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Impact of service changes on neonatal transfer patterns over 10 years

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Introduction: Many changes have been made to the staffing and organisation of neonatal care in the UK in the past 10 years. This study assessed the extent to which these changes had affected the transfer of babies between different parts of the service.

Methods: Data from the Trent Neonatal Survey, an ongoing study of neonatal intensive care activity in the former Trent Health Region of the UK, were used to evaluate neonatal inter-hospital transfers over a 10-year period, from 1 January 1995 to 31 December 2004. The number of transfers and the types of transfer were analysed and trends in gestation and disease severity over the study period were assessed. Rates of "inappropriate transfer" were also identified.

Results: 8105 babies were transferred over the period; 2294 babies underwent urgent postnatal transfer and this equates to approximately two such transfers every three days. The maximum number of journeys by any one baby was eight. Intensive care activity rose during the 10 years but the number of inappropriate transfers remained persistently high.

Conclusions: Organisational changes in neonatal care during the 10-year period have been insufficient to deal with the rising demand, as reflected by the persistently high rate of inappropriate transfers.

The movement of some neonates has always been seen to be an integral part of neonatal intensive care. However, in order that expensive facilities are used optimally, it has long been recognised that not all such movements have occurred under optimal circumstances. A "snapshot survey" in 1999 revealed that many perinatal centres in the UK were unable to meet "in-house" demand for neonatal intensive care on a regular basis,¹ and that in some regions the transfer of mothers and babies between units was frequently unplanned.

There have been a number of changes to the organisation of neonatal services over the past decade, starting with the "purchaser-provider split" in the early 1990s, the introduction of the European Working Time Directive, shortening of the training time for medical staff, the introduction of advanced nurse practitioners and, most recently, a move towards centralisation of care.

The British Association of Perinatal Medicine standards, published in 2001,² recommended managed clinical networks as the preferred option for service provision. The Department of Health rapidly supported this view and subsequently published a formal endorsement in the spring of 2003.³ As a consequence, networks have now been implemented widely across the UK. Part of this process has included, in some areas, the introduction of specialist transport teams. Recent papers have described the numbers and types of neonatal transfers in the Yorkshire⁴ and Thames⁵ regions by such teams. These papers have highlighted some current challenges with intensive care capacity in the UK, and the high level of resources that neonatal transfers require.

Our aim in this study was to put some of these more recent changes in context by looking at neonatal transport practice in a single region over the past 10 years. Specifically, we hoped to answer the following question: have organisational changes over this time had an impact on the numbers and types of neonatal transfer?

METHODS

Information about babies, born alive and admitted to a neonatal unit, was collected as part the Trent Neonatal

Survey (TNS). This is an ongoing study of neonatal intensive care activity in the geographically defined population of the former Trent Health Region (UK). The area covered has a population of approximately five million and just over 55 000 births/year. All of the perinatal services in Trent contribute to the TNS and units in adjacent regions also permit data collection on Trent babies. The present survey was established in February 1990. The database holds information relating to all babies of 32 weeks' gestation, or less, born to a Trent resident mother and admitted to a neonatal unit since that time, along with data about all inter-hospital neonatal transfers. Data for TNS are collected by a group of six part-time research nurses who visit each of the units on a regular basis and complete a standardised dataset about each baby. Information is obtained from the clinical records, discussions with staff, and where appropriate, personal observation.

In 1996, two units from the South Humber region were added to the Neonatal Survey, and in 2004, two units from Northamptonshire were added. Babies from South Humber and Northamptonshire were excluded from the analysis so that the same geographical area was studied throughout the time period. We did not assess the impact of any boundary changes on patient flows because we thought that any such change would have been very small with, in general, the effects being administrative rather than clinical.

Data from TNS from 1 January 1995 to 31 December 2004 were analysed. Transfer data were identified for all newborns (irrespective of gestation) admitted to a neonatal unit. Transfers were subdivided into:

- "flying squad transfers"—that is, postnatal transfers for acute care;
- In-utero transfers—note that data was not available for babies transferred in utero, but where delivery was delayed

Abbreviations: CRIB, critical risk index for babies; CSAG, Clinical Standards Advisory Group; TNS, Trent Neonatal Survey

Table 1 Total number of births, total number of transfers and number of inappropriate transfers by year

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	Total
No of live births	57 727	57 280	55 780	55 633	53 772	51 847	50 769	51 046	53 261	55 021	542 136
No of transfers	788	744	832	927	990	847	768	652	728	829	8105
Rate of transfers/1000 live births	13.7	13.0	14.9	16.7	18.4	16.3	15.1	12.8	13.7	15.1	15.0
No. of inappropriate transfers	113	65	102	227	248	234	231	165	213	236	1834
Rate of inappropriate transfers/1000 live births	2.0	1.1	1.8	4.1	4.6	4.5	4.6	3.2	4.0	4.3	3.4
Percentage of transfers that were inappropriate	14.3	8.7	12.3	24.5	25.1	27.6	30.1	25.3	29.3	28.5	22.6

and the transfer did not lead to a neonatal unit admission of the baby;

- Routine transfers—that is, transfers back to a baby's home unit, or transfers for non-acute specialist opinions.

