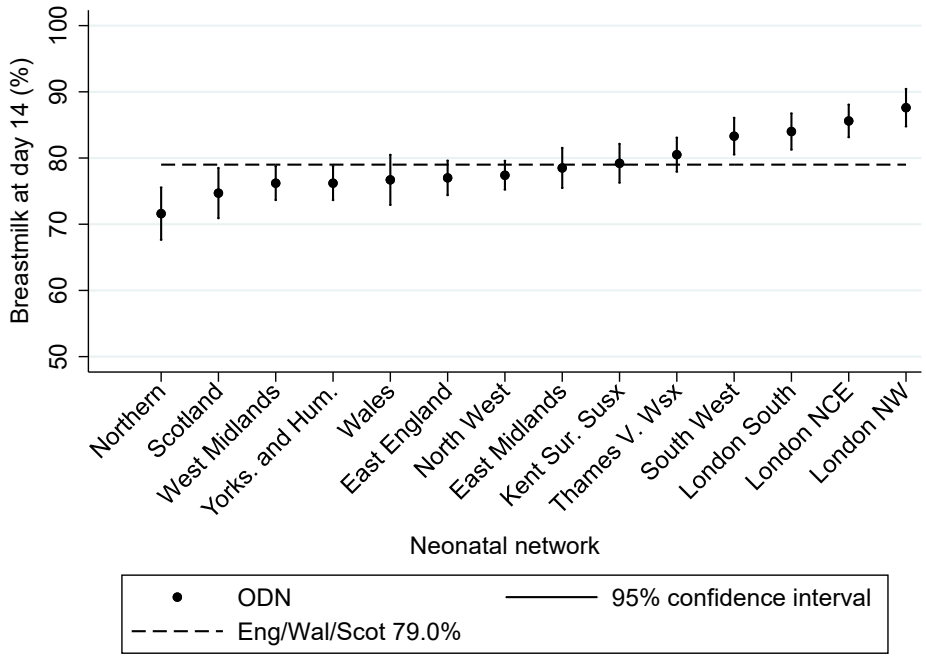


Figure 35: Caterpillar plot of proportions of any breastmilk feeding on day 14 of life, by neonatal unit.

Unit proportions are represented by dots. The 95% confidence intervals for a unit are shown by a vertical line with each dot. Neonatal units can be identified on NNAP Online. Units with < 3 eligible babies with an outcome are not included.

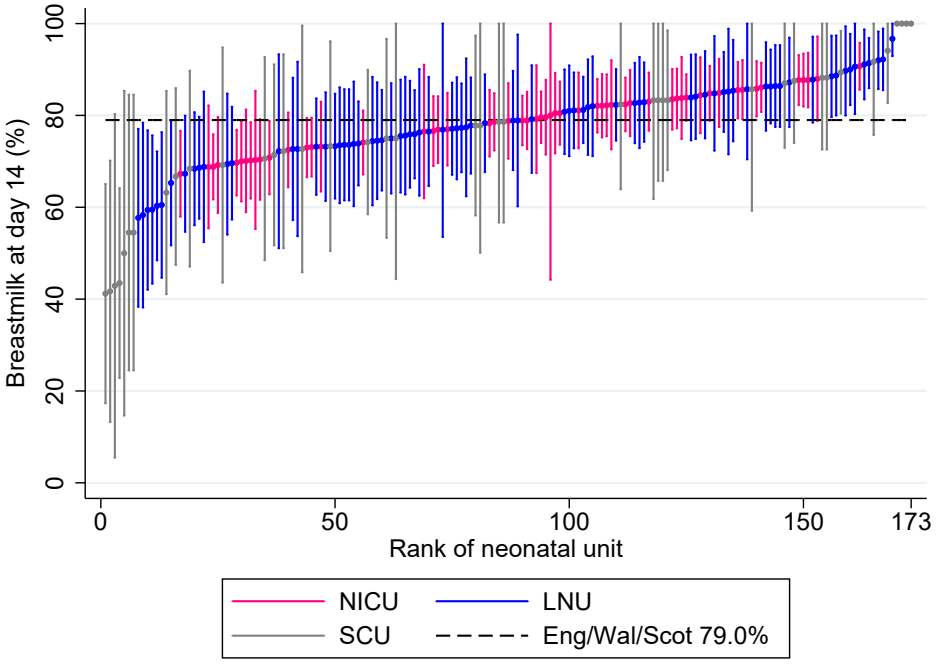


Table 17: Feeding at day 14 of life, by neonatal network.

Network	Eligible babies	With Outcome	Mothers milk only (%)	Mixed feeding (%)	Any mothers milk (%)	Other (%)	Missing (%)
East Midlands ODN	735	735	199 (27.1%)	378 (51.4%)	577 (78.5%)	158 (21.5%)	0 (0%)
East of England Perinatal ODN	1,044	1,038	296 (28.5%)	503 (48.5%)	799 (77%)	239 (23%)	6 (0.6%)
Kent, Surrey, Sussex ODN	766	764	260 (34%)	345 (45.2%)	605 (79.2%)	159 (20.8%)	2 (0.3%)
London ODN - North C & E	821	808	171 (21.2%)	521 (64.5%)	692 (85.6%)	116 (14.4%)	13 (1.6%)
London ODN - North West	543	540	185 (34.3%)	288 (53.3%)	473 (87.6%)	67 (12.4%)	3 (0.6%)
London ODN - South	714	713	185 (25.9%)	414 (58.1%)	599 (84%)	114 (16%)	1 (0.1%)
North West ODN	1,476	1,474	437 (29.6%)	70 (47.8%)	1141 (77.4%)	333 (22.6%)	2 (0.1%)
Northern ODN	522	518	125 (24.1%)	246 (47.5%)	371 (71.6%)	147 (28.4%)	4 (0.8%)
Scotland	526	525	134 (25.5%)	258 (49.1%)	392 (74.7%)	133 (25.3%)	1 (0.2%)
South West ODN	724	723	204 (28.2%)	398 (55%)	602 (83.3%)	121 (16.7%)	1 (0.1%)
Thames Valley & Wessex ODN	941	940	241 (25.6%)	516 (54.9%)	757 (80.5%)	183 (19.5%)	1 (0.1%)
Wales	499	498	88 (17.7%)	294 (59%)	382 (76.7%)	116 (23.3%)	1 (0.2%)
West Midlands ODN	1,124	1,112	251 (22.6%)	596 (53.6%)	847 (76.2%)	265 (23.8%)	12 (1.1%)
Yorkshire & Humber ODN	1,108	1,108	271 (24.5%)	573 (51.7%)	844 (76.2%)	264 (23.8%)	0 (0%)
Eng/Wal/Scot	**11,543**	**11,496**	**3,047 (26.5%)**	**6,034 (52.5%)**	**9,081 (79%)**	**2,415 (21%)**	**47 (0.4%)**

Table 18: Feeding at day 14 of life, by neonatal unit level

Unit level	Eligible babies	With outcome	Mothers milk only (%)	Mixed feeding (%)	Any mothers milk (%)	Other (%)	Missing (%)
SCU	641	640	113 (17.7%)	370 (57.8%)	483 (75.5%)	157 (24.5%)	1 (0.2%)
LNU	4,240	4,228	947 (22.4%)	2,403 (56.8%)	3,350 (79.2%)	878 (20.8%)	12 (0.3%)
NICU	6,662	6,628	1,987 (30%)	3,261 (49.2%)	5,248 (79.2%)	1,380 (20.8%)	34 (0.5%)
Eng/Wal/Scot	**11,543**	**11,496**	**3,047 (26.5%)**	**6,034 (52.5%)**	**9,081 (79%)**	**2,415 (21%)**	**47 (0.4%)**

Summary of findings

- The overall proportion of babies receiving breastmilk feeding at 14 days of life is 79% (9,081 of 11,496). In 2022, the upper gestational age limit was increased to include babies born at 32 and 33 weeks gestational age. For the 2021 data report, the NNAP published data for this measure relating only to babies born at less than 32 weeks.
- In 2021, the proportion for England and Wales was 80.5%, a comparable analysis for 2022 (babies born at less than 32 weeks gestational age, England and Wales only) gives a proportion of 81.9% (5,294 of 6,465); indicating some modest improvement in promoting maternal milk use for premature babies.
- Across neonatal networks, proportions range from 71.6% (Northern ODN) to 87.6% (London ODN – North West) (*Figure 34*). Notably the difference in use of breastmilk at day 14 is much less marked than the difference on day 1 or 2.
- Among neonatal units with three or more eligible babies, proportions range from 41.2% to 100% (*Figure 35*).
- Achievement is slightly higher in NICUs (79.2% - 5,248 of 6,628) and LNUs (79.2% - 3,350 of 4,228), than SCUs (75.5% - 483 of 640) (*Table 18)*.

4.3. Breastmilk feeding at discharge home

Does a baby born at less than 34 weeks gestational age receive any of their own mother's milk at discharge to home from a neonatal unit?

For babies to benefit from both early risk modification (e.g. reduction in NEC) and long term benefits of breastmilk, mothers of very preterm babies have to be successful in establishing expression, and to sustain this expression and intent to breastmilk feed over a long period. This measure of the 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.

For 2022 reporting of breastmilk feeding at discharge home, the upper gestational age limit was increased to include babies born at 32 and 33 weeks gestational age. This change was made to increase the relevance and utility of this measure for units caring for fewer babies born at lower gestational ages, and to align with the MatNeoSIP measurement strategy in England.

Full details of this measure can be found in the NNAP 2022 audit measures guide: https://www.rcpch.ac.uk/work-we-do/clinical-audits/nnap/measures.

Results

Figure 36: Caterpillar plot of any breastmilk feeding at discharge home, by neonatal network or operational delivery network (ODN).

Network proportions are represented by dots. The 95% confidence intervals for a network are shown by a vertical line with each dot. Full results are available on NNAP Online.

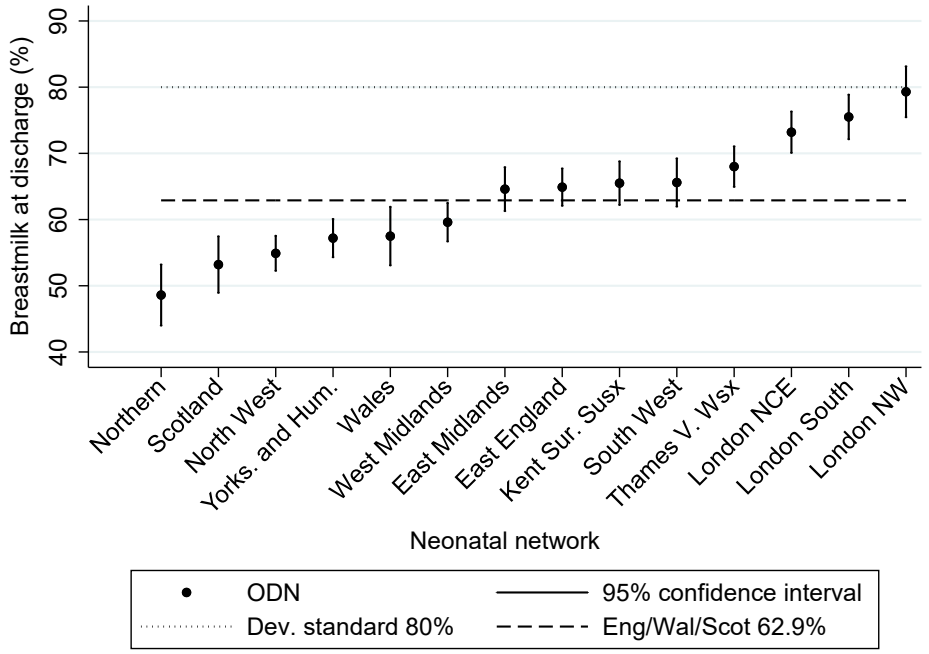


Figure 37: Caterpillar plot of any proportions of breastmilk feeding at discharge home, by neonatal unit.

Unit proportions are represented by dots. The 95% confidence intervals for a unit are shown by a vertical line with each dot. Neonatal units can be identified on NNAP Online. Units with < 3 eligible babies with an outcome are not included.

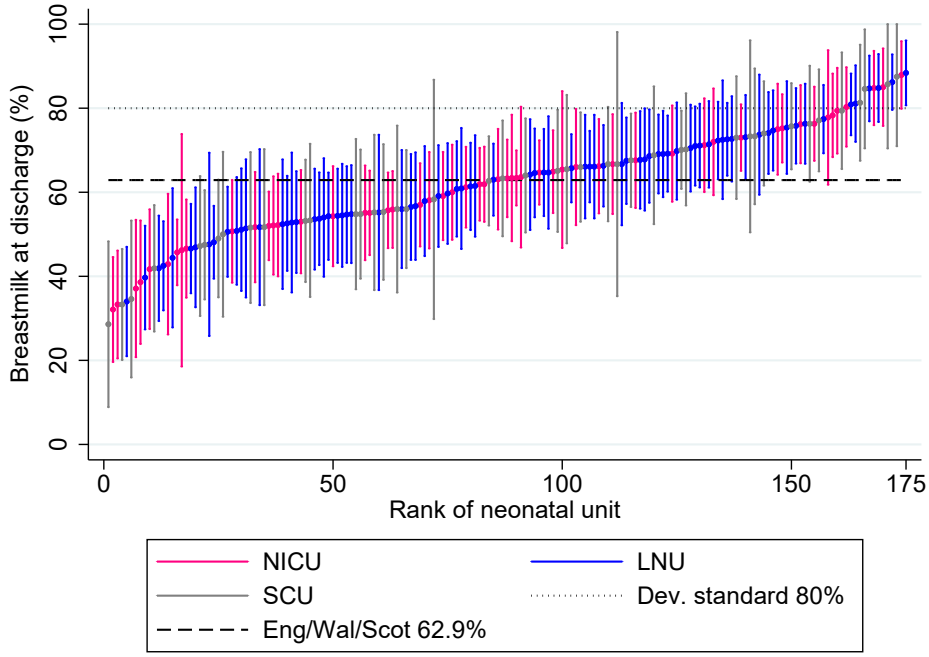


Figure 38: Proportion of babies receiving any breastmilk by day 2, compared to proportion receiving any mother's milk at discharge, by neonatal unit.

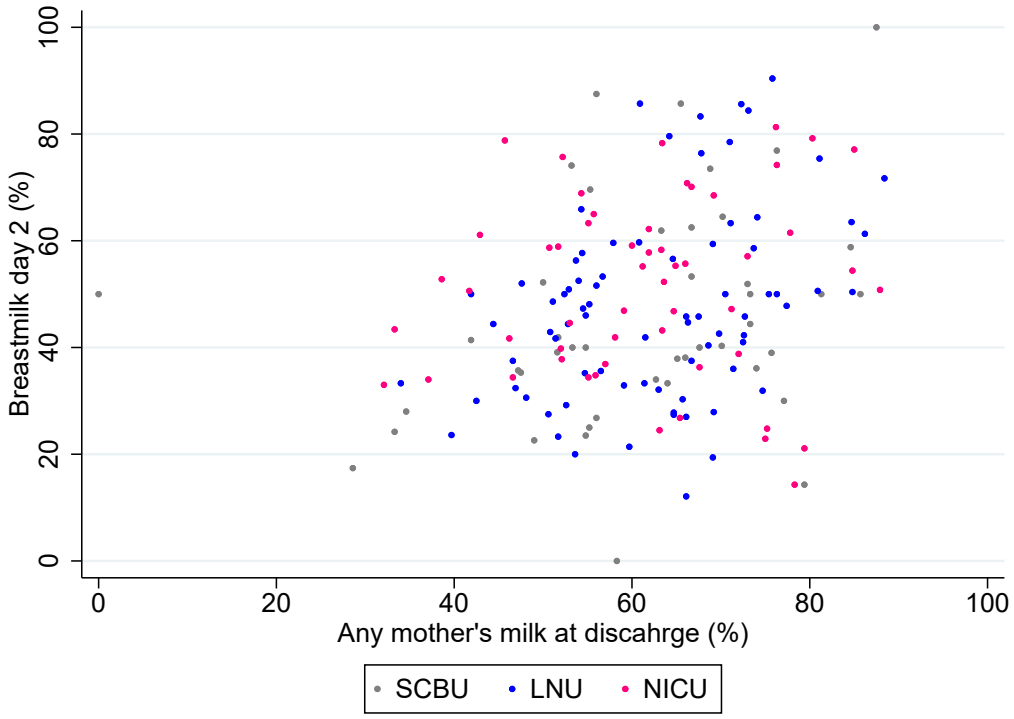


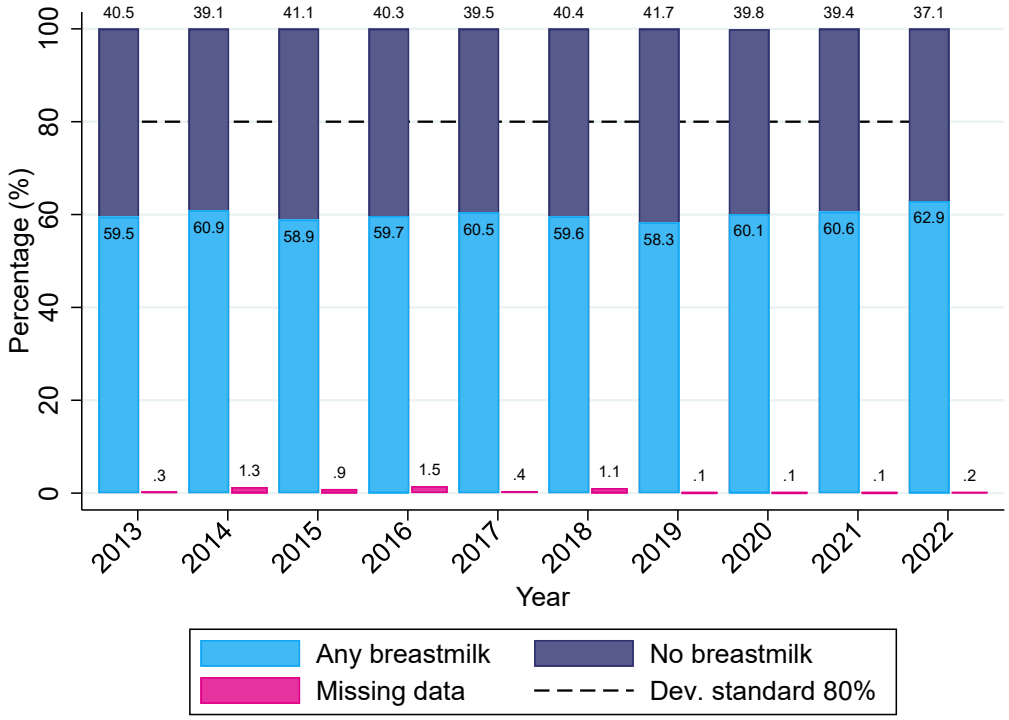
Table 19: Feeding at discharge home, by neonatal network.

