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Analysis of term admissions to neonatal care

This article considers a retrospective study of term admissions (≥37 weeks' gestation) to the neonatal intensive care unit at Sunderland Royal Hospital between 1 January 2014 and 31 December 2014. The study aims to identify the most common causes of term admission to neonatal care and to identify any admissions that could have possibly been avoided. The results are compared to data provided by NHS England.

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Key points

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1. Term admissions increased across England between 2011 and 2013, whereas preterm admissions remained the same.
2. Term admissions make up around 60% of admissions to neonatal care across England compared to 39% of all admissions to the NICU at Sunderland Royal Hospital.
3. There should be no avoidable term admissions to neonatal care.
4. The number of infants requiring admission to the NICU at Sunderland Royal Hospital for social issues was higher compared to the national percentage and a proportion of these admissions could have possibly been avoided.

Background

NHS England commissioned the Neonatal Data Analysis Unit (NDAU) to undertake a review of data held in the National Neonatal Research Database (NNRD), which collects data from contributing units providing any level of neonatal care. The aim of the data review was to identify the main reasons for term admissions to neonatal care and to see if term admissions to neonatal care were increasing.

The results showed a clear increase in term admissions between 2011 and 2013, from 42,135 to 48,000; an increase of 13.9%.[1] Preterm admissions stayed almost exactly the same, going from 32,312 to 32,231. Therefore, in an effort to reduce term admissions, NHS England requested that individual neonatal intensive care units (NICUs) carry out local audits to identify their most common reasons for term admissions. Sunderland Royal Hospital (SRH) set out to additionally determine the workload that term admissions placed on the NICU team and to identify any admissions that could have been avoided.

Methodology

This was a retrospective study with data taken from discharge summaries from BadgerNet database and MediTech application software. The audit was registered with the trust. The inclusion criterion was all neonates admitted to the NICU, born at ≥37 weeks' gestation between 1/1/14 and 31/12/14, which included admissions to level 1, 2 and 3 neonatal care. There is no provision of transitional care at Sunderland. A standardised pro forma was designed to analyse factors that may have contributed to admissions. This included:

- gestational age
- referral source (location of admission from)
- reason for admission
- level of respiratory and inotropic support
- mode of delivery
- duration of stay
- if the infant was born by caesarean section:

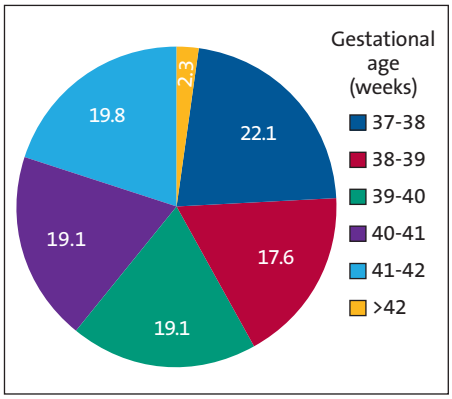

FIGURE 1 The different gestational ages at birth of term infants admitted to the NICU (%, n=131).

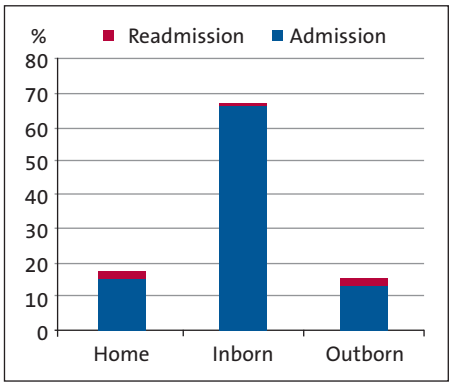

FIGURE 2 The referral source of term infants admitted to the NICU (n=131).