Provider ODN	Eligible babies	With outcome	Mothers milk only (%)	Mixed feeding (%)	Any mothers milk (%)	Other (%)	Missing (%)
East Midlands ODN	836	835	122 (14.6%)	417 (49.9%)	539 (64.6%)	296 (35.4%)	1 (0.1%)
East of England Perinatal ODN	1,149	1,149	199 (17.3%)	547 (47.6%)	746 (64.9%)	403 (35.1%)	0 (0%)
Kent, Surrey, Sussex ODN	838	837	139 (16.6%)	409 (48.9%)	548 (65.5%)	289 (34.5%)	1 (0.1%)
London ODN - North C & E	808	807	113 (14%)	478 (59.2%)	591 (73.2%)	216 (26.8%)	1 (0.1%)
London ODN - North West	445	445	85 (19.1%)	268 (60.2%)	353 (79.3%)	92 (20.7%)	0 (0%)
London ODN - South	657	656	90 (13.7%)	405 (61.7%)	495 (75.5%)	161 (24.5%)	1 (0.2%)
North West ODN	1,427	1,425	221 (15.5%)	562 (39.4%)	783 (54.9%)	642 (45.1%)	2 (0.1%)
Northern ODN	475	471	76 (16.1%)	153 (32.5%)	229 (48.6%)	242 (51.4%)	4 (0.8%)
Scotland	552	549	79 (14.4%)	213 (38.8%)	292 (53.2%)	257 (46.8%)	3 (0.5%)
South West ODN	683	683	174 (25.5%)	274 (40.1%)	448 (65.6%)	235 (34.4%)	0 (0%)
Thames Valley & Wessex ODN	932	932	105 (11.3%)	529 (56.8%)	634 (68%)	298 (32%)	0 (0%)
Wales	504	501	102 (20.4%)	186 (37.1%)	288 (57.5%)	213 (42.5%)	3 (0.6%)
West Midlands ODN	1,145	1,141	133 (11.7%)	547 (47.9%)	680 (59.6%)	461 (40.4%)	4 (0.4%)
Yorkshire & Humber ODN	1,178	1,178	185 (15.7%)	489 (41.5%)	674 (57.2%)	504 (42.8%)	0 (0%)
Eng/Wal/Scot	**11,629**	**11,609**	**1,823 (15.7%)**	**5,477 (47.2%)**	**7,300 (62.9%)**	**4,309 (37.1%)**	**20 (0.2%)**

Table 20: Feeding at discharge home, by neonatal unit level

Unit level	Eligible babies	With outcome	Mothers milk only (%)	Mixed feeding (%)	Any mothers milk (%)	Other (%)	Missing (%)
SCU	1,712	1,706	293 (17.2%)	767 (45%)	1,060 (62.1%)	646 (37.9%)	6 (0.4%)
LNU	5,663	5,660	854 (15.1%)	2,767 (48.9%)	3,621 (64%)	2,039 (36%)	3 (0.1%)
NICU	4,254	4,243	676 (15.9%)	1,943 (45.8%)	2,619 (61.7%)	1,624 (38.3%)	11 (0.3%)
Eng/Wal/Scot	**11,629**	**11,609**	**1,823 (15.7%)**	**5,477 (47.2%)**	**7,300 (62.9%)**	**4,309 (37.1%)**	**20 (0.2%)**

Figure 39. Breastmilk feeding at discharge home, by NNAP reporting year (2013 to 2022)



Notes for interpretation:

- *Results for years 2010-2016 are recalculated so that missing data is excluded from the denominator (with outcome), therefore results vary from published results. Otherwise, all results use contemporaneous definitions.*
- *Years 2013, 2014, 2020 and 2021 do not include Scotland.*
- *Prior to 2019, the upper gestational age limit was 33 weeks.* In 2020 and 2021, the gestational age limit was 32 weeks.
- In 2022, the upper gestational age limit was increased to included babies born at 32 and 33 weeks gestational age (see summary of findings for further interpretation of the 2022 result).

Summary of findings

- The overall proportion of babies receiving breastmilk feeding at discharge home is 62.9% (7,300 of 11,611). In 2022, the measure definition changed to include babies born at 32 and 33 weeks gestation. In 2021, the proportion for England and Wales was 60.6%, a comparable analysis for 2022 (babies born at less than 32 weeks gestational age, England and Wales only) gives a proportion of 60.1%.; indicating that the apparent improvement is explained by the change in gestational age inclusion criteria.

- In the previous nine years of NNAP reporting, proportions of breastmilk feeding at discharge have remained relatively static, ranging between 58.3 and 60.9% (*Figure 39*).

- Across neonatal networks, proportions range from 48.6% (Northern ODN) to 79.3% (London ODN – North West). In 2021, the range was 52% (Northern ODN) to 75.6% (London ODN – South) (*Figure 36*). The differences between networks in proportions of breastmilk feeding are comparable, but much larger in scale, at discharge compared to at day 14. It may be that small differences in proportions of feeding at day 14 become amplified by the interplay between family, professional and cultural influences, resulting in the much wider range of the proportion of babies fed at least some maternal breastmilk by the time of discharge.
- Achievement is marginally higher in LNUs (64% - 3,621 of 5,660), than SCUs (62.1% - 1,060 of 1,706) and NICUs (61.7% - 2,619 of 4,245) (*Table 20*).
- *Figure 38* indicates some association between proportions of initiation of breastmilk feeding by day 2 and proportions of breastmilk feeding at discharge home, however it is important to note that association may not imply causation. Additional factors and underlying mechanism may be responsible for the observed correlation and therefore further analysis is required to account for other potentially confounding factors.

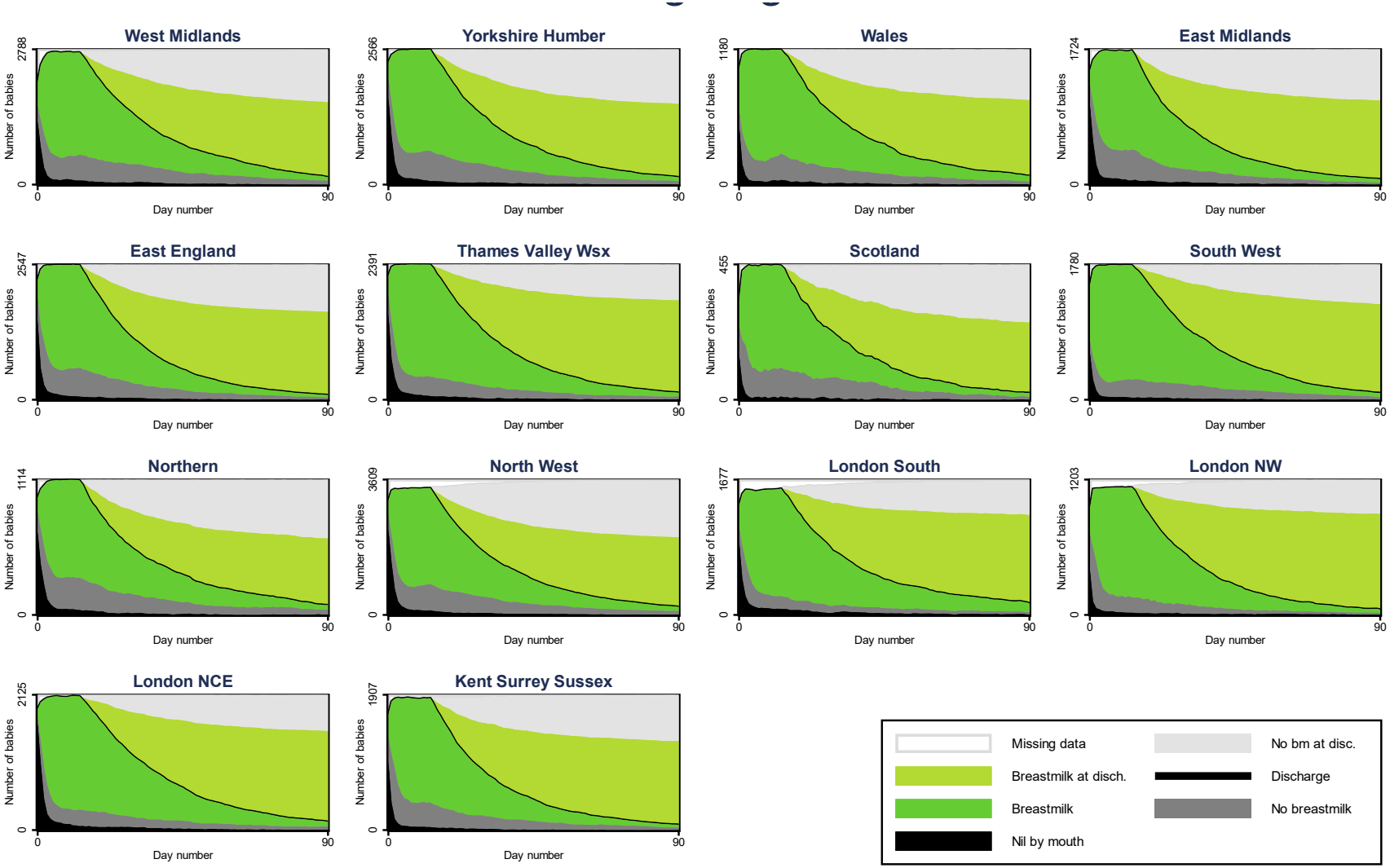
4.4. Breastmilk feeding through the neonatal admission

These plots describe the number of very preterm babies receiving their mother's milk as inpatients. The plots show the number of babies (on the vertical axis) who were fed with breastmilk, and alternatives, for each day of life (on the horizontal axis). The timing of discharge is denoted by a solid black curved line separating the green colour segments. The purpose of these plots is to illustrate how practice varies between ODNs and units, and to stimulate focussed quality improvement activity. An example plot is given in Figure 40 based on the feeding journey from admission to day 90 in a unit with 100 babies and achieving the NNAP developmental standard of 80% of babies receiving any of their mother's own milk at discharge home from the neonatal unit.

Figure 40. Breastmilk feeding from admission to day 90, example neonatal unit plot

Figure 41 shows examples of plots which describe rates of maternal milk feeding for very preterm babies as inpatients, and how they vary by network. Unit plots are available on NNAP Online.

Figure 41. Breastmilk feeding proportions from admission to day 90, by neonatal network



4.5. Parental consultation within 24 hours of admission

Is there a documented consultation with parents by a senior member of the neonatal team within 24 hours of a baby's admission?* [28,29,30]

**Consultant or middle grade doctor, or a nurse practitioner acting in such a role.*

It is important that neonatal teams explain to parents, the care provided to babies admitted to neonatal unit. If families are well informed they will be more able to be fully involved in decision making for 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. This measure of care looks at whether parents have had a consultation with 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. A consultation should take place within 24 hours of admission for every baby, for every admission.

Full details of this measure can be found in the NNAP 2022 audit measures guide: https://www.rcpch.ac.uk/work-we-do/clinical-audits/nnap/measures.

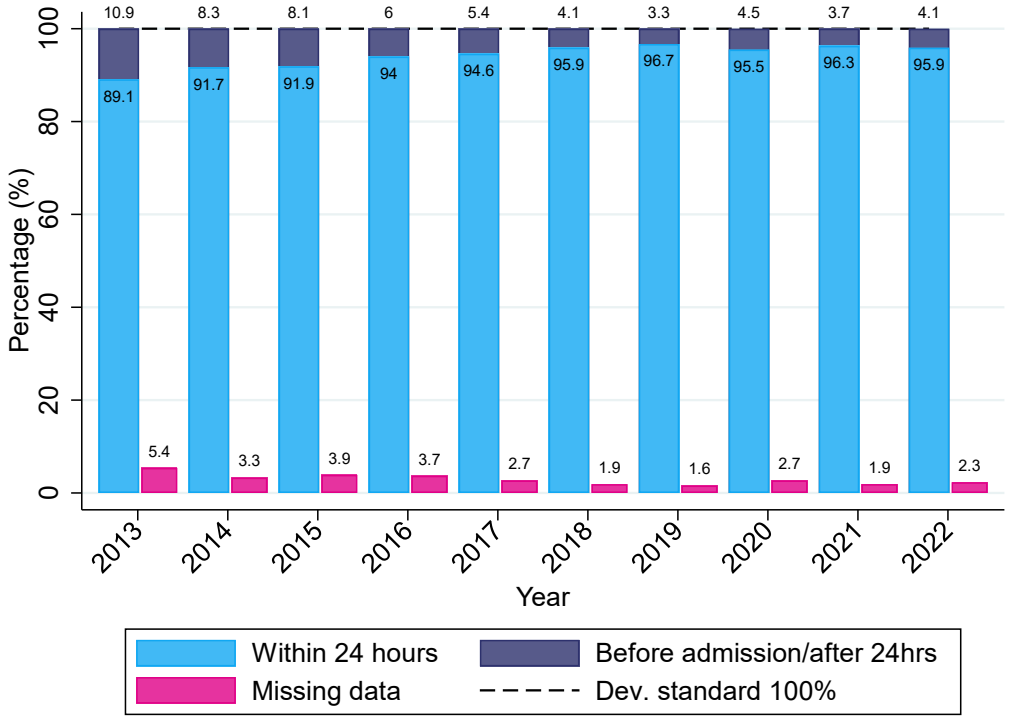
[28] Scottish Government. *Neonatal Care in Scotland: A Quality Framework*. 2013. Available from http://www.gov.scot/Resource/0041/00415230.pdf.

[29] Welsh Health Specialised Services Committee, NHS Wales. *All Wales Neonatal Standards - 2nd Edition*. 2013. Available from http://www.wales.nhs.uk/document/219405.

[30] Department of Health. *Toolkit for high quality neonatal services*. 2009. Available from https://webarchive.nationalarchives.gov.uk/ukgwa/20100604134939/http://www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsPolicyAndGuidance/DH_107845

Results

Figure 42: Time of first consultation, according to the contemporaneous NNAP measurement criteria, by NNAP reporting year (2013 to 2022).



Notes for interpretation:

- *Results for 2013-2016 are recalculated so that missing data is excluded from the denominator (with outcome), therefore results vary from published results. Otherwise, all results use contemporaneous definitions.*
- *Years 2013, 2014, 2020 and 2021 do not include Scotland.*
- *The 2020 data year was the first in which all admissions, rather than just first episodes, were included in this measure.*
- *In 2022, the cohort changed from babies discharged in the calendar year, to babies first admitted in the calendar year.*

Figure 43: Caterpillar plot of the proportions of first consultation within 24 hours of admission, by neonatal network or operational delivery network (ODN).

Network proportions are represented by dots. The 95% confidence intervals for a network are shown by a vertical line with each dot. Full results are available on NNAP Online.

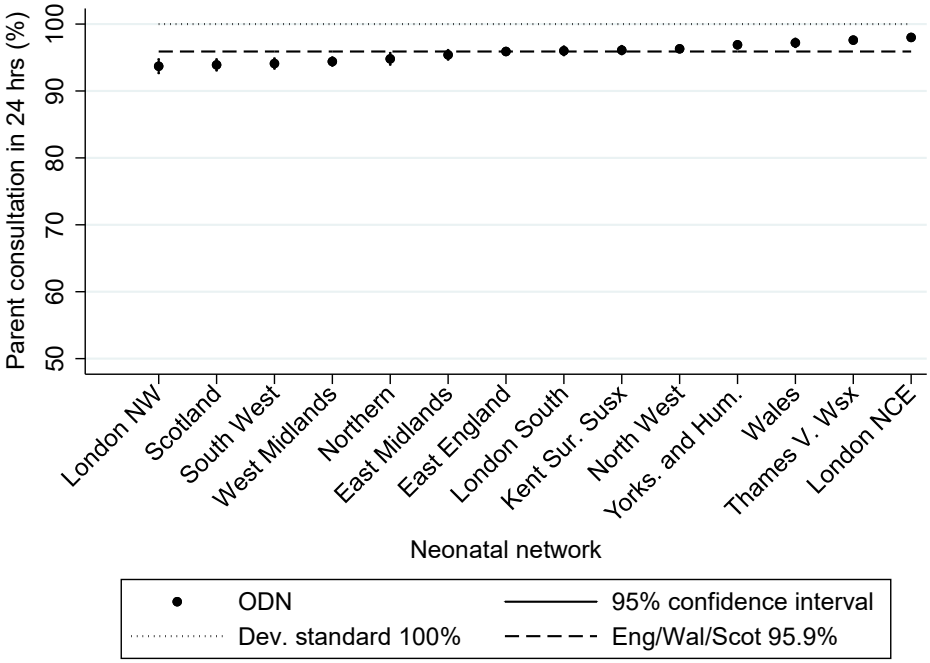


Figure 44. Caterpillar plot of the proportions of first consultation within 24 hours of admission: neonatal units.

Unit proportions are represented by dots. The 95% confidence intervals for a unit are shown by a vertical line with each dot. Neonatal units can be identified on NNAP Online.

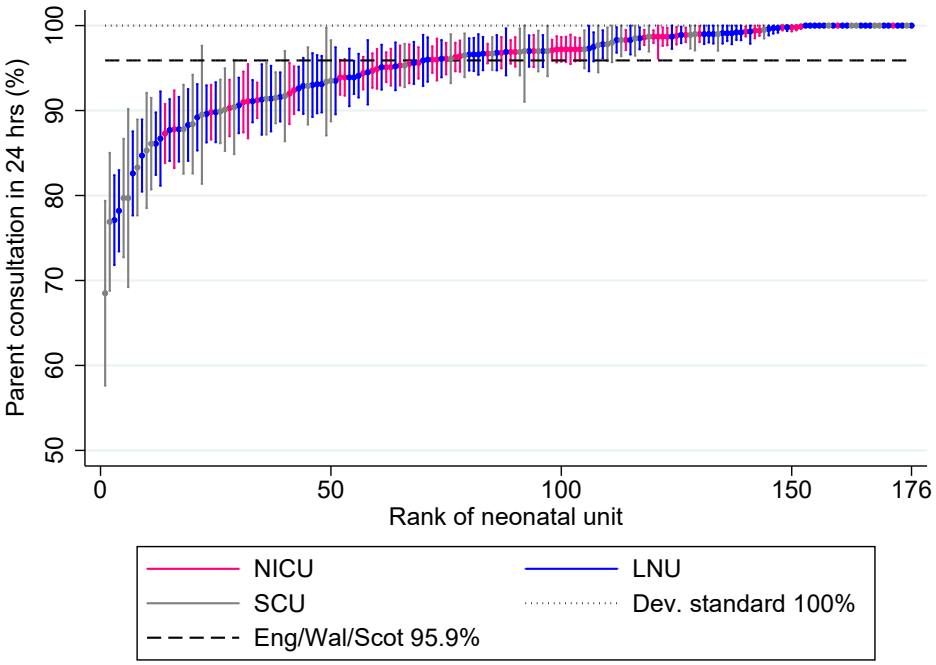


Table 21: First consultation within 24 hours of every admission, by neonatal unit level.

Unit Level	Eligible admissions	With outcome	Within 24 hours	Before admission	After 24 hours	No consultation	Unknown (%)
SCU	7,084	6,882	6,481 (94.2%)	175	150	76	202 (2.9%)
LNU	22,986	22,460	21,459 (95.5%)	467	369	165	526 (2.3%)
NICU	26,449	25,889	25,017 (96.6%)	209	451	212	560 (2.1%)
Eng/Wal/Scot	**56,519**	**55,231**	**52,957 (95.9%)**	**851**	**970**	**453**	**1,288 (2.3%)**

Summary of findings

- The proportion of admissions where a consultation took place between parents and a senior member of the neonatal team within 24 hours is 95.9% (52,957 of 55,231). The proportion of neonatal admissions where a consultation with parents took place within 24 hours of admission has remained static over the past five years (*Figure 42*).
- Across neonatal networks, the proportion ranges from 93.7% (London ODN – North West) to 98% (London ODN - North) (*Figure 43*, *NNAP Online*).
- Neonatal units range in their achievement of this measure from 68.5% to 100%, with 24 units achieving the NNAP developmental standard of 100% (*Figure 44*, *NNAP Online*). Conversely, there are 26 units where not only was the developmental standard not met, but in which more than 1 in 10 families do not seem to have met a senior clinician within 24 hours of their babies' admission.

4.6. Parental inclusion in consultant ward rounds

What proportion of baby care days had a consultant-led ward round with at least one parent included?

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

Professionals, parents' advocates, and parents agree that including parents in consultant ward rounds supports parental partnership in care. Consultant ward rounds occur regularly (usually daily, or more often) on neonatal units. This measure looks at the proportion of baby care days that had a consultant-led ward round with at least one parent included. Prior to 2022, we focussed on the proportion of admissions where parents were present on a consultant ward round on at least one occasion during a baby's stay.

Full details of this measure can be found in the NNAP 2022 audit measures guide: https://www.rcpch.ac.uk/work-we-do/clinical-audits/nnap/measures.

Results

Figure 45: Caterpillar plot of proportions of baby care days that had a consultant-led ward round with at least one parent included, by neonatal network (ODN).

Network proportions are represented by dots. The 95% confidence intervals for a network are shown by a vertical line with each dot. Full results are available on NNAP Online. Confidence intervals in the figure are smaller than other caterpillar plots because the unit of analysis is baby days rather than babies or episodes.

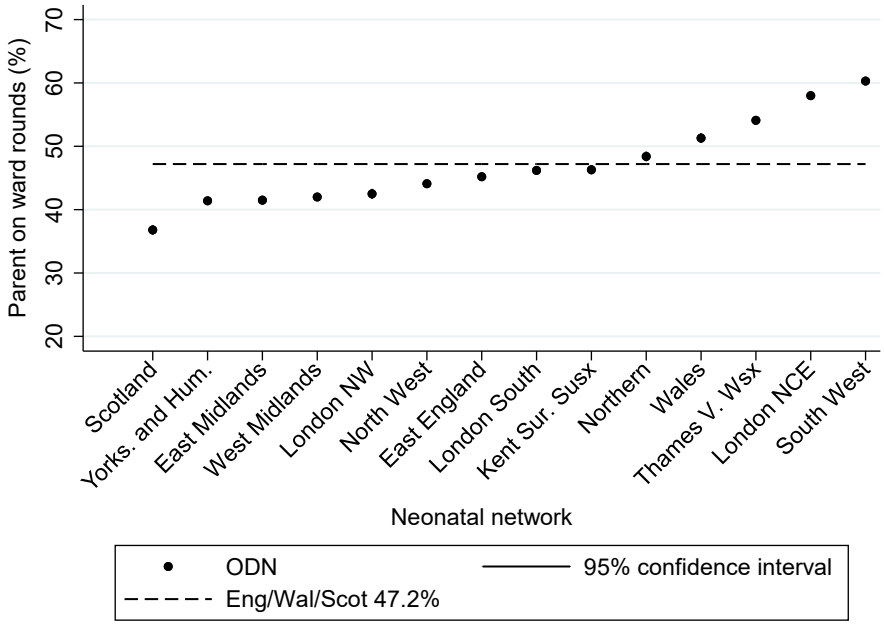


Figure 46: Caterpillar plot of proportions of baby care days that had a consultant-led ward round with at least one parent included, by neonatal unit.

Unit proportions are represented by dots. The 95% confidence intervals for a unit are shown by a vertical line with each dot. Neonatal units can be identified on NNAP Online. Confidence intervals in the figure are smaller than other caterpillar plots because the unit of analysis is baby days rather than babies or episodes.

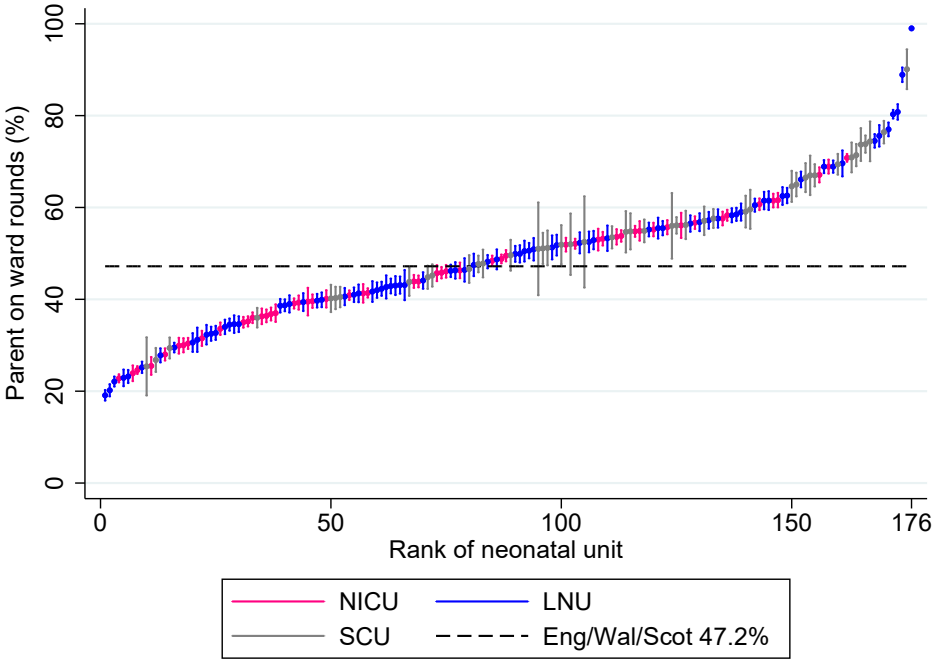


Table 22. Baby care days with at least one parent included on a consultant ward round, by length of stay

Length of stay	Eligible ward rounds	With data entered	Ward rounds		No ward round	Missing data (%)
			Ward rounds with no parent included	Ward rounds with a parent included (%)		
≤7	105,980	70,631	27,205	43,426 (61.5%)	11,236	24,113 (22.8%)
8-14	116,358	77,440	35,944	41,496 (53.6%)	12,689	26,229 (22.5%)
15-21	106,042	70,667	36,468	34,199 (48.4%)	12,212	23,163 (21.8%)
22-28	85,767	57,618	31,616	26,002 (45.1%)	9,260	18,889 (22%)
>28 days	440,797	295,059	170,476	124,583 (42.2%)	40,011	105,727 (24%)
Eng/Wal/Scot	**854,944**	**571,415**	**301,709**	**269,706 (47.2%)**	**85,408**	**198,121 (23.2%)**

Table 23: Baby care days with at least one parent included on a consultant ward round, by neonatal unit level

Unit level	Eligible ward rounds	With data entered	Ward rounds		No ward round	Missing data (%)
			Parent not included	Ward rounds with a parent included (%)		
SCU	81,360	49,273	22,773	26,500 (53.8%)	16,801	15,286 (18.8%)
LNU	323,322	246,439	127,708	118,731 (48.2%)	27,718	49,165 (15.2%)
NICU	450,262	275,703	151,228	124,475 (45.1%)	40,889	133,670 (29.7%)
Eng/Wal/Scot	**854,944**	**571,415**	**301,709**	**269,706 (47.2%)**	**85,408**	**198,121 (23.2%)**

Summary of findings

- NNAP reporting of parental inclusion in consultant ward rounds now focussed solely on the proportion of baby care days where a parent was included on the consultant ward round.
- In 2022 parents were included in ward rounds on 269,706 days of a possible 571,415 days on which a ward round occurred (47.2%). This is a 3.1 percentage point improvement since 2021, when 44.1% (227,552 of 515,565) had a parent included on the ward round.
- Across neonatal networks, proportions range from 36.8% (Scotland) to 60.3% (South West ODN) (*Figure 45*). Scotland only re-joined the NNAP for the 2022 data year, and awareness of this measure in Scotland may not be high.
- Among neonatal units, proportions range from 19.1% to 99% (*Figure 46*). Variation is high, and may be explained by both varying enthusiasm for, and success in delivery of, parental inclusion in consultant ward rounds.
- Parental inclusion in consultant ward rounds is higher in SCUs at 53.8% (26,500 of 49,273), compared to LNUs – 48.2% (118,731 of 246,439), and NICUs – 45.1% (124,475 of 275,703) (*Table 23*). This is likely related to the typically longer length of stay for babies cared for by NICUs.
- The proportion of baby care days where parents were involved in ward rounds is higher for shorter durations of stay. Early in a neonatal stay, more – and more significant - clinical decisions and diagnoses are made and parents may therefore be more likely to involve themselves in ward round care planning.
- A ward round is recorded as not taking place on 85,408 of 854,944 baby care days (10%). Data was missing for 198,121 (23.2%) baby care days (*Table 22*).

4.7. Key messages, recommendations and actions for improvement

- In 2022, the proportion of babies receiving breastmilk feeding at discharge home ranged from 48.6% to 79.3% between neonatal networks. Over time, there has been no overall change in the proportion of preterm babies receiving breastmilk feeding at the time of discharge to home. For the first time in 2022, the NNAP also reports the proportion of babies receiving breastmilk within the first two days of life; this ranges from 34% to 76.7% between neonatal networks. Improving rates of initiation of breastmilk feeding may maximise the early benefits of breastmilk and increase the chances of establishing longer term breastmilk feeding.
- There is wide variation at all levels of neonatal unit and between networks in the proportion of consultant ward rounds with parental involvement. Parents were included in ward rounds on 47.2% (269,706 of 571,415) of care days where a ward round happened on that day, ranging from 36.8% to 60.3% between neonatal networks. A ward round is recorded as not taking place on 10% (85,408 of 854,944) of baby care days, and data was missing for 23.2% (198,121 of 854,944) of baby care days.
- The proportion of neonatal admissions where a consultation with parents took place within 24 hours of admission has remained static over the past five years, with parents having a consultation with a senior member of the team for 95.9% (52,957 of 55,231) of admissions in 2022.

The NNAP makes the following national recommendation:

4. All **Royal Colleges** associated with preterm perinatal care (the **Royal College of Paediatrics and Child Health**, the **Royal College of Obstetricians and Gynaecologists**, the **Royal College of Nursing** and the **Royal College of Midwives**) should include a focus on the importance of early breastmilk feeding, and guidance on how to support parents to establish and sustain breastmilk feeding, in training relating to intrapartum care, fetal medicine care and perinatal care.

Actions for local quality improvement

- **Trusts/Health Boards** should ensure that, post the COVID-19 pandemic, full, unrestricted 24/7 access for parents to be with their baby is maintained and is central to all decision making in the neonatal service. This will support improvements in the proportion of babies receiving their mother's own milk and facilitate parent partnership in care more broadly.

- **Neonatal units** and **neonatal networks** with low rates of breastmilk feeding (within 2 days, at 14 days and at discharge), should:
    - Ensure they have a dedicated neonatal unit-based lead for infant feeding
    - Ensure that there is immediate availability of high-quality breast pumps in all neonatal settings.

- **Neonatal units** and **neonatal networks** with low rates of breastmilk feeding (within 2 days, at 14 days and at discharge), should identify opportunities to improve, and use existing quality improvement programmes and resources to support their improvement work, such as:
    - The UNICEF UK Baby Friendly Initiative
    - BAPM toolkits and resources:
        - Optimising Early Maternal Breast Milk for Preterm Infants: A QI Toolkit
        - Optimising Maternal Breastmilk for Preterm Infants Part 2 – To discharge and beyond: A QI Toolkit
        - Perinatal Optimisation Passports
    - Bliss resources:
        - Information for parents about feeding and related aspects of neonatal care
        - Emotional and practical support from Bliss
        - Bliss Baby Charter
    - West of England Academic Health Sciences Network, Perinatal Excellence to Reduce Injury in Premature Birth (PERIPrem)
    - PERIPrem Cymru
    - The Scottish Patient Safety Programme (SPSP) Maternity and Children Quality Improvement Collaborative (MCQIC) Preterm Perinatal Wellbeing Package
    - UK Neonatal Partnership Board report - National Reviews of Maternity and Neonatal Care: Supporting the perinatal team to implement recommendations.

- **Neonatal units** with low rates of breastmilk feeding at discharge should consider developing quality improvement projects involving the multidisciplinary care team and informed by the perspectives of parents with diverse neonatal experiences, to ensure high quality support before and at the time of discharge for the continuation of breastmilk feeding after discharge.

- **Neonatal units** and **neonatal networks** with low proportions of parent involvement in ward rounds and with high proportions of missing data, should address their data incompleteness, and seek to engage in activities to improve their parent partnership in care, such as:

- Co-designing quality improvement activities and projects with parents with both diverse backgrounds and experiences of neonatal care, and actively seek feedback to understand the barriers to involvement in consultant ward rounds and other aspects of their baby's care.
- Seeking to learn from other units and networks who have successfully implemented family integrated and centred care within their services.
- Using quality improvement methodologies and programmes to support their work, such as:
  - BAPM, Family Integrated Care: A Framework for Practice
  - Bliss resources:
    - Information for parents about feeding and related aspects of neonatal care
    - Emotional and practical support from Bliss
    - Bliss Baby Charter
    - Training and learning to support family integrated care and partnership
  - FiCare – The Family Integrated Care model

5. Neonatal nurse staffing

5.1. Nurse staffing on neonatal units

What proportion of nursing shifts are numerically staffed according to guidelines and service specification? [31,32,33]

Recommended nurse staffing levels are defined in the Neonatal Critical Care Service Specification[31], Toolkit for High Quality Neonatal Services[32] and the BAPM Service Standards for Hospitals Providing Neonatal Care[33] according to the level of care being provided. The NNAP looks at the total nurses required per shift and reports the proportion of shifts with sufficient nurses to meet the requirements of the Service Specification and Standards.

Full details of this measure can be found in the NNAP 2022 audit measures guide: https://www.rcpch.ac.uk/work-we-do/clinical-audits/nnap/measures.

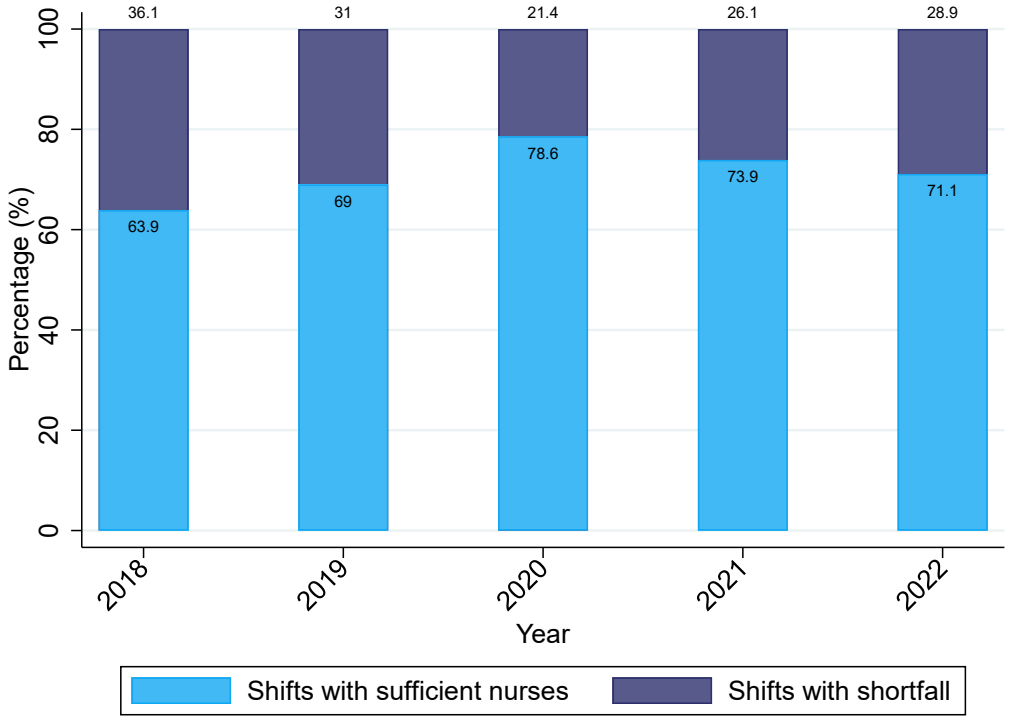
[31] NHS England. *Neonatal Critical Care Service Specification*. 2016. Available from https://www.england.nhs.uk/commissioning/spec-services/npc-crg/group-e/e08/.

[32] Department of Health. *Toolkit for high quality neonatal services*. 2009. Available from https://webarchive.nationalarchives.gov.uk/ukgwa/20100604134939/http://www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsPolicyAndGuidance/DH_107845

[33] British Association of Perinatal Medicine. *Service Standards for Hospitals Providing Neonatal Care (3rd edition)*. 2010. Available at: https://www.bapm.org/resources/32-service-standards-for-hospitals-providing-neonatal-care-3rd-edition-2010

Results

Figure 47: Proportion nurse shift sufficiently staffed, according to the contemporaneous NNAP measurement criteria, by NNAP reporting year 2018-2022



Notes for interpretation:

- *Years 2020 and 2021 do not include Scotland.*

Figure 48: Proportion of nurse shifts sufficiently staffed, by neonatal network or operational delivery network (ODN).

Network proportions are represented by dots. The 95% confidence intervals for a network are shown by a vertical line with each dot. Full results are available on NNAP Online. Confidence intervals in the figure are smaller than other caterpillar plots because the unit of analysis is nursing shifts rather than babies or episodes.

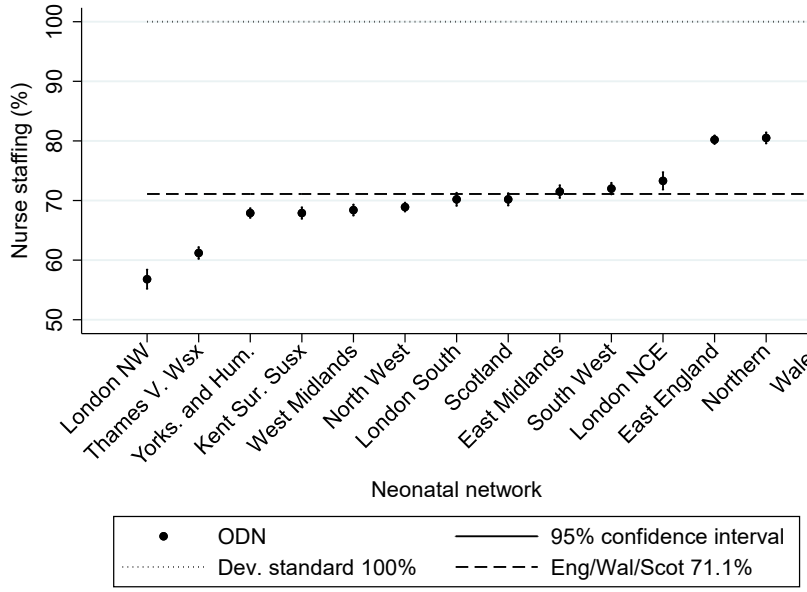


Figure 49: Proportion of nurse shifts sufficiently staffed, by neonatal unit

Unit proportions are represented by dots. The 95% confidence intervals for a unit are shown by a vertical line with each dot. Neonatal units can be identified on NNAP Online. Confidence intervals in the figure are smaller than other caterpillar plots because the unit of analysis is nursing shifts rather than babies or episodes.