Reason for admission	All admissions to SRH (%)	Admissions of inborn (%)	NHS England (%)
Respiratory disease	52.7	51.9	30.1
Social issues (foster care)	11.5	13.9	1.1
Jaundice	4.6	4.7	5.2
Infection	3.8	2.8	9.1
Hypoglycaemia	3.8	3.7	9.6
Poor feeding/weight loss	3.8	3.7	3.8
Congenital	2.3	2.8	2.0
Asphyxia	1.5	1.9	3.1
Other	16.0	14.8	36.0

TABLE 1 The main reasons for term admissions to SRH, taken from the BadgerNet database entries and compared to NHS England data.

- whether it was elective or emergency
- if it was elective before 39 weeks' gestation, were antenatal steroids given?

The data collected was then compared to data provided by NHS England from the analysis undertaken by the NDAU using the NNRD.

Results

Between 1/1/2014 and 31/12/2014, there were 131 admissions to the NICU of infants born ≥37 weeks' gestation. This made up 39% of all admissions to the NICU in 2014. Seven of these were readmissions after discharge.

The proportion of different gestational ages at birth is shown in **FIGURE 1** (previous page). Of term admissions, 2.3% were born at >42 weeks' gestation. There was an even spread of the other gestational ages.

The analysis of 'inborn', 'born at home' or 'referred from other hospitals' admissions and readmissions is shown in **FIGURE 2** (previous page). The majority of term admissions were born at SRH although 15.3% were transfers in from other hospitals. The three readmissions from other hospitals were infants who were referred for extra corporeal membrane oxygenation (ECMO) at Freeman Royal Hospital.

The main reasons for admissions to SRH were taken from the BadgerNet database using the primary reason for admission field; the results are compared against those provided by NHS England (**TABLE 1**). Infants born in SRH are also entered in a separate column to question whether referrals from other hospitals or infants born at home accounted for some of the discrepancies between SRH admission and the reasons found by NHS England. No patient was recorded as having more than one main reason for admission.

Reason for admission	All admissions to SRH (%)	Admissions of inborn (%)
Bradycardia/apnoea	1.5	1.9
Cardiovascular	1.5	0.9
Convulsions	3.0	1.9
Distal intestinal obstruction syndrome	0.8	0.9
Haemolytic anaemia (rhesus)	1.5	1.9
Hypoxic-ischaemic encephalopathy	2.2	0.9
Hypothermia	0.8	0.9
Intrauterine growth restriction	0.8	0.9
Observation	0.8	0.9
Post-haemorrhagic hydrocephalus	0.8	0.9
Social issues (maternal)	1.5	1.9
Subgaleal haematoma	0.8	0.9
Total	16.0	14.8

TABLE 2 The other causes of term admission to SRH NICU.

Respiratory disease was the most common reason for admission to the NICU in 2014, accounting for 52.7% of all admissions, of which 51.9% of infants admitted were from the SRH labour ward. This is noticeably more than NHS England's results where, although respiratory disease was the most common admission reason, it only accounted for 30.1%.

Social issues (foster care) was the second most common admission reason at SRH, making up 11.5% of all admissions and 13.9% of inborn admissions, considerably more than the 1.1% found by NHS England.

Infection and hypoglycaemia each comprised 3.8% of SRH admissions, compared to 9.1% and 9.6% respectively found by NHS England.

TABLE 2 shows the other causes of term admission to SRH NICU. Convulsions accounted for 3% of term admissions to SRH and hypoxic-ischaemic encephalopathy accounted for 2.2%. **TABLE 3** shows the other causes of admission found by NHS England. 'Other' accounts for 19.4% and 9.5% are classed as 'missing'. Cardiovascular disease and cardiac disease are defined as different reasons; 0.2% of term admissions were due to 'preterm' although NHS England acknowledges that this may highlight some inconsistencies in data entry.

TABLE 4 shows the secondary outcomes at SRH. Nearly half (45%) of term admissions to SRH NICU needed ventilator support; 41% invasive and 59% non-invasive ventilation, including CPAP. The mean duration of invasive ventilation was 2.0 days compared to 1.5 days for

non-invasive ventilation.

Inotropic support was required by 6% of term admissions. The mean duration of support required was 2.1 days.

The mean duration of stay for term admissions was 4.6 days. The median duration of stay was 3 days. Of the 124 infants admitted, 122 (98.4%) were discharged. Two (1.6%) of the infants died in hospital.

FIGURE 3 shows the different modes of delivery for term admissions to SRH NICU. Fifty-two percent were delivered by spontaneous vaginal delivery and 32% were delivered by caesarean section.

Of those delivered by caesarean section, 50% were emergency and 50% elective. Forty-three percent of elective caesarean sections were delivered before 39 weeks' gestation. Seven of these infants were inborn (one was readmitted after discharge), with four (57%) receiving antenatal steroids (as per SRH guidelines) and three (43%) not. The mean duration of stay for both groups was 2.5 days. There was no difference in the amount of respiratory support required between the groups; both had one infant that required one day of non-invasive ventilation.

Reason for admission	NHS England (%)
Other	19.4
Missing	9.5
Cardiovascular disease	1.9
Investigation	1.4
Surgery	0.9
Other neurological disease	0.8
Convulsions	0.7
Cardiac disease	0.6
Failed oximetry screening	0.4
Preterm	0.2
Short observation	0.2
Total	36.0

TABLE 3 The other causes of term admission according to NHS England.

Workload of term admissions	
Requiring ventilation	45%
Invasive ventilation	41%
Non-invasive ventilation	59%
Mean duration of invasive ventilation	2.0 days
Mean duration of non-invasive ventilation	1.5 days
Requiring inotropic support	6%
Mean duration of inotropic support	2.1 days
Mean duration of stay	4.6 days
Median duration of stay	3.0 days

TABLE 4 The secondary outcomes at SRH NICU.

Limitations

The data from NHS England reflect some inaccuracies in data entry – as demonstrated by 'preterm' being the cited reason for 0.2% of 'term' infant admissions. Data are not always entered by healthcare professionals and may not be entered correctly. It is not clear why cardiac disease is considered a different admission reason to cardiovascular disease; this could be an indicator of data entry by non-clinical staff. The data may reflect the most obvious clinical sign at admission and not necessarily the appropriate reason for admission.

A very large proportion of NHS England results are classified as 'missing' (just under 10% of the study population) or 'other' (just under 20%). Probably these fields were either incomplete or clinicians chose 'other'. There is clearly a need for accurate data entry at provider level.

In some cases, the admission reason may have been recorded as the underlying clinical condition (eg congenital abnormality) rather than the clinical reason (eg respiratory disease, weight loss).

NHS England data span a period of three years, from 2011-2013, whereas the SRH audit reviews 2014 data. There was no comparison with previous years at SRH to see if the national trends are reflected within the Sunderland figures.

Discussion

There appears to be a national problem, with NHS England recognising that an increase in term admissions is a proxy indicator for harm. Previous network audits have demonstrated that reasons for term admissions vary from unit to unit depending on commissioning practices, variation in admission policies and clinical practices. This is the justification for individual units being asked to carry out audits; to identify what their local issues are in regards to term admissions.

There are a number of interesting contrasts between the data provided by NHS England and the results found at SRH, most noticeably the much higher rate of term admissions due to social issues (ie foster care) at SRH. SRH guidelines state that if there are safeguarding issues, all assessments of families and guardians should be completed and birth plans for fostering should be in place before 32 weeks' gestation.[2] This is clearly a target that is not being met at SRH, as shown by

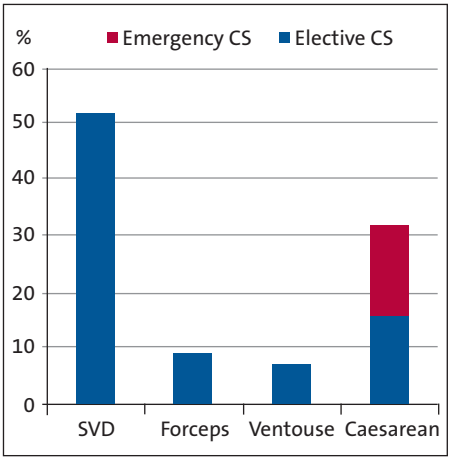

FIGURE 3 The modes of delivery for term admissions to SRH NICU. Key: SVD = spontaneous vaginal delivery, CS = caesarean section.

the high proportion of admissions due to social issues (13.9%). NHS England found that this accounted for 1.1% of term admissions nationally.