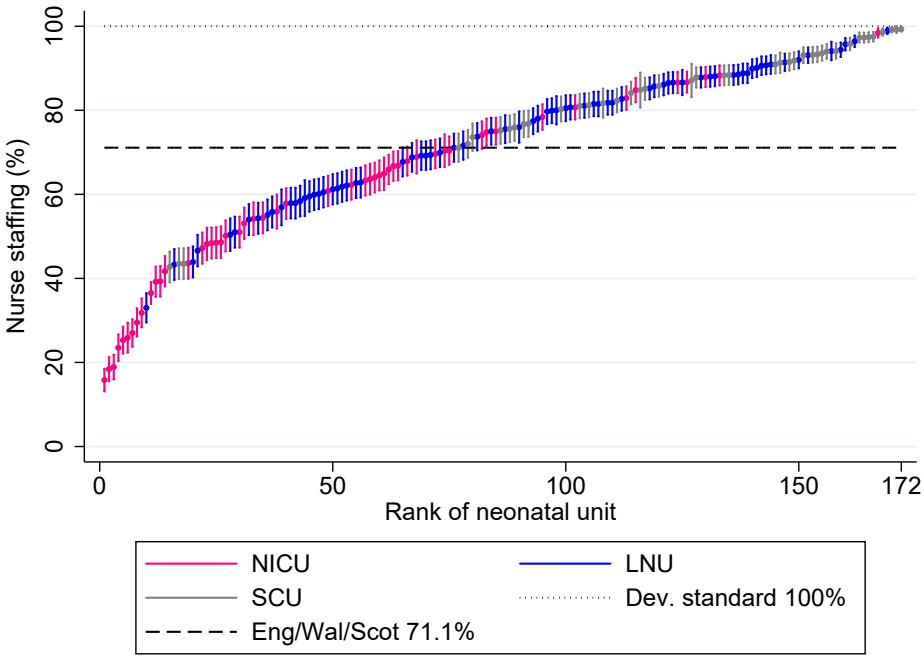


Figure 50: Adherence to recommended nurse staffing levels. Neonatal units in England, Scotland and Wales, 2022.

The number of nurse shifts required to deliver adequate staffing according to the guidelines for all 2022 shifts, based on the babies present on each shift, is shown on the horizontal axis as "unit annual workload". For example, a unit that required four nurses to care for its babies for every one of its 730 shifts had an annual workload of 4 x 730 = 2920. The vertical axis shows the proportion of these nurse shifts reported to be staffed according to guidelines.

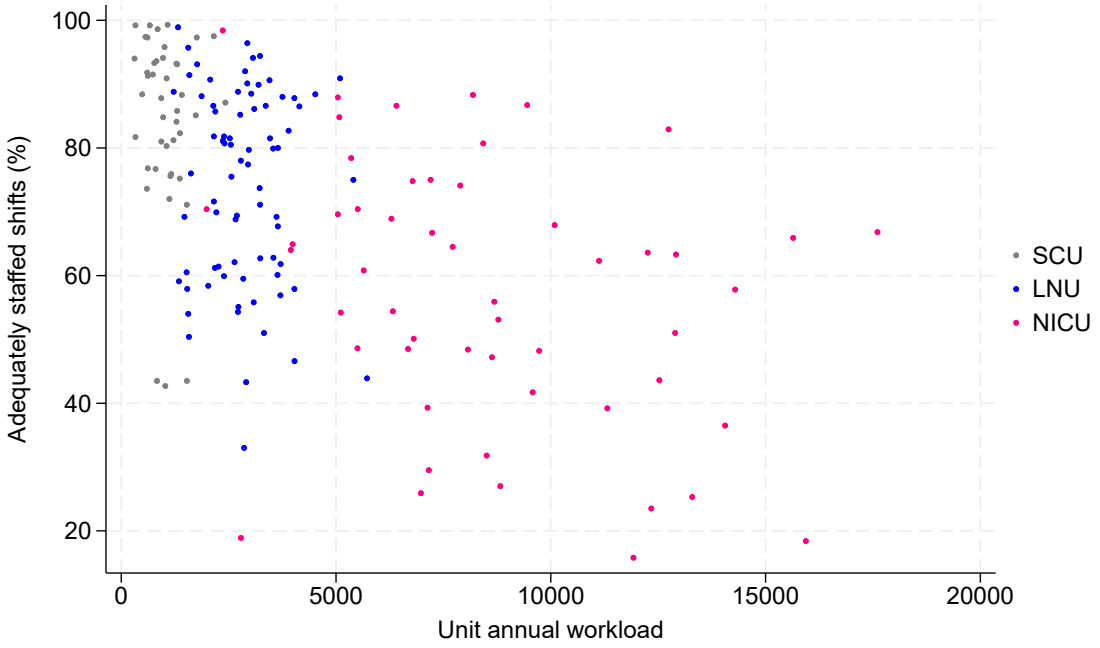
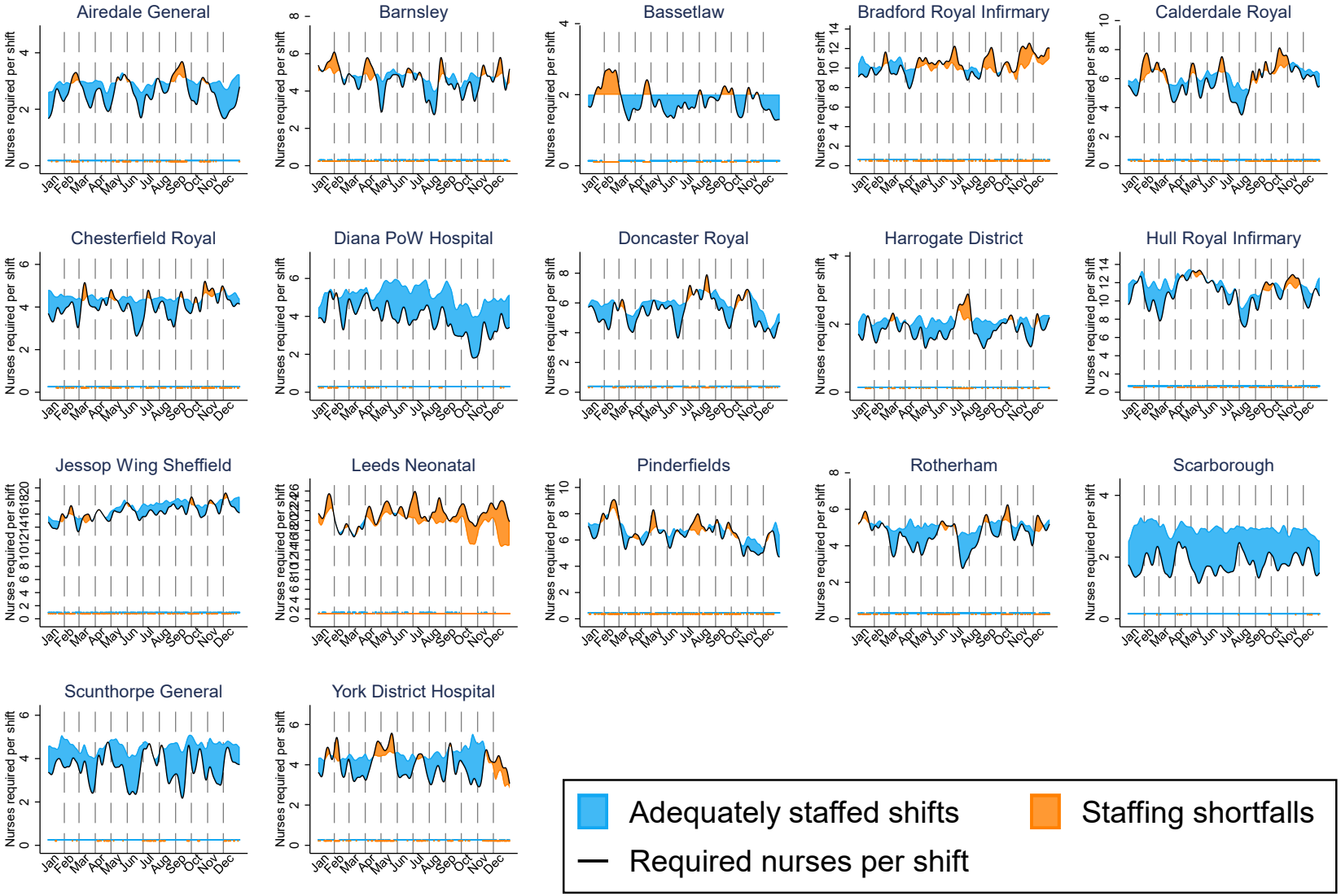


Table 24: Proportion of nurse shifts sufficiently staffed, by neonatal unit level.

Unit level	Total eligible shifts	Sufficiently staffed shifts
SCU	29,692	25,020 (84.3%)
LNU	53,631	39,738 (74.1%)
NICU	37,880	21,360 (56.4%)
Eng/Wal/Scot	**121,203**	**86,118 (71.1%)**

Figure 51. Nurse staffing summaries by month, Yorkshire & Humber Network (example)

Figure 51 is an example of nurse staffing summary plots designed to make this data useful to Trusts/Health Boards and Neonatal Networks. The horizontal axis show time in months for the year of interest. The vertical axis indicates the number of nurses. The solid black line represents the number of nurses that would be needed to care for the babies present in the unit, with some smoothing. The blue shading describes nurse staffing surplus to minimum requirement, and the orange shading shows where there is a staffing shortfall. These plots are available for all neonatal units on NNAP Online.


Airedale General
Barnsley
Bassetlaw
Bradford Royal Infirmary
Calderdale Royal
Chesterfield Royal
Diana PoW Hospital
Doncaster Royal
Harrogate District
Hull Royal Infirmary
Jessop Wing Sheffield
Leeds Neonatal
Pinderfields
Rotherham
Scarborough
Scunthorpe General
York District Hospital
Nurses required per shift
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Adequately staffed shifts
Staffing shortfalls
Required nurses per shift

Summary of findings

- The proportion of neonatal nurse shifts staffed according to recommended levels in 2022 across England, Wales and Scotland is 71.1% (England and Wales only – 71.1%), having fallen for a second year in a row (2021 – 73.9%, 2020 – 78.6% - England and Wales only) (*Figure 47*). The continuing decline in neonatal nurse staffing levels is a matter of serious concern to those providing and commissioning neonatal services, given its association with increased mortality[34].

- Among networks, the proportion of shifts staffed according to recommended levels ranges from 56.8% (London ODN – North West) to 85.3% (Wales) (*Figure 48*). Neonatal unit staffing levels range from 15.8% to 99.3% (*Figure 49*).

- Levels of nurse staffing are higher in SCUs at 84.3% (25,020 of 29,692), compared to LNUs – 74.1% (39,738 of 53,631), and NICUs – 56.4% (21,360 of 37,880) (*Table 24*). To some extent this is explained by the structure of small services who need fewer staff on each shift, who need to have some staff capacity to be able to manage sudden increases in workload. In contrast, larger services may appear to have too few staff if only a small relative proportional deficit exists on any given shift. The nurse staffing summaries by month should help contextualise staffing for planning purposes (see example *Figure 51*).

- It is notable that units of all sizes and levels experience very good, and very concerning staffing. This variation should be addressed as a matter of urgency, given the association between neonatal nurse staffing and mortality in neonatal care[34]. However, identification of outlying services though the NNAP would not be organisationally meaningful because of the high number of services that would be identified as such (over-dispersion).

[34] Hamilton KE, Redshaw ME, Tarnow-Mordi W. Nurse staffing in relation to risk-adjusted mortality in neonatal care. Arch Dis Child Fetal Neonatal Ed. 2007 Mar;92(2):F99-F103. doi: 10.1136/adc.2006.102988. Epub 2006 Nov 6. PMID: 17088341; PMCID: PMC2675478. Available at: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2675478/

5.2. Key messages, recommendations and actions for improvement

- The proportion of neonatal nurse shifts staffed according to recommended levels in 2022 across England, Wales and Scotland is 71.1% - 86,118 of 121,203 (England and Wales only – 71.1%), having fallen for a second year in a row (2021 – 73.9%, 2020 – 78.6% - England and Wales only). The continuing decline in neonatal nurse staffing levels is a matter of serious concern to those providing and commissioning neonatal services, given its association with increased mortality[35].

The NNAP makes the following national recommendation:

1. The **UK Government**, **Welsh Government** and **Scottish Government** should ensure that the implementation of fully funded medium-to-long-term NHS-wide workforce plans deliver the recruitment, training, development and retention of neonatal nurses to improve the proportion of shifts with sufficient staffing and therefore improve survival rates and the quality of care in neonatal units.

Useful resources

- Case study: *Using the NNAP measure for neonatal nurse staffing to support benchmarking, oversight of safe staffing and quality improvement across the Herts and West Essex Local Maternity and Neonatal System.*

[35] Hamilton KE, Redshaw ME, Tarnow-Mordi W. Nurse staffing in relation to risk-adjusted mortality in neonatal care. Arch Dis Child Fetal Neonatal Ed. 2007 Mar;92(2):F99-F103. doi: 10.1136/adc.2006.102988. Epub 2006 Nov 6. PMID: 17088341; PMCID: PMC2675478. Available at: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2675478/

6. Care processes

6.1. On-time screening for retinopathy of prematurity (ROP)

Does a baby born at less than 31 weeks gestational age, or weighing less than 1501g at birth undergo the first ROP screening according to the guideline?[36]

Retinopathy of prematurity (ROP) is a complication of prematurity which is largely treatable. If left undetected and untreated, severe disease can result in visual impairment. Babies at risk of developing severe ROP should be screened according to the UK screening of retinopathy of prematurity guideline.[36]

Prior to 2022, the NNAP reported against the previous guideline, and described screening within an extended window of a week either side of the then target week as adherent.

The updated guideline was published by the RCPCH in March 2022, and the NNAP measure was updated in line with the guideline. The NNAP now reports whether the time of first examination recommendation is met:

- For infants born before 31+0 weeks' GA, the first ROP examination should be performed between 31+0 and 31+6 weeks' postmenstrual age (PMA), or at 4 completed weeks' postnatal age (PNA) (28 – 34 days), whichever is later.
- For infants born from 31+0 weeks' GA, the first ROP examination should be performed at 36 weeks' PMA or 4 completed weeks' PNA (28 – 34 days), whichever is sooner.

Therefore, it is fully expected that the overall proportion of babies receiving "on time" screening will reduce this year. This is not reflective of a reduction in the quality of care, but both a tightening of the audit criteria and the alteration to a revised clinical guideline. The audit criterion in the new guideline is that the proportion of babies screened in accordance with the guideline should be reported. Previously, the NNAP had chosen to report adherence to an extended 'window' encompassing a week either side of the then target week.

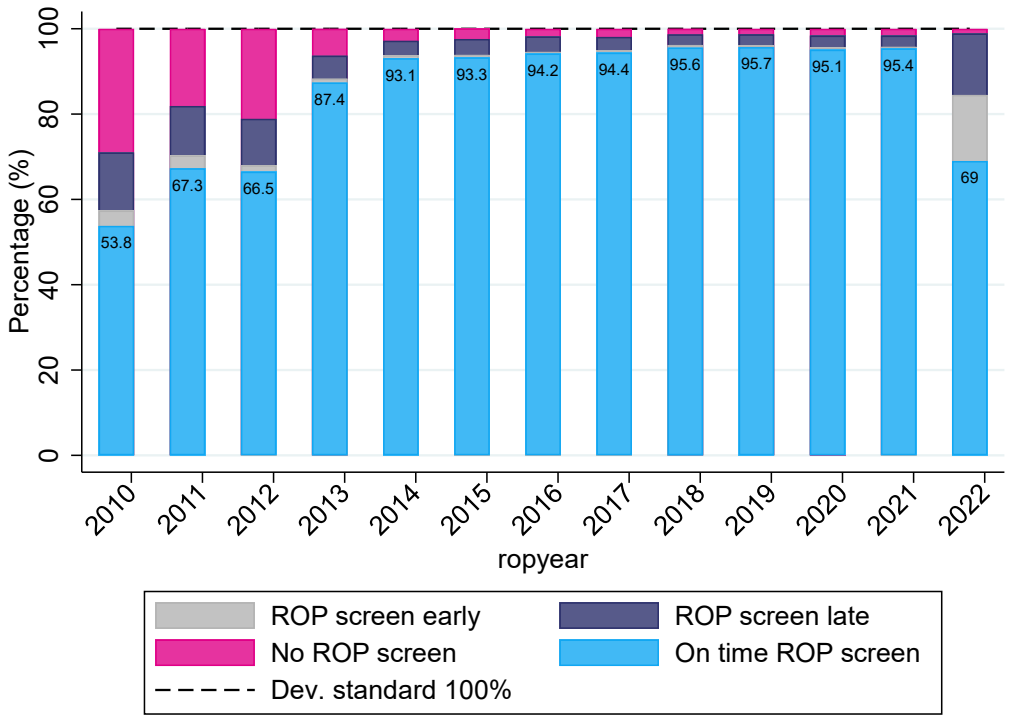
[36] Royal College of Paediatrics and Child Health. UK Screening of Retinopathy of Prematurity Guideline, March 2022. Available at: https://www.rcpch.ac.uk/sites/default/files/2022-12/FC61116_Retinopathy_Guidelines_14.12.22.pdf

Due to the publication of the new guideline in March 2022, NNAP reporting for 2022 starts from 1 April 2022. A small number of babies who were in hospital prior to the guideline change might have had their screening dates selected prior to the implementation of the new guideline.

Full details of this measure can be found in the NNAP 2022 audit measures guide: https://www.rcpch.ac.uk/work-we-do/clinical-audits/nnap/measures.

Results

Figure 52. Timing of ROP screening, according to the contemporaneous NNAP measurement criteria, by NNAP reporting year (2010-2022).



Notes for interpretation:

- *Years 2013, 2014, 2020 and 2021 do not include Scotland.*
- *In 2010-2012, on time screens after discharge were not counted as adherent, results have been recalculated to include those as adherent, so results will vary from those originally published.*
- *In 2022, the ROP screening window was changed in line with the updated screening guideline, published March 2022. Only babies admitted after 1 April 2022 are included in 2022 reporting.*

Figure 53. Caterpillar plot of the proportions of on-time ROP screening, by neonatal network or operational delivery network (ODN).

Network proportions are represented by dots. The 95% confidence intervals for a network are shown by a vertical line with each dot. Full results are available on NNAP Online.