SRH does not have a transitional care ward, which is where the majority of infants reside at other hospitals if there are social issues, this could explain the difference between SRH and the national results. NHS England did apply a 'location of care' filter to try and differentiate between infants who had care on the NICU from infants who received care at other locations (transitional care wards, postnatal wards, etc). Alternatively, social services could be less efficient at SRH compared to other hospitals.

This has resource implications as it costs around £500 a day to care for an infant receiving specialist neonatal care; these babies certainly need to be cared for at a safe place but not necessarily in a NICU. This would appear to be an avoidable, unnecessary admission to the NICU, both on a local and national level, and rectifying this issue would free up a lot of cots for those infants needing neonatal unit care throughout the country.

The most common reason for term admissions to the NICU both at SRH and nationally, is respiratory disease making up 52.7% of admissions to SRH and 30.1% of admissions nationally. It was hypothesised that this difference may be due to SRH being a tertiary care centre receiving referrals from smaller hospitals for infants who require ventilation. However, when only inborn admissions were analysed, respiratory disease still comprised 51.9% of term admissions. Consultants at SRH enter the data and the authors believe the results to be very accurate.

Infection and hypoglycaemia combined accounted for 7.6% of SRH term admissions to the NICU, compared to 18.7% nationally. Units that have reduced their term admission rates cite midwifery involvement as vital. Midwives work within multidisciplinary teams therefore involvement of all healthcare professionals is crucial if term admissions are to be reduced. The low rates of infection and hypoglycaemia at SRH may be due to the practice of following a standardised protocol and guidelines relating to prophylactic antenatal care of infections (eg intrapartum antibiotics for group B streptococcus colonisation, prolonged rupture of membranes, etc) and management of infants at risk of hypoglycaemia.

SRH guidelines state that for all elective caesarean sections before 39 weeks' gestation, the mother should be given antenatal steroids as this has been shown to reduce neonatal morbidity by reducing respiratory distress syndrome.[3] Only 57% of term admissions delivered by elective caesarean section before 39 weeks' gestation were given antenatal steroids at SRH, however, there was no significant difference in the mean duration of stay (2.5 days for each group) or the amount of respiratory support required (in both groups one infant required one day of non-invasive ventilation). It would be useful to look at all infants delivered by elective caesarean section between 37 and 39 weeks' gestation to see if there is a significant difference in respiratory admissions by the administration of antenatal steroids.

In analysing the data, all admissions to the NICU were considered, 15.3% of these were transfers in from other hospital trusts and the likelihood is that these were unavoidable. These transfers may not be suitable for inclusion in future analyses.

Conclusion and recommendations

The most common causes of term admission to neonatal care at SRH are similar to those identified by NHS England from the NNRD, with the exception of social admissions. There should be no avoidable term admissions to neonatal care; further analysis should be undertaken at SRH to identify whether any of these admissions were avoidable through improved antenatal care and better birth arrangements for safeguarding the unborn baby with clear plans for fostering.

Data entry must be accurate. When there are clear inaccuracies in data, review by the clinicians at provider level will improve the situation.

Term admissions to the NICU should be on the basis of clinical need and not social need. Trusts should review their use of transitional care units to reduce unnecessary admissions to the NICU.

Further analyses of admissions should continue to look at trends, and standardised protocols and guidelines should be in place to avoid morbidities such as hypoglycaemia, hypothermia and sepsis.

Acknowledgement

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