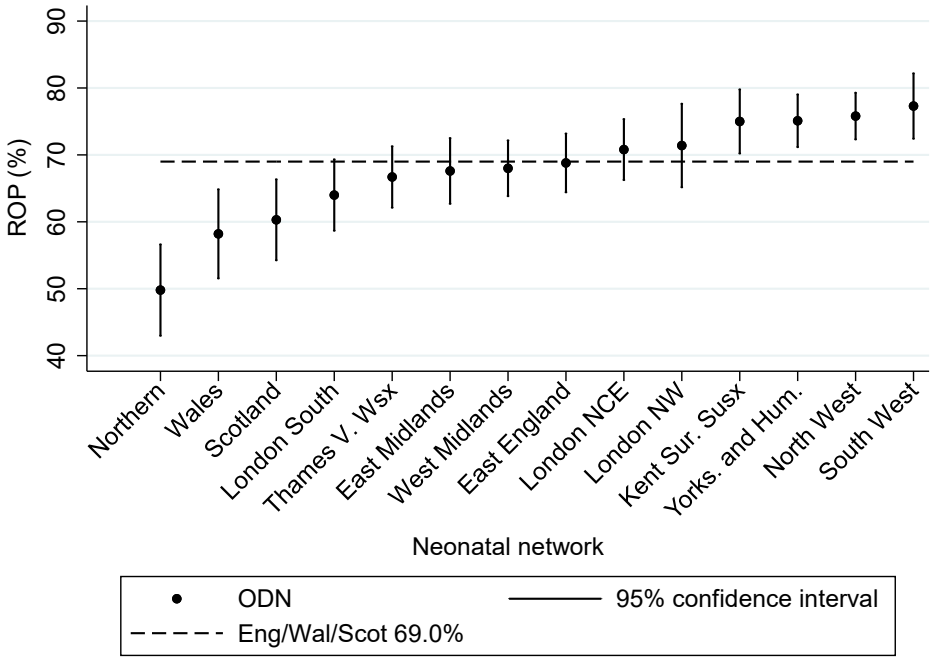


Figure 54. Caterpillar plot of the proportions of on-time ROP screening: neonatal units.

Unit proportions are represented by dots. The 95% confidence intervals for a unit are shown by a vertical line with each dot. Neonatal units can be identified on NNAP Online.

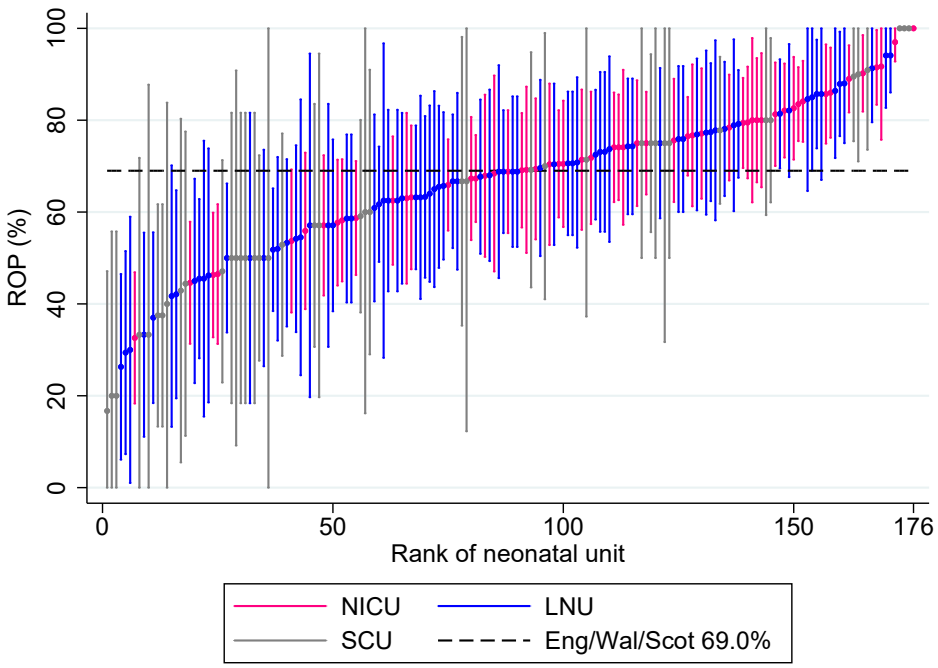


Table 25: Proportions of on-time ROP screening, by neonatal unit level

Unit level	Count	Any screen	Screened on time			Screened early	Screened late	No screen
			Total (%)	During care	After discharge			
SCU	452	438	281 (62.2%)	263	18	61	96	14
LNU	2,042	2,020	1,366 (66.9%)	1,277	89	308	346	22
NICU	2,589	2,571	1,862 (71.9%)	1,797	65	420	289	18
Eng/Wal/Scot	**5,083**	**5,029**	**3,509 (69%)**	**3,337**	**172**	**789**	**731**	**54**

Summary of findings

- The NNAP reports adherence to the updated UK screening for retinopathy of prematurity guideline, published in March 2022, for the first time this year. Overall, 69% (3,509 of 5,083) of eligible babies are screened according to the guideline. Adherence to the guideline is higher in NICUs at 71.9% (1,862 of 2,589), compared to LNUs – 66.9% (1,366 of 2,042), and SCUs – 62.2% (281 of 452) (*Table 25*).
- Network proportions range from 49.8% (Northern ODN) to 77.3% (South West ODN) (*Figure 53*). The variation between neonatal networks in on-time screening persists despite the introduction of new guidance and is a matter of some concern.
- Across neonatal units, proportions range from 16.7% to 100% (*Figure 54*).

6.2. Follow-up at two years of age

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)?

The NICE guideline on the developmental follow-up of children and young people born preterm[37] recommends that all children born at less than 30 weeks gestational age should receive a developmental assessment at two years (corrected age), with follow up also required at high gestational ages where there are additional risk factors. A developmental assessment is also recommended at four years for babies born before 28 weeks gestation.

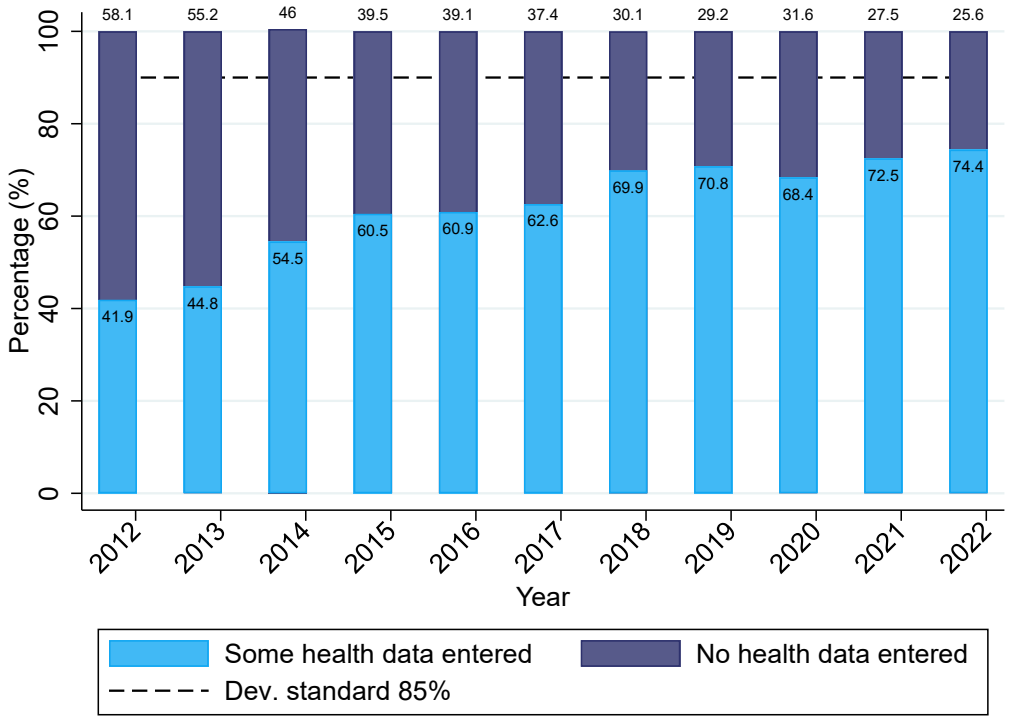
The NNAP measure currently focusses on whether a follow-up developmental assessment took place at two years of age. The long-term intention of the NNAP is to report the outcomes of this assessment, and the NICE guideline recommends the recording of the results of the assessment for audit purposes.

Full details of this measure can be found in the NNAP 2022 audit measures guide: https://www.rcpch.ac.uk/work-we-do/clinical-audits/nnap/measures.

[37] NICE guideline [NG72]. Developmental follow-up of children and young people born preterm. 2017. Available at: https://www.nice.org.uk/guidance/ng72

Results

Figure 55. Two-year follow-up proportions, according to the contemporaneous NNAP measurement criteria, by NNAP reporting year (2012-2022).



Notes for interpretation:

- *Years 2013, 2014, 2015, 2020 and 2021 do not include Scotland.*
- *In years 2012-2015, babies died post discharge have been included as "health data entered" as per latest methodology, therefore results differ from previously published results, where these babies are included in no health data entered.*

Figure 56. Caterpillar plot of the proportions of two-year follow-up assessment, by neonatal network or operational delivery network (ODN).

Network proportions are represented by dots. The 95% confidence intervals for a network are shown by a vertical line with each dot. Full results are available on NNAP Online.

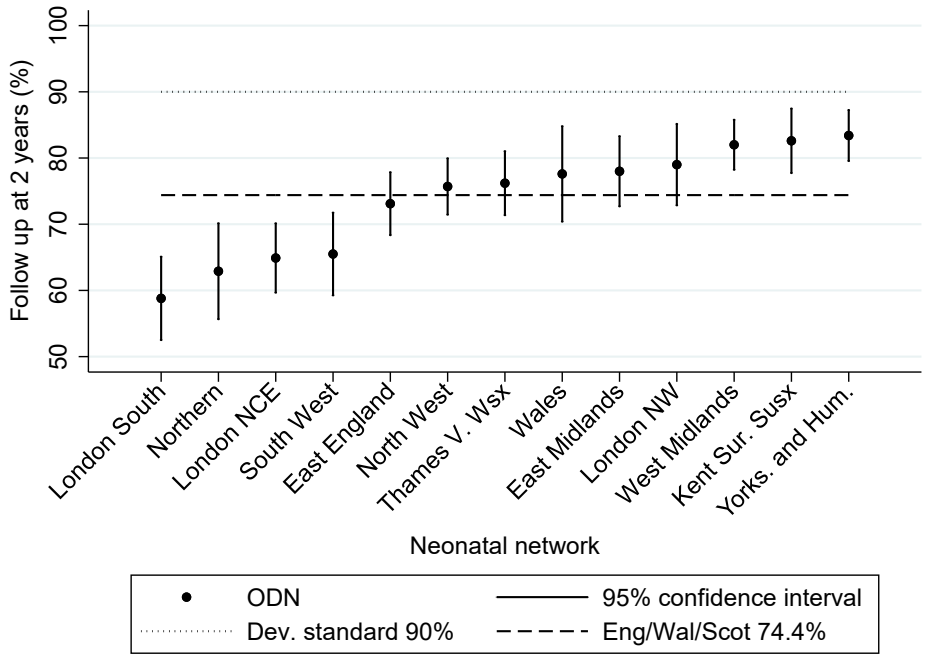


Figure 57: Caterpillar plot of the proportions of two-year follow-up assessment: neonatal units.

Unit proportions are represented by dots. The 95% confidence intervals for a unit are shown by a vertical line with each dot. Neonatal units can be identified on NNAP Online.

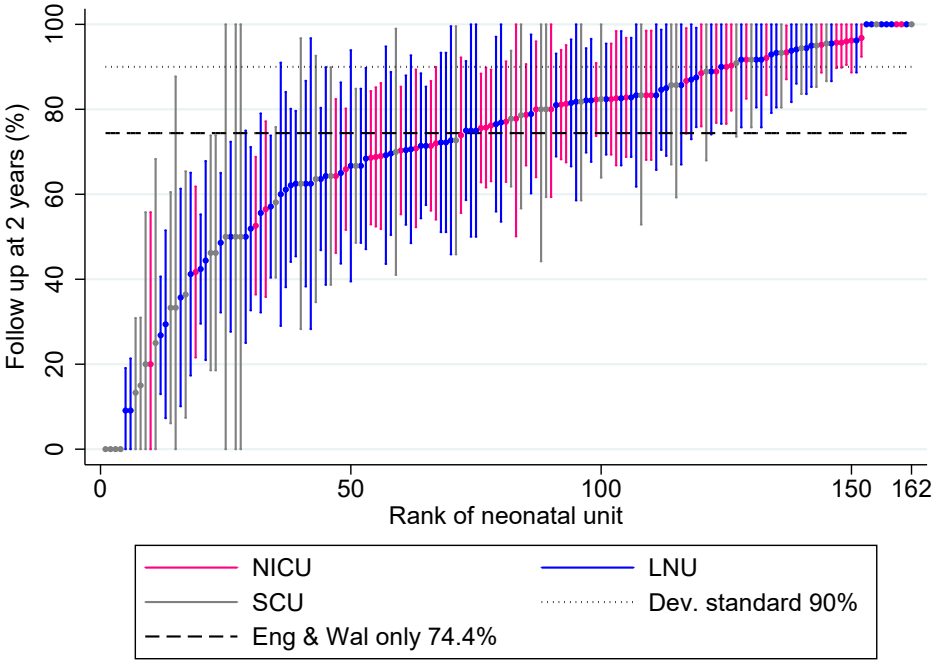


Table 26: Two-year follow up assessment, by neonatal unit level.

Unit level	Eligible babies	Some two-year follow up health data entered (%)	Two-year follow up completed outside of range	No health data entered		
				Lost to follow-up	Not assessed for other reason	No data entered at all
SCU	480	310 (64.6%)	15	7	67	81
LNU	1,625	1,150 (70.8%)	102	25	195	153
NICU	1,537	1,251 (81.4%)	47	17	173	49
Eng & Wal only	**3,642**	**2,711 (74.4%)**	**164**	**49**	**435**	**283**

Summary of findings

- The proportion of babies born at less than 30 weeks gestation receiving a two-year follow-up assessment within the appropriate time window is 74.4% (2,711 of 3,642). This is a 1.8 percentage point increase since 2021 (p=0.08), when 72.6% (2,628 of 3,622) of eligible babies received a two-year follow up (*Figure 55*).
- Network delivery of two-year follow up ranges from 58.8% (London ODN – South) to 83.4% (Yorkshire & Humber ODN) (*Figure 56*).
- Among neonatal units, proportions range from 0% to 100%, with 24.1% (39 of 162) achieving the NNAP developmental standard of 90% (*Figure 57*).
- Achievement is higher in NICUs (81.4% - 1,251 of 1,537) than LNUs (70.8% - 1,150 of 1,625) and SCUs (64.6% - 310 of 480) (*Table 26*).

6.3. Non-invasive breathing support

What proportion of babies born at less than 32 weeks gestational age only receive non-invasive breathing support during the first week of life?*

**Invasive respiratory support is defined as that delivered through an endotracheal tube.*

Bronchopulmonary Dysplasia (BPD) is the most common form of chronic lung disease in infancy associated with preterm birth. Despite the advances in perinatal care such as administration of antenatal corticosteroids, surfactant and gentler ventilation strategies, the proportion of babies with BPD has remained constant. However, there is substantial variation in the proportions of BPD among neonatal networks even after comparing the proportions with a matched group of babies with very similar case mix.

One the contributing factors to BPD is the type and duration of respiratory support provided to the babies. Provision of non-invasive respiratory support, to avoid mechanical ventilation through endotracheal tube, and early extubation of very preterm infants onto non-invasive support have been shown to reduce the risk of BPD[38]. Variations in respiratory care practices (the type and duration of respiratory support) may contribute to these variations in proportions of BPD.

The NICE guidance (NG 124) recommends provision of non-invasive respiratory support through nasal CPAP or high flow humidified oxygen therapy as primary mode of respiratory support for preterm infants[39]. It is expected that in the UK, marked variation exists in the adoption of the NICE guidance. Through the identification of variation between neonatal networks, and unit of a similar designation, the NNAP can support quality improvement.

The NNAP reports this measure for the first time this year. Full details can be found in the NNAP 2022 audit measures guide: https://www.rcpch.ac.uk/work-we-do/clinical-audits/nnap/measures.

Unit and network results for this measure are balanced on gestational age. Balancing is a process that compares the outcome or exposure of babies at a unit to a sample of babies from the national population whose gestational ages are comparable to those of the unit of comparison. The weighted national result (referred to as the “balanced proportion”) is

[38] Jensen EA. Prevention of bronchopulmonary dysplasia: A summary of evidence-based strategies. NeoReviews 2019;20:e189-e201

[39] National Institute for Health and Care Excellence (NICE). Specialist neonatal respiratory care for babies born preterm. NICE guideline [NG124]. April 2019. Available at: https://www.nice.org.uk/guidance/ng124

then compared to the unit's result (referred to the "observed proportion"), with the difference between their proportions referred to as the "treatment effect". A positive treatment effect indicates that babies at the unit would have been more likely to receive only non-invasive respiratory support had they been treated elsewhere, and a negative treatment effect indicates that they would have been less likely to receive only non-invasive respiratory support elsewhere.

For a full description of the NNAP methodology and statistical analysis plan, see: https://www.rcpch.ac.uk/nnap-data-flow-methodology.

Results

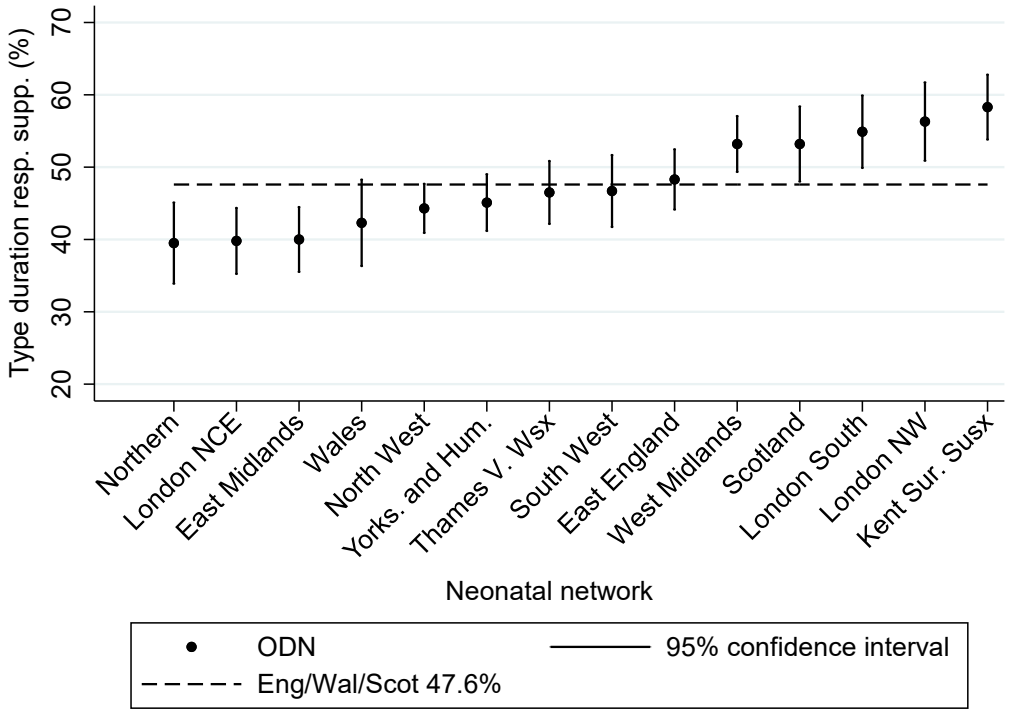
Table 27: Observed proportion of babies receiving only non-invasive respiratory support in the first 7 days of life, by neonatal level.

Unit level	Eligible babies	With outcome	Non-invasive respiratory support (%)	Missing (%)
Other*	91	84	32 (38.1%)	7 (7.7%)
SCU	383	379	181 (47.8%)	4 (1%)
LNU	2,344	2,332	1,277 (54.8%)	12 (0.5%)
NICU	4,053	3,999	1,747 (43.7%)	54 (1.3%)
Eng/Wal/Scot	**6,871**	**6,794**	**3,237 (47.6%)**	**77 (1.1%)**

**'Other' units are those that are hospital or healthcare locations not associated with an NNAP neonatal unit, NNAP units that have closed before the start of this audit year, or location records that are unknown.*

Figure 58: Caterpillar plot of the observed proportion of babies receiving only non-invasive respiratory support in the first 7 days of life (TOP) and treatment effect (BOTTOM), by neonatal network.

Network proportions are represented by dots. The 95% confidence intervals for a network are shown by a vertical line with each dot. Full results are available on NNAP Online.



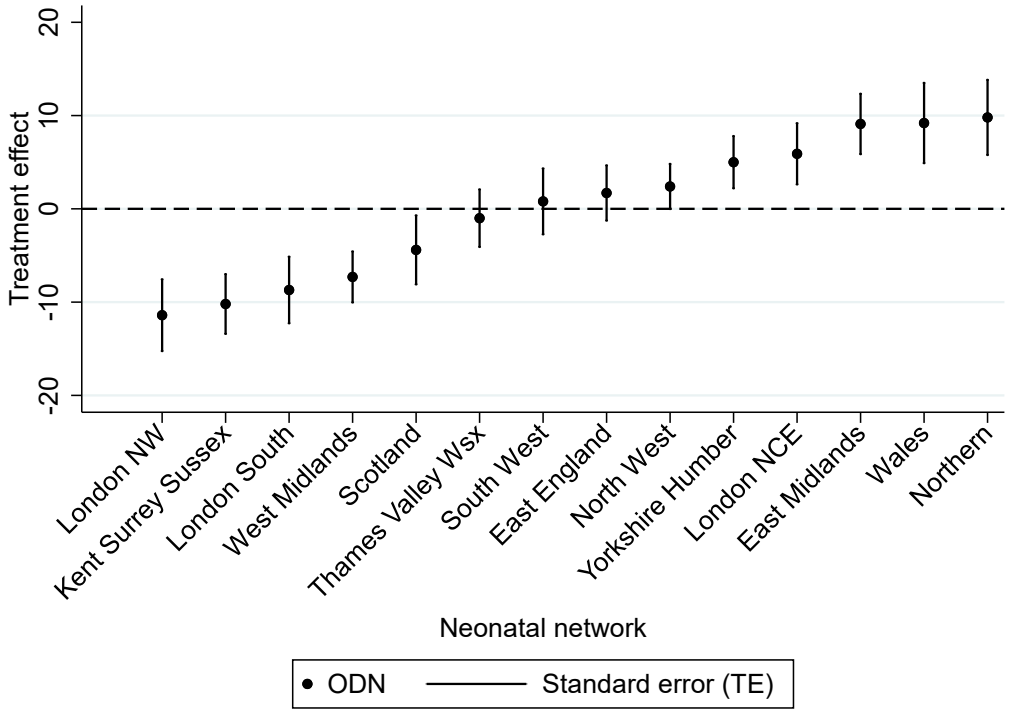


Figure 59: Caterpillar plot of the observed proportion of babies receiving only non-invasive respiratory support in the first 7 days of life (TOP) and treatment effect (BOTTOM), by neonatal unit.

Unit proportions are represented by dots. The 95% confidence intervals for a unit are shown by a vertical line with each dot. Neonatal units can be identified on NNAP Online.

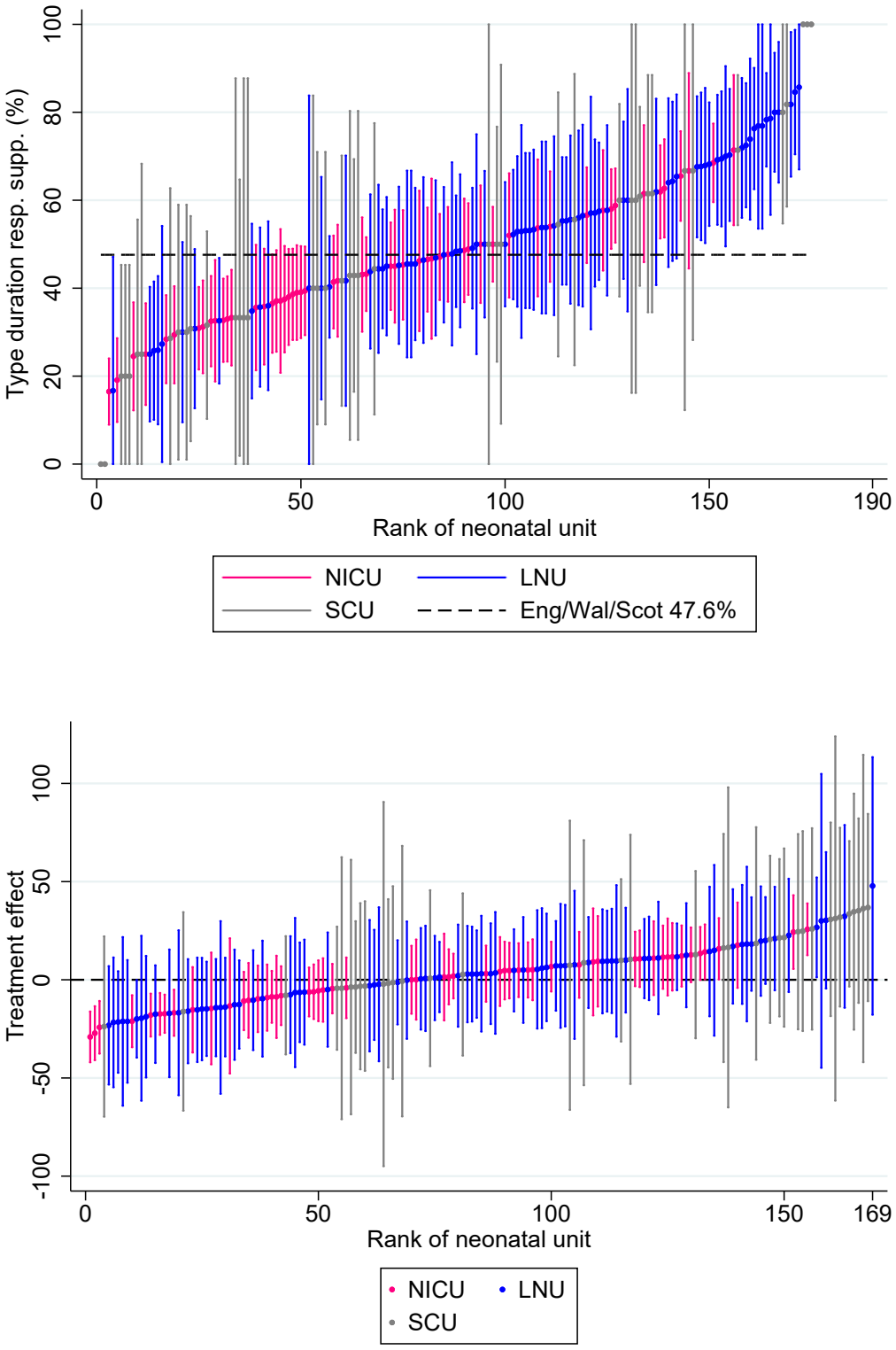
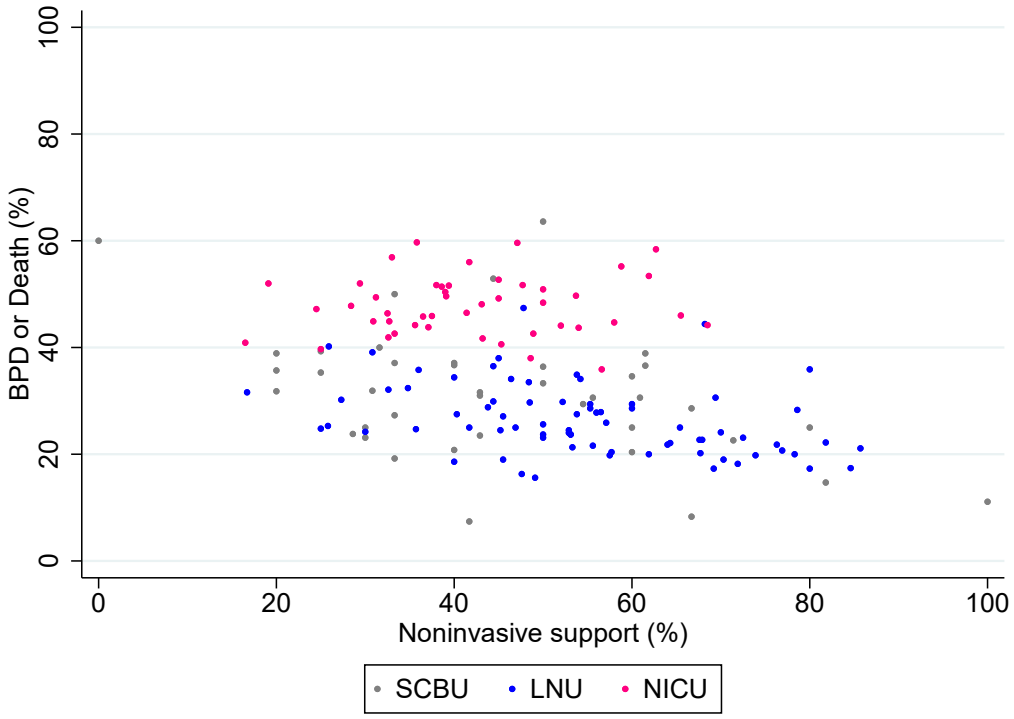


Figure 60: Proportion of babies with BPD, compared to proportion receiving only non-invasive breathing support in the first 7 days, by neonatal unit.



Summary of findings

- Overall, 47.6% (3,237 of 6,794) of babies born at less than 32 weeks gestational age received only non-invasive respiratory support in the first seven days of life.
- Among neonatal networks, observed proportions of non-invasive respiratory support range from 39.5% (Northern ODN) to 58.3% (Kent, Surrey, Sussex ODN). The high variance observed between neonatal networks is not explained by gestational age differences in the babies cared for by the network – this is shown in the treatment effect analysis (*Figure 58*). Whether a baby is cared for in a one network or another seems to lead to differences in successful adherence to NICE guidance on use of non-invasive ventilation.
- At unit level still more striking differences are observed in the proportion of babies who are managed solely with non-invasive ventilation. The proportion of babies in NICUs receiving only non-invasive breathing support in the first 7 days varies from 16.5% to 71.4%. Even when baseline characteristics are taken into account, the unit of care changes the chance of a very preterm baby being cared for in this way by as much as 54.8% (treatment effect ranges from -29.1% to 25.7% between NICUs, *Figure 59*, NNAP Online).

- There is some limited evidence of an association between proportions of exclusive non-invasive breathing support and proportions of BPD (*Figure 60*). However, it is important to note that association may not imply causation. Additional factors and underlying mechanism may be responsible for the observed correlation and therefore further analysis is required to account for other potentially confounding factors, and to consider the association for NICU level only.

6.4. Key messages, recommendations and actions for improvement

- The NNAP introduced a new measure for 2022 in order to identify any variation in the exclusive use of non-invasive breathing support, which is recommended by NICE for support of the least mature infants[40]. The proportion of babies in NICUs receiving only non-invasive breathing support in the first 7 days varies from 16.5% to 71.4%, and analysis shows this variation is unexplained by gestational age mix.
- The NNAP reports adherence to the updated UK screening for retinopathy of prematurity (ROP) guideline, published in March 2022, for the first time this year. Overall, 69% (3,509 of 5,083) of eligible babies were screened appropriately according to the new guideline, a proportion that should not be compared to previously published audit results which reported against the previous ROP guideline. The variation between neonatal networks in on-time screening is wide (49.8% to 77.3%) and concerning, as it was under the previous guideline.

Actions for local quality improvement

- **Neonatal services** with low adherence to recommended clinical practices such as non-invasive breathing support and ROP screening should:
  - use NNAP Online to identify comparable services with better adherence to identify opportunities for shared learning.
  - use quality improvement methodology and available resources to develop and deliver an action plan to improve adherence in their hospitals. For example,
    - NICE Quality Standard [QS193]. Specialist neonatal respiratory care for babies born preterm.
    - Royal College of Paediatrics and Child Health. UK Screening of Retinopathy of Prematurity Guideline
    - NNAP ROP screening calculator
    - BAPM, Minimising the burden of bronchopulmonary dysplasia - A BAPM Quality Improvement Toolkit (expected publication Autumn 2023)
    - Case study: *More than meets the eye: understanding the impact of guideline changes on retinopathy of prematurity screening performance*. Bradford Teaching Hospitals NHS Foundation Trust

[40] NICE Quality Standard [QS193]. Specialist neonatal respiratory care for babies born preterm. 15 July 2020. Available at: https://www.nice.org.uk/guidance/qs193.

- Case study: *Use of non-synchronised non-invasive positive pressure ventilation (NS-NIPPV) to reduce extubation failure in preterm infants*. Lancashire Women & Newborn Centre

7. Audit questions, standards and associated guidelines

NNAP question	Start year	Cohort	Measure type	Developmental standard	Associated guidelines
Mortality until discharge home Does a baby born at 24 to 31 weeks gestational age inclusive die before discharge home, or 44 weeks post-menstrual age (whichever occurs sooner)?		Born July 2019 to June 2022	Outcome	No developmental standard.	
Bronchopulmonary dysplasia (BPD) Does an admitted baby born at less than 32 weeks' gestational age develop bronchopulmonary dysplasia (BPD) or die?		Final discharge 2022-2022	Outcome	No developmental standard.	
Necrotising enterocolitis (NEC) 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?		Final discharge in 2022	Outcome	No developmental standard.	
Late onset 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?		Final discharge in 2022	Outcome	No developmental standard.	
Neonatal preterm brain injury Does a baby born at less than 32 weeks' gestational age experience any of the following forms of brain injury? • Germinal matrix/ intraventricular haemorrhage • Post haemorrhagic ventricular dilatation • Cystic periventricular leukomalacia		Final discharge in 2022	Outcome	No developmental standard.	
Birth in a centre with a NICU Is a baby: • born at less than 27 weeks gestational age, or • less than 800 grams at birth, or • born as a multiple at less than 28 weeks gestational age		First admission in 2022	Process	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.	British Association for Perinatal Medicine, Perinatal Management of Extreme Preterm Birth before 27 weeks of gestation A Framework for Practice NHS England, Neonatal Critical Care Service Specification

delivered in a maternity service on the same site as a designated NICU?					
Antenatal steroids Does a mother who delivers a baby between 22 and 33 weeks' gestational age receive a full course of antenatal corticosteroids within 1 week prior to delivery?		First admission in 2022	Process	No developmental standard.	NICE guideline [NG25], Preterm Labour and Birth
Antenatal magnesium sulphate Does a mother who delivers a baby below 30 weeks' gestational age receive magnesium sulphate in the 24 hours prior to delivery?		First admission in 2022	Process	Ninety percent (90%) of eligible mothers should receive antenatal magnesium sulphate.	NICE guideline [NG25], Preterm Labour and Birth
Deferred cord clamping Does a baby born at less than 34 weeks' gestational age have their cord clamped at or after one minute?		First admission in 2022	Process	Sixty percent (60%) of babies born at less than 34 weeks' should have deferred cord clamping.	NICE guideline [NG25], Preterm Labour and Birth
Normal temperature on admission Does a 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?		First admission in 2022	Process	Timeliness and normal temperature should be met for at least ninety percent (90%) of babies.	NHS England, Neonatal Critical Care Service Specification
Breastmilk feeding in first 2 days of life Does a baby born at less than 34 weeks' gestational age receive any of their own mother's milk in the first 2 days of life?	2022	First admission in 2022	Process	No developmental standard.	UNICEF UK. The Baby Friendly Initiative
Breastmilk feeding at day 14 Does a baby born at less than 34 weeks' gestational age receive any of their own mother's milk at day 14 of life?		Final discharge in 2022	Process	No developmental standard.	UNICEF UK. The Baby Friendly Initiative
Breastmilk feeding at discharge home Does a baby born at less than 34 weeks' gestational age receive any of their own mother's milk at discharge to home from a neonatal unit?		Final discharge in 2022	Process	Eighty percent (80%) of babies born at less than 34 weeks' gestational age should receive at least some of their mother's milk at discharge home from the neonatal unit.	UNICEF UK. The Baby Friendly Initiative
Parental consultation within 24 hours of admission Is there a documented consultation with parents by a senior member of the neonatal team*, within 24 hours of admission? **By senior member of the neonatal team, NNAP means a consultant or middle grade doctor, or a nurse practitioner acting in such a role.*		First admission in 2022	Process	A consultation should take place within 24 hours of admission for every baby (100%).	Scottish Government, Neonatal Care in Scotland: A Quality Framework NHS Wales. All Wales Neonatal Standards – 3rd Edition. Department of Health. Toolkit for high quality neonatal services
Parental inclusion in consultant ward rounds What proportion of baby care days had a consultant-led ward round* with at least one parent included?		Final discharge in 2022	Process	No developmental standard.	UNICEF UK. The Baby Friendly Initiative. Scottish Government, Neonatal Care in Scotland: A Quality Framework

**Consultant ward round refers to any ward round where a consultant is in attendance, at any time of the day.*					Bliss Baby Charter
Nurse staffing on neonatal units What proportion of nursing shifts are numerically staffed according to guidelines and service specification?		Shifts in 2022	Structure	100% of shifts staffed according to guidelines and service specification.	NHS Wales. All Wales Neonatal Standards – 3rd Edition. NHS England. Neonatal Critical Care Service Specification BAPM. Service Standards for Hospitals Providing Neonatal Care
On-time screening for retinopathy of prematurity (ROP) Does a baby born at less than 31 weeks gestational age, or weighing less than 1501g at birth undergo the first ROP screening according to the guideline?		Final discharge in 2022	Process	All (100%) of eligible babies should receive ROP screening within the recommended time windows for first screening.	Royal College of Paediatrics and Child Health. UK screening of retinopathy of prematurity guideline: Summary of recommendations, March 2022.
Follow-up at two years of age Does a baby born at less than 30 weeks gestational age receive medical follow-up at two years gestationally corrected age (18-30 months' gestationally corrected acceptable age range)?		Born July 2019 to June 2020	Process	Ninety percent (90%) of babies with two-year follow-up data entered.	NICE guideline [NG72], Developmental follow-up of children and young people born preterm.
Type and duration of respiratory support What proportion of babies born at less than 32 weeks' gestation only receive non-invasive respiratory support during the first week of life?	2022	First admission in 2022	Process	No developmental standard.	NICE Quality standard [QS193] Specialist neonatal respiratory care for babies born preterm

8. Unit participation

Table A: NNAP participating neonatal units

*HD days – Total number of high dependency days delivered by the neonatal unit in the calendar year. High dependency days are those recorded as HRG 2[41].

**IC days – Total number of intensive care days delivered by the neonatal unit in the calendar year. Intensive care days are those recorded as HRG 1[41].

Unit name	Trust/Health Board	Unit level	HD days*	IC days**	HD & IC days*
East Midlands ODN					
Leicester Neonatal Service[1]	University Hospitals of Leicester NHS Trust	NICU†	2,361	3,294	5,655
Nottingham City Hospital	Nottingham University Hospitals NHS Trust	NICU	1,692	1,367	3,059
Nottingham University Hospital (QMC)	Nottingham University Hospitals NHS Trust	NICU	1,458	1,924	3,382
Kettering General Hospital	Kettering General Hospital NHS Foundation Trust	LNU	836	296	1,132
King's Mill Hospital	Sherwood Forest Hospitals NHS Foundation Trust	LNU	820	178	998
Lincoln County Hospital	United Lincolnshire Hospitals NHS Trust	LNU	1,049	313	1,362
Northampton General Hospital	Northampton General Hospital NHS Trust	LNU	968	381	1,349
Royal Derby Hospital	University Hospitals of Derby & Burton NHS Foundation Trust	LNU	1,465	667	2,132
Pilgrim General Hospital	United Lincolnshire Hospitals NHS Trust	SCU	75	19	94
Queen's Hospital, Burton on Trent	University Hospitals of Derby & Burton NHS Foundation Trust	SCU	101	40	141
East of England Perinatal ODN					
Luton & Dunstable University Hospital	Bedfordshire Hospitals NHS Foundation Trust	NICU	2,819	2,257	5,076
Norfolk & Norwich University Hospital	Norfolk & Norwich University Hospitals NHS Foundation Trust	NICU†	2,240	2,133	4,373
Rosie Maternity Hospital, Addenbrookes	Cambridge University Hospitals NHS Foundation Trust	NICU	4,339	3,196	7,535
Basildon University Hospital	Mid & South Essex NHS Foundation Trust	LNU	1,162	434	1,596
Broomfield Hospital, Chelmsford	Mid & South Essex NHS Foundation Trust	LNU	1,171	421	1,592

[41] NHS England. Service specification E08/S/a: Neonatal Critical Care. Available at: https://www.england.nhs.uk/commissioning/wp-content/uploads/sites/12/2015/01/e08-serv-spec-neonatal-critical.pdf

Colchester General Hospital	East Suffolk & North Essex NHS Foundation Trust	LNU	777	301	1,078
Ipswich Hospital	East Suffolk & North Essex NHS Foundation Trust	LNU	996	290	1,286
Lister Hospital	East & North Hertfordshire NHS Trust	LNU	1,085	302	1,387
Peterborough City Hospital	North West Anglia NHS Foundation Trust	LNU	944	414	1,358
Princess Alexandra Hospital	The Princess Alexandra Hospital NHS Trust	LNU	999	319	1,318
Queen Elizabeth Hospital, King's Lynn	The Queen Elizabeth Hospital, King's Lynn, NHS Foundation Trust	LNU	384	87	471
Southend Hospital	Mid & South Essex NHS Foundation Trust	LNU	650	308	958
Watford General Hospital	West Hertfordshire Hospitals NHS Trust	LNU	708	136	844
Bedford Hospital	Bedfordshire Hospitals NHS Foundation Trust	SCU	266	57	323
Hinchingbrooke Hospital	North West Anglia NHS Foundation Trust	SCU	291	34	325
James Paget Hospital	James Paget University Hospitals NHS Foundation Trust	SCU	357	51	408
West Suffolk Hospital	West Suffolk NHS Foundation Trust	SCU	528	62	590
Kent, Surrey, Sussex ODN					
Medway Maritime Hospital	Medway NHS Foundation Trust	NICU	2,585	1,472	4,057
Royal Sussex County Hospital	University Hospitals Sussex NHS Foundation Trust	NICU†	2,359	2,519	4,878
St Peter's Hospital	Ashford & St Peter's Hospitals NHS Foundation Trust	NICU	1,844	1,728	3,572
William Harvey Hospital	East Kent Hospitals University NHS Foundation Trust	NICU	1,390	1,123	2,513
East Surrey Hospital	Surrey & Sussex Healthcare NHS Trust	LNU	1,068	260	1,328
Frimley Park Hospital	Frimley Health NHS Foundation Trust	LNU	978	310	1,288
Tunbridge Wells Hospital	Maidstone & Tunbridge Wells NHS Trust	LNU	1,578	362	1,940
Conquest Hospital	East Sussex Healthcare NHS Trust	SCU	267	15	282
Darent Valley Hospital	Dartford & Gravesham NHS Trust	SCU	507	69	576
Princess Royal Hospital, Haywards Heath	University Hospitals Sussex NHS Foundation Trust	SCU	274	23	297
Queen Elizabeth The Queen Mother Hospital	East Kent Hospitals University NHS Foundation Trust	SCU	235	32	267
Royal Surrey County Hospital	Royal Surrey County Hospital NHS Foundation Trust	SCU	261	18	279
Worthing Hospital	University Hospitals Sussex NHS Foundation Trust	SCU	271	20	291
London ODN - North Central & East					
Homerton University Hospital	Homerton Healthcare NHS Foundation Trust	NICU	3,992	3,169	7,161
The Royal London Hospital	Barts Health NHS Trust	NICU†	4,180	3,219	7,399
University College London Hospital[2]	University College London Hospitals NHS Foundation Trust	NICU†	3,011	2,043	5,054

Barnet Hospital	Royal Free London NHS Foundation Trust	LNU	2,051	453	2,504
Newham University Hospital	Barts Health NHS Trust	LNU	1,181	370	1,551
North Middlesex University Hospital	North Middlesex University Hospital NHS Trust	LNU	1,416	324	1,740
Queen's Hospital, Romford	Barking, Havering & Redbridge University Hospitals NHS Trust	LNU	1,652	535	2,187
Whipps Cross University Hospital	Barts Health NHS Trust	LNU	970	244	1,214
Whittington Hospital	Whittington Health NHS Trust	LNU	1,791	405	2,196
Royal Free Hospital	Royal Free London NHS Foundation Trust	SCU	104	24	128
London ODN - North West					
Chelsea & Westminster Hospital	Chelsea & Westminster Hospital NHS Foundation Trust	NICU	3,072	3,382	6,454
Queen Charlotte & Chelsea Hospital	Imperial College Healthcare NHS Trust	NICU	2,931	1,645	4,576
Hillingdon Hospital	The Hillingdon Hospitals NHS Foundation Trust	LNU	1,117	232	1,349
Northwick Park Hospital	London North West University Healthcare NHS Trust	LNU	1,276	205	1,481
St Mary's Hospital, London	Imperial College Healthcare NHS Trust	LNU	1,321	367	1,688
West Middlesex University Hospital	Chelsea & Westminster Hospital NHS Foundation Trust	SCU	518	81	599
London ODN - South					
Evelina London Children's Hospital	Guy's & St Thomas' NHS Foundation Trust	NICU†	3,152	5,447	8,599
King's College Hospital	King's College Hospital NHS Foundation Trust	NICU†	3,399	3,996	7,395
St George's Hospital	St George's University Hospitals NHS Foundation Trust	NICU	4,089	3,306	7,395
Croydon University Hospital	Croydon Health Services NHS Trust	LNU	861	303	1,164
Kingston Hospital	Kingston Hospital NHS Foundation Trust	LNU	905	240	1,145
Queen Elizabeth Hospital, Woolwich	Lewisham & Greenwich NHS Trust	LNU	775	312	1,087
St Helier Hospital	Epsom & St Helier University Hospitals NHS Trust	LNU	823	153	976
University Hospital Lewisham	Lewisham & Greenwich NHS Trust	LNU	1,038	350	1,388
Epsom General Hospital	Epsom & St Helier University Hospitals NHS Trust	SCU	47	7	54
Princess Royal University Hospital, Farnborough	King's College Hospital NHS Foundation Trust	SCU	426	98	524
North West ODN					
Alder Hey Children's Hospital[3]	Alder Hey Children's NHS Foundation Trust	NICU	1,333	557	1,890
Arrowe Park Hospital	Wirral University Teaching Hospital NHS Foundation Trust	NICU	1,771	1,437	3,208
Lancashire Women & Newborn Centre, Burnley General Hospital	East Lancashire Hospitals NHS Trust	NICU	2,180	1,865	4,045

Liverpool Women's Hospital	Liverpool Women's NHS Foundation Trust	NICU†	2,791	3,421	6,212
Royal Bolton Hospital	Bolton NHS Foundation Trust	NICU	3,532	1,468	5,000
Royal Oldham Hospital	Pennine Acute Hospitals NHS Trust	NICU	2,953	1,925	4,878
Royal Preston Hospital	Lancashire Teaching Hospitals NHS Foundation Trust	NICU	1,536	1,211	2,747
St Mary's Hospital, Manchester	Manchester University NHS Foundation Trust	NICU†	5,363	5,529	10,892
Countess of Chester Hospital	Countess of Chester Hospital NHS Foundation Trust	LNU	323	51	374
Leighton Hospital	Mid Cheshire Hospitals NHS Foundation Trust	LNU	720	248	968
North Manchester General Hospital	Manchester University NHS Foundation Trust	LNU	797	151	948
Ormskirk District General Hospital	Southport & Ormskirk Hospital NHS Trust	LNU	455	121	576
Royal Albert Edward Infirmary	Wrightington, Wigan & Leigh NHS Foundation Trust	LNU	623	139	762
Royal Lancaster Infirmary	University Hospitals of Morecambe Bay NHS Foundation Trust	LNU	404	82	486
Stepping Hill Hospital	Stockport NHS Foundation Trust	LNU	1,061	200	1,261
Tameside General Hospital	Tameside & Glossop Integrated Care NHS Foundation Trust	LNU	365	96	461
Victoria Hospital, Blackpool	Blackpool Teaching Hospitals NHS Foundation Trust	LNU	646	158	804
Warrington Hospital	Warrington & Halton Teaching Hospitals NHS Foundation Trust	LNU	596	257	853
Whiston Hospital	St Helens & Knowsley Teaching Hospitals NHS Trust	LNU	699	189	888
Wythenshawe Hospital	Manchester University NHS Foundation Trust	LNU	1,215	260	1,475
Furness General Hospital	University Hospitals of Morecambe Bay NHS Foundation Trust	SCU	22	18	40
Northern ODN					
Royal Victoria Infirmary	The Newcastle Upon Tyne Hospitals NHS Foundation Trust	NICU†	3,238	2,822	6,060
Sunderland Royal Hospital	South Tyneside & Sunderland NHS Foundation Trust	NICU	909	796	1,705
The James Cook University Hospital	South Tees Hospitals NHS Foundation Trust	NICU	2,754	1,430	4,184
Cumberland Infirmary	North Cumbria Integrated Care NHS Foundation Trust	SCU	110	39	149
Darlington Memorial Hospital	County Durham & Darlington NHS Foundation Trust	SCU	67	34	101
Northumbria Specialist Emergency Care Hospital	Northumbria Healthcare NHS Foundation Trust	SCU	173	36	209
Queen Elizabeth Hospital, Gateshead	Gateshead Health NHS Foundation Trust	SCU	78	5	83
University Hospital of North Durham	County Durham & Darlington NHS Foundation Trust	SCU	177	54	231
University Hospital of North Tees	North Tees and Hartlepool NHS Foundation Trust	SCU	231	26	257
West Cumberland Hospital	North Cumbria Integrated Care NHS Foundation Trust	SCU	111	17	128
Scotland					

Aberdeen Maternity Hospital	NHS Grampian	NICU†	1,091	684	1,775
Ayrshire Maternity Unit, Crosshouse	NHS Ayrshire & Arran	NICU	758	290	1,048
Ninewells Hospital, Dundee	NHS Tayside	NICU	1,107	645	1,752
Princess Royal Maternity Hospital, Glasgow	NHS Greater Glasgow & Clyde	NICU†	1,162	663	1,825
Royal Hospital for Children & Young People, Glasgow	NHS Greater Glasgow & Clyde	NICU	2,458	2,636	5,094
Simpson Centre for Reproductive Health, Edinburgh	NHS Lothian	NICU†	1,713	1,413	3,126
Victoria Hospital, Kirkcaldy	NHS Fife	NICU	752	234	986
Wishaw General Hospital	NHS Lanarkshire	NICU	1,123	1,097	2,220
Forth Valley Royal Hospital	NHS Forth Valley	LNU	489	197	686
Raigmore Hospital, Inverness	NHS Highland	LNU	413	143	556
Royal Alexandra Hospital, Paisley	NHS Greater Glasgow & Clyde	LNU	740	164	904
Borders General Hospital, Melrose	NHS Borders	SCU	79	5	84
Dumfries & Galloway Royal Infirmary	NHS Dumfries & Galloway	SCU	117	4	121
St John's Hospital, Livingston	NHS Lothian	SCU	122	3	125
South West ODN					
Derriford Hospital	University Hospitals Plymouth NHS Trust	NICU	1,586	1,315	2,901
Southmead Hospital	North Bristol NHS Trust	NICU	2,779	1,936	4,715
St Michael's Hospital	University Hospitals Bristol & Weston NHS Foundation Trust	NICU†	3,026	2,932	5,958
Gloucestershire Royal Hospital	Gloucestershire Hospitals NHS Foundation Trust	LNU	1,393	516	1,909
Great Western Hospital	Great Western Hospitals NHS Foundation Trust	LNU	778	286	1,064
Musgrove Park Hospital	Somerset NHS Foundation Trust	LNU	654	296	950
Royal Cornwall Hospital	Royal Cornwall Hospitals NHS Trust	LNU	1,094	311	1,405
Royal Devon & Exeter Hospital	Royal Devon University Healthcare NHS Foundation Trust	LNU	1,273	245	1,518
Royal United Hospital	Royal United Hospitals Bath NHS Foundation Trust	LNU	1,030	225	1,255
North Devon District Hospital	Royal Devon University Healthcare NHS Foundation Trust	SCU	148	26	174
Torbay Hospital	Torbay & South Devon NHS Foundation Trust	SCU	247	34	281
Yeovil District Hospital	Yeovil District Hospital NHS Foundation Trust	SCU	119	14	133
Thames Valley & Wessex ODN					
John Radcliffe Hospital	Oxford University Hospitals NHS Foundation Trust	NICU†	4,362	4,470	8,832
Princess Anne Hospital	University Hospital Southampton NHS Foundation Trust	NICU†	2,667	3,370	6,037

Queen Alexandra Hospital	Portsmouth Hospitals University NHS Trust	NICU	2,168	2,604	4,772
Basingstoke & North Hampshire Hospital	Hampshire Hospitals NHS Foundation Trust	LNU	543	137	680
Milton Keynes University Hospital	Milton Keynes University Hospital NHS Foundation Trust	LNU	1,416	244	1,660
Poole General Hospital	University Hospitals Dorset NHS Foundation Trust	LNU	1,232	254	1,486
Royal Berkshire Hospital	Royal Berkshire NHS Foundation Trust	LNU	1,798	417	2,215
Royal Hampshire County Hospital	Hampshire Hospitals NHS Foundation Trust	LNU	471	166	637
Salisbury District Hospital	Salisbury NHS Foundation Trust	LNU	581	92	673
St Richard's Hospital	University Hospitals Sussex NHS Foundation Trust	LNU	305	69	374
Stoke Mandeville Hospital	Buckinghamshire Healthcare NHS Trust	LNU	1,291	330	1,621
Wexham Park Hospital	Frimley Health NHS Foundation Trust	LNU	671	231	902
Dorset County Hospital	Dorset County Hospital NHS Foundation Trust	SCU	256	33	289
St Mary's Hospital, Isle of Wight	Isle Of Wight NHS Trust	SCU	70	5	75
Wales					
Singleton Hospital	Swansea Bay University Local Health Board	NICU	2,302	1,492	3,794
The Grange University Hospital	Aneurin Bevan University Local Health Board	NICU	2,102	1,541	3,643
University Hospital of Wales	Cardiff & Vale University Local Health Board	NICU	2,945	2,572	5,517
Glan Clwyd Hospital	Betsi Cadwaladr University Local Health Board	LNU	1,047	532	1,579
Prince Charles Hospital	Cwm Taf Morgannwg University Local Health Board	LNU	493	104	597
Glangwili General Hospital	Hywel Dda University Local Health Board	SCU	575	47	622
Princess of Wales Hospital, Bridgend	Cwm Taf Morgannwg University Local Health Board	SCU	413	43	456
Wrexham Maelor Hospital	Betsi Cadwaladr University Local Health Board	SCU	137	40	177
Ysbyty Gwynedd	Betsi Cadwaladr University Local Health Board	SCU	186	57	243
West Midlands ODN					
Birmingham Heartlands Hospital	University Hospitals Birmingham NHS Foundation Trust	NICU	2,549	1,673	4,222
Birmingham Women's Hospital	Birmingham Women's & Children's NHS Foundation Trust	NICU†	3,315	3,159	6,474
New Cross Hospital	The Royal Wolverhampton NHS Trust	NICU	2,154	1,703	3,857
Royal Stoke University Hospital	University Hospitals of North Midlands NHS Trust	NICU	1,474	1,777	3,251
University Hospital Coventry	University Hospitals Coventry & Warwickshire NHS Trust	NICU	1,799	1,937	3,736
Birmingham City Hospital	Sandwell & West Birmingham Hospitals NHS Trust	LNU	2116	657	2,773
Manor Hospital	Walsall Healthcare NHS Trust	LNU	1,029	305	1,334

Princess Royal Hospital, Telford	The Shrewsbury & Telford Hospital NHS Trust	LNU	1,075	306	1,381
Russell's Hall Hospital	The Dudley Group NHS Foundation Trust	LNU	1,095	328	1,423
Worcestershire Royal Hospital	Worcestershire Acute Hospitals NHS Trust	LNU	945	322	1,267
George Eliot Hospital	George Eliot Hospital NHS Trust	SCU	73	20	93
Good Hope Hospital	University Hospitals Birmingham NHS Foundation Trust	SCU	85	20	105
Hereford County Hospital	Wye Valley NHS Trust	SCU	228	29	257
Warwick Hospital	South Warwickshire NHS Foundation Trust	SCU	107	24	131
Yorkshire & Humber ODN					
Bradford Royal Infirmary	Bradford Teaching Hospitals NHS Foundation Trust	NICU	1,857	1,546	3,403
Hull Royal Infirmary	Hull University Teaching Hospitals NHS Trust	NICU†	2,208	1,752	3,960
Jessop Wing, Sheffield	Sheffield Teaching Hospitals NHS Foundation Trust	NICU†	2,718	2,829	5,547
Leeds Neonatal Service[4]	Leeds Teaching Hospitals NHS Trust	NICU†	3,855	3921	7,776
Barnsley District General Hospital	Barnsley Hospital NHS Foundation Trust	LNU	594	304	898
Calderdale Royal Hospital	Calderdale & Huddersfield NHS Foundation Trust	LNU	880	438	1,318
Chesterfield Royal Hospital	Chesterfield Royal Hospital NHS Foundation Trust	LNU	640	149	789
Diana Princess of Wales Hospital	Northern Lincolnshire & Goole NHS Foundation Trust	LNU	609	325	934
Doncaster Royal Infirmary	Doncaster & Bassetlaw Teaching Hospitals NHS Foundation Trust	LNU	983	399	1,382
Pinderfields General Infirmary (Pontefract)	Mid Yorkshire Hospitals NHS Trust	LNU	1,080	536	1,616
Rotherham District General Hospital	The Rotherham NHS Foundation Trust	LNU	735	161	896
Scunthorpe General Hospital	Northern Lincolnshire & Goole NHS Foundation Trust	LNU	548	215	763
York District Hospital	York & Scarborough Teaching Hospitals NHS Foundation Trust	LNU	686	216	902
Airedale General Hospital	Airedale NHS Foundation Trust	SCU	176	26	202
Bassetlaw District General Hospital	Doncaster & Bassetlaw Teaching Hospitals NHS Foundation Trust	SCU	27	13	40
Harrogate District Hospital	Harrogate & District NHS Foundation Trust	SCU	51	30	81
Scarborough General Hospital	York & Scarborough Teaching Hospitals NHS Foundation Trust	SCU	42	28	70

[1] Includes Leicester Royal Infirmary and Leicester General Hospital.

[2] Not included in all measures due to data quality issues.

[3] Neonatal surgical unit only, not included in all measures.

[4] Includes Leeds General Infirmary and St James's Hospital.

†Neonatal intensive care units providing surgery.

9. Pathogens: bloodstream infection reporting

Bacterial, fungal and yeast positive blood cultures reported to the NNAP in 2022 for the late onset bloodstream infection measure have been classified as shown below into organisms whose growth would be regarded as indicative of a bloodstream infection without further clinical evidence of infection (clearly pathogenic), and into a list of other organisms. This list of organisms included for NNAP reporting is available below. The NNAP are grateful to Dr Jim Gray, Consultant Microbiologist at Birmingham Women's and Children's NHS Foundation Trust, who kindly reviewed organisms reportedly cultured in blood, and helped classify them into 'clearly pathogenic' and 'other' organisms.

For more information, see Fraser C, Muller-Pebody B, Blackburn R, Gray J, Oddie SJ, Gilbert RE, Harron K. Linking surveillance and clinical data for evaluating trends in bloodstream infection rates in neonatal units in England. PLoS One. 2019 Dec 12;14(12):e0226040. doi: 10.1371/journal.pone.0226040.eCollection 2019.

Clearly pathogenic organisms		
Acinetobacter Baumannii	Enterobacter Sakazakii	Salmonella Apapa
Aeromonas Caviae	Enterobacter Sp.	Salmonella Arizonae
Aeromonas Hydrophila	Enterococcus Avium	Salmonella Brandenburg
Aeromonas Salmonicida	Enterococcus Casseliflavus	Salmonella Colindale
Aeromonas Sobria	Enterococcus Durans	Salmonella Cotham
Aeromonas Sp	Enterococcus Faecalis	Salmonella Cubana
Anaerococcus Prevotii	Enterococcus Faecium	Salmonella Djugu
Aspergillus	Enterococcus Gallinarum	Salmonella Dublin
Aspergillus Fumigatus	Enterococcus Hirae	Salmonella Enteritidis
Aspergillus Niger	Enterococcus Raffinosus	Salmonella Gold-Coast
Aspergillus Sp	Enterococcus Sp.	Salmonella Hadar
B Haemolytic Streptococci	Escherichia	Salmonella Heidelberg
Bacteroides Capillosus	Escherichia Coli	Salmonella Hofit
Bacteroides Distasonis	Escherichia Hermannii	Salmonella Hull
Bacteroides Fragilis	Escherichia Sp	Salmonella Infantis
Bacteroides Ovatus	Escherichia Vulneris	Salmonella Kedougou
Bacteroides Sp	Fusobacterium Necrophorum	Salmonella Kiambu
Bacteroides Uniformis	Fusobacterium Nucleatum	Salmonella Kibusi
Bacteroides Vulgatus	Fusobacterium Sp	Salmonella Kintambo
C. Koseri	Gardnerella	Salmonella Kisarawe
Campylobacter Fetus	Gardnerella Vaginalis	Salmonella Matopeni
Campylobacter Jejuni	Group B Streptococcus	Salmonella Mississippi
Campylobacter Sp	Group G Streptococcus	Salmonella Monschaui

Campylobacter Ureolyticus	Haemophilus Influenzae	Salmonella Montevideo
Candida	Hafnia Alvei	Salmonella Muenchen
Candida Albicans	Hansenula Sp	Salmonella Muenster
Candida Ciferrii	Klebsiella	Salmonella Newport
Candida Dubliniensis	Klebsiella Aerogenes	Salmonella Oranienburg
Candida Fabianii	Klebsiella Ornithnolytica	Salmonella Poona
Candida Famata	Klebsiella Oxytoca	Salmonella Reading
Candida Glabrata	Klebsiella Planticola	Salmonella Saphra
Candida Guilliermondii	Klebsiella Pneumoniae	Salmonella Senftenberg
Candida Haemulonis	Klebsiella Pneumoniae Subsp Ozenae	Salmonella Sinstorf
Candida Krusei	Klebsiella Sp.	Salmonella Sp.
Candida Lusitaniae	Kluyvera Sp	Salmonella Stanley
Candida Parapsilosis	Leclercia Adecarboxylata	Salmonella Tel-El-Kebir
Candida Sp.	Listeria Monocytogenes	Salmonella Typhi And Paratyphi
Candida Tropicalis	Listeria Sp	Salmonella Typhimurium
Cedecea Lapagei	Malassezia Furfur	Salmonella Unnamed
Citrobacter	Malassezia Pachydermatis	Salmonella Virchow
Citrobacter Amalonaticus	Malassezia Sp	Salmonella Vitkin
Citrobacter Braakii	Morganella Morganii	Salmonella Wichita
Citrobacter Diversus	Mrsa	Serratia Liquefaciens
Citrobacter Farmeri	Neisseria Meningitidis	Serratia Marcescens
Citrobacter Freundii	Pantoea Agglomerans	Serratia Odorifera
Citrobacter Koseri	Pantoea Septica	Serratia Plymuthica
Citrobacter Sp.	Pantoea Sp	Serratia Proteamaculas
Clostridium Beijerinckii	Pasteurella	Serratia Rubidaea
Clostridium Bifermentans	Pasteurella Haemolytica	Serratia Sp.
Clostridium Butyricum	Pasteurella Multocida	Shigella Flexneri
Clostridium Paraputrificum	Pasteurella Pneumotropica	Shigella Sonnei
Clostridium Perfringens	Pasteurella Sp.	Staphylococcus Aureus
Clostridium Septicum	Peptostreptococcus	Stellatoidea
Clostridium Sordelli	Peptostreptococcus Asaccharolyticus	Streptococcus Agalactiae
Clostridium Sp.	Peptostreptococcus Magnus	Streptococcus Anaerobic
Clostridium Sporogenes	Prevotella Bivia	Streptococcus Anginosus
Clostridium Tertium	Prevotella Buccalis	Streptococcus Bovis
Coccidioides Sp.	Prevotella Oralis	Streptococcus Constellatus
Coliform	Proteus Mirabilis	Streptococcus Faecalis
Cryptococcus Albidus	Proteus Penneri	Streptococcus Group A Stem
Cryptococcus Sp.	Proteus Sp.	Streptococcus Group B Stem
E.Coli	Proteus Vulgaris	Streptococcus Group C Stem
Enterobacter	Providencia Alcalifaciens	Streptococcus Group D Stem
Enterobacter Aerogenes	Providencia Stuartii	Streptococcus Group G Stem
Enterobacter Agglomerans	Pseudomonas Aeruginosa	Streptococcus Milleri
Enterobacter Agglomerans	Raoultella Planticola	Streptococcus Milleri Group
Enterobacter Amnigenus	Raoultella Sp	Streptococcus Pneumoniae

Enterobacter Asburiae	Raoultella Terrigena	Streptococcus Pyogenes
Enterobacter Cloacae	Rhodotorula	Veillonella Atypica
Enterobacter Cloacae Complex	Rhodotorula Rubra	Veillonella Named
Enterobacter Gergoviae	Rhodotorula Sp	Yeasts
Enterobacter Hormaechei	S. Aureus	Yeasts (Other)
Enterobacter Intermedium	Salmonella Aba	Yersinia Enterocolitica
Enterobacter Intermedius	Salmonella Agama	Yersinia Sp.
Enterobacter Kobei	Salmonella Ajiobo	

Other organisms		
Abiotrophia	Corynebacterium Xerosis	Paenibacillus Glucanolyticus
Abiotrophia Adiacens	Coryneform Bacilli	Paenibacillus Pabuli
Abiotrophia Defectiva	Delftia Acidovorans	Paenibacillus Sp
Achromobacter Sp	Dermabacter Hominis	Parabacteroides Distasonis
Achromobacter Xylosoxidans	Dermacoccus Sp	Paracoccus Sp
Acidovorax Temperans	Diphtheroids	Paracoccus Yeeii
Acinetobacter Anitratus	Eggerthella Lenta	Pediococcus Acidilactici
Acinetobacter Calcoaceticus	Eikenella Corrodens	Penicillium Sp
Acinetobacter Haemolyticus	Elizabethkingia Miricola	Peptococcus Sp
Acinetobacter Johnsonii	Elizabethkingia Sp	Phialophora
Acinetobacter Junii	Eubacterium Lentum	Propionibacterium Acnes
Acinetobacter Lwoffii	Exophiala Sp.	Propionibacterium Freudenreichii
Acinetobacter Parvus	Flavimonas Oryzihabitans	Propionibacterium Sp
Acinetobacter Radioresistens	Flavobacterium Sp.	Proprionebacterium Acnes
Acinetobacter Sp.	Gemella Haemolysans	Pseudoclavibacter Sp
Acinetobacter Ursingii	Gemella Morbillorum	Pseudomonas Alcaligenes
Actinomyces	Geotrichum Sp	Pseudomonas Fluorescens
Actinomyces Bovis	Globicatella Sanguis	Pseudomonas Luteola
Actinomyces Cardiffensis	Gordonia Bronchialis	Pseudomonas Oleovorans
Actinomyces Naeslundii	Gordonia Sp	Pseudomonas Oryzihabitans
Actinomyces Neuii	Gram Negative Bacilli	Pseudomonas Paucimobilis
Actinomyces Odontolyticus	Granulicatella Adiacens	Pseudomonas Putida
Actinomyces Oris	Granulicatella Elegans	Pseudomonas Sp.
Actinomyces Sp.	Haematobacter Sp	Pseudomonas Stutzeri
Actinomyces Viscosus	Haemophilus	Pseudoxanthomonas Kaohsiungensis
Aerococcus Sp	Haemophilus Aphrophilus	Psychrobacter Phenylpyruvicus
Aerococcus Urinae	Haemophilus Haemolyticus	Rahnella Named
Aerococcus Viridans	Haemophilus Parahaemolyticus	Rahnella Sp
Agrobacterium Tumefaciens	Haemophilus Parainfluenzae	Ralstonia Pickettii
Alcaligenes Faecalis	Haemophilus Paraphrohaemolyticus	Ralstonia Sp.
Alcaligenes Sp	Haemophilus Sp.	Rhizobium Radiobacter

Alpha Haemolytic Streptococcus	Kingella Denitrificans	Rhodococcus
Alternaria Sp.	Kingella Kingae	Rhodococcus Bronchialis
Anaerobes (Not Specified)	Kingella Sp	Rhodococcus Sp
Anitratus	Kocuria Kristinae	Roseomonas Gilardii
Arcanobacterium Haemolyticum	Kocuria Rhizophila	Roseomonas Mucosa
Arthrobacter Sp	Kocuria Rosea	Roseomonas Sp
Aurantimonas Altamirensis	Kocuria Sp	Rothia Aeria
Bacillus	Kocuria Species	Rothia Dentocariosia
Bacillus Cereus	Kocuria Varians	Rothia Sp
Bacillus Circulans	Kytococcus Schroeteri	Rothia Spp
Bacillus Licheniformis	Lactobacillus	Ruminococcus Gnavus
Bacillus Pumilus	Lactobacillus Crispatus	Scopulariopsis Brevicaulis
Bacillus Silvestris	Lactobacillus Fermentum	Sphingobacterium Multivorum
Bacillus Sp.	Lactobacillus Gasseri	Sphingomonas
Bacillus Subtilis	Lactobacillus Jensenii	Sphingomonas Paucimobilis
Bifidobacterium	Lactobacillus Lactis	Sphingomonas Sp
Bifidobacterium Adolescentis	Lactobacillus Paracasei	Staph Saprophyticus
Bifidobacterium Breve	Lactobacillus Rhamnosus	Staphylococcus Capitis
Bifidobacterium Catenulatum	Lactobacillus Sp.	Staphylococcus Coagulase Negative
Bifidobacterium Longum	Lactococcus Cremoris	Staphylococcus Epidermidis
Bifidobacterium Sp	Lactococcus Garvieae	Staphylococcus Haemolyticus
Brevibacillus Parabrevis	Lactococcus Lactis	Staphylococcus Hominis
Brevibacterium	Lactococcus Sp.	Staphylococcus Lugdunensis
Brevibacterium Casei	Leuconostoc Sp	Staphylococcus Pettenkoferi
Brevibacterium Sp	Lysinibacillus Sp	Staphylococcus Simulans
Brevundimonas Diminuta	Mallassezia Furfur	Staphylococcus Sp.
Brevundimonas Sp	Massilia Timonae	Staphylococcus Vitulinus
Brevundimonas Vesicularis	Methylobacterium Sp	Staphylococcus Warneri
Burkholderia Capecia	Microbacterium Aurum	Stenotrophomonas Acidaminiphila
Burkholderia Cepacia	Microbacterium Paraoxydans	Stenotrophomonas Maltophilia
Burkholderia Gladioli	Microbacterium Sp	Stenotrophomonas Sp
Capnocytophaga	Micrococcus	Stephanoascus Ciferrii
Chryseobacterium Indologenes	Micrococcus Luteus	Steptococcus Mutans
Chryseobacterium Meningosepticum	Micrococcus Lylae	Stomatococcus Mucilaginosus
Chryseobacterium Sp.	Micrococcus Sp.	Stomatococcus Sp
Chryseomonas Indologenes	Micrococcus Varians	Streptococcus Alactolyticus
Collinsella Aerofaciens	Microsporum Sp	Streptococcus Alpha And Non-Haemolytic
Comamonas Acidovorans	Mixed Growth	Streptococcus Cristatus
Comamonas Testosteroni	Moraxella Catarrhalis	Streptococcus Gordonii
Cons	Moraxella Lacunata	Streptococcus Infantarius Subsp Nov

Cons (Mixed)	Moraxella Nonliquefaciens	Streptococcus Infantis
Corynebacterium	Moraxella Osloensis	Streptococcus Intermedius Group
Corynebacterium Afermentans	Moraxella Sp.	Streptococcus Lutetiensis
Corynebacterium Amycolatum	Mycobacterium Sp.	Streptococcus Mitis
Corynebacterium Aurimucosum	Neisseria Cinerea	Streptococcus Oralis
Corynebacterium Auris	Neisseria Flavescens	Streptococcus Other Group
Corynebacterium Coyleae	Neisseria Lactamica	Streptococcus Parasinguinis
Corynebacterium Diphtheriae	Neisseria Mucosa	Streptococcus Peroris
Corynebacterium Imitans	Neisseria Perflava	Streptococcus Pseudoporcinus
Corynebacterium Jeikeium	Neisseria Polysacchareae	Streptococcus Salivarius
Corynebacterium Minutissimum	Neisseria Sicca	Streptococcus Sanguis
Corynebacterium Mucifaciens	Neisseria Sp	Streptococcus Sobrinus
Corynebacterium Propinquum	Neisseria Subflava	Streptococcus Sp.
Corynebacterium Pseudodiphtheriticum	Oceanobacillus Profundus	Streptococcus Thermophilus
Corynebacterium Simulans	Ochrobactrum Anthropi	Streptococcus Vestibularis
Corynebacterium Sp.	Ochrobactrum Sp	Streptococcus Viridans
Corynebacterium Striatum	Paenibacillus Amylolyticus	

10. Glossary of terms

BAPM	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. https://www.bapm.org/
BPD	Bronchopulmonary dysplasia
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. https://www.bliss.org.uk
cPVL	Cystic periventricular leukomalacia
DCC	Deferred cord clamping
GIRFT	Getting It Right First Time (GIRFT) is a national programme designed to improve the treatment and care of patients through in-depth review of services, benchmarking, and presenting a data-driven evidence base to support change.
HQIP	The Healthcare Quality Improvement Partnership (HQIP) aims 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 is led by a consortium of the Academy of Medical Royal Colleges, the Royal College of Nursing and National Voices. https://www.hqip.org.uk/
HRG	Healthcare resource group: Standard groupings of clinically similar treatments which use common levels of healthcare resource.
Hyperthermia	A body temperature more than 37.5°C
Hypothermia	A body temperature less than 36.5°C
IVH	Intraventricular haemorrhage
LNU	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[42].
MatNeoSIP	The Maternity and Neonatal Safety Improvement Programme (MatNeoSIP), formerly known as the Maternal and Neonatal Health Safety Collaborative, is the programme supporting improvement in the quality and safety of maternity and neonatal units across England. https://www.england.nhs.uk/mat-transformation/maternal-and-neonatal-safety-collaborative/
MBRRACE-UK	Mothers and Babies: Reducing Risk through Audits and Confidential Enquiries across the UK. https://www.npeu.ox.ac.uk/mbrrace-uk
NCAPOP	National Clinical Audit and Patient Outcomes Programme
NEC	Necrotising enterocolitis
NHSE	NHS England
NICE	National Institute for Health and Care Excellence
NICU	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[42].
NMPA	The National Maternity and Perinatal Audit 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

[42] Department of Health. *Toolkit for high quality neonatal services*. 2009. Available from https://webarchive.nationalarchives.gov.uk/ukgwa/20100604134939/http://www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsPolicyAndGuidance/DH_107845

	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). www.maternityaudit.org.uk
NNAP	National Neonatal Audit Programme
Normothermia	A body temperature between 36.5°C and 37.5°C
ODN	Operational delivery network: In England, managed clinical networks for the coordination of neonatal critical care.
Outlier	A result that is statistically above or below expected performance. The NNAP defines outliers in four categories: • outstanding: three or more standard deviations above expected performance • excellent: between two and three standard deviations above expected performance • alert: between two and three standard deviations below expected performance • alarm: three or more standard deviations below expected performance.
PERIPrem	Perinatal Excellence to Reduce Injury in Premature Birth https://www.weahsn.net/our-work/transforming-services-and-systems/periprem/
PReCePT	The Prevention of Cerebral Palsy in PreTerm Labour. https://www.weahsn.net/our-work/transforming-services-and-systems/precept/
Preterm	Preterm is defined by the World Health Organisation as a baby born alive before 37 weeks of pregnancy are completed. This definition is sub-categorised by gestational age: • extremely preterm (less than 28 weeks) • very preterm (28 to 32 weeks) • moderate to late preterm (32 to 37 weeks).
QI	Quality improvement
RCPCH	The Royal College of Paediatrics and Child Health (RCPCH) was founded in 1996 and now has over 17,000 members across the world. The RCPCH plays

	a major role in postgraduate medical education, professional standards, research and policy. https://www.rcpch.ac.uk
RCOphth	Royal College of Ophthalmologists
ROP	Retinopathy of prematurity
SCU	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[42].