To assess trends over time, we looked at transfer activity both in terms of absolute numbers and rates. For babies of ≤ 32 weeks' gestation who were transferred, rates were calculated per 1000 total live births and as a rate per 1000 live births of ≤ 32 weeks' gestation. The second rate was included to see what proportion of preterm babies were being transferred.

We defined flying squad and in-utero transfers as inappropriate based on the criteria of the Clinical Standards Advisory Group (CSAG) published in 1993.⁶ These were:

- Infants (from district general hospitals without the appropriate intensive care facilities or capacity) should not travel beyond their nearest referral centre (or centres if they are more or less equidistant).
- Tertiary centres should not transfer out their own babies.

A rate of inappropriate transfer was then calculated for the population per year. This was the number of inappropriate transfers as a percentage of all transfer activity for the year. The upper limit gold standard set by the CSAG was 10%.

The mean critical risk index for babies (CRIB) scores⁷ were calculated for transferred and non-transferred babies, to see whether the disease severity changed over the study period.

For the purposes of context, we also obtained the total live birth rate for the region for each year of the study and calculated the total intensive care activity using the British Association of Perinatal Medicine accepted definition from 1992⁸—that is, the definition that was being used at the start of the study period.

RESULTS

From 1 January 1995 to 31 December 2004 there were 542 136 live births in the Trent Region, and 8105 transfers took place. There were 2294 "flying squad transfers", 1605 in-utero transfers that generated a baby needing admission to a

neonatal unit and 4206 "routine" transfers. The total number of transfers, and the transfer rate remained fairly constant over the 10-year period studied. There was a transient rise in transfer activity in the mid 1990s but this pattern was not sustained (table 1).

Of the 8105 transfers, 1834 were inappropriate. Each baby was only counted once as an inappropriate transfer even if subsequent journeys met the definition for being inappropriate. This equates to an inappropriate transfer rate of 22.6%, much higher than the 10% standard set by the CSAG. The number of inappropriate transfers remained high over the study period, with no evidence of improvement as a result of organisational change (table 1). Many babies were transferred more than once—the maximum number of transfers per baby was eight. Some babies were transferred more than once, simply because of a return journey to their local unit, but many were involved in multiple transfers for other clinical reasons, particularly referrals for specialist opinions.

Tables 2 and 3 show the data for the transferred preterm babies ≤ 32 weeks' gestation. The data show that the transfer rates for all of the preterm babies remained remarkably stable.

The average rate of transfer journeys, all types, of babies born ≤ 32 weeks' gestation was 358.2/1000 live births. About 2659 babies, ≤ 32 weeks' gestation, were transferred out of a total of 12 777 live births; 20.8% of babies of this gestation were transferred at some point in their course. There was some indication that the rate of in-utero transfers in this group tended to fall over the period (tables 2 and 3).

CRIB scores of transferred babies ≤ 32 weeks' gestation

CRIB scores of transferred babies were compared with those of babies who were not transferred (table 4). The disease severity seemed to decline over time for both transferred and non-transferred babies presumably as a result of increased antenatal steroid and surfactant use over the period.⁹

Figure 1 is included for context, and shows the annual neonatal intensive care activity (British Association of Perinatal Medicine definition 1992⁸) and live birth rate for the region over the period.

Table 2 Types of transfer for all babies ≤ 32 weeks' gestational age by year

Year	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	Total
Total no of transfers	421	428	463	538	597	470	435	350	409	465	4576
Total no of in-utero transfers	124	130	116	137	114	99	107	102	95	98	1122
Rate of in-utero transfers/1000 births	2.1	2.3	2.1	2.5	2.1	1.9	2.1	2.0	1.8	1.8	2.1
Total no of flying squad transfers	84	82	91	104	172	123	80	67	89	126	1018
Rate of flying squad transfers/1000 births	1.5	1.4	1.6	1.9	3.2	2.4	1.6	1.3	1.7	2.3	1.9
Total no of routine transfers	213	216	256	297	311	248	248	181	225	241	2436
Rate of routine transfers/1000 births	3.7	3.8	4.6	5.3	5.8	4.8	4.9	3.5	4.2	4.4	4.5

Table 3 Rates of transfer of babies <32 weeks' gestation, by year per 1000 births <32 weeks' gestation

Year	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	Total
Rate of in utero transfers/1000 births <32 weeks	111.0	118.0	87.7	103.8	82.9	77.1	86.4	78.5	68.6	73.5	87.8
Rate of flying squad transfers/1000 births <32 weeks	75.2	74.5	68.8	78.8	125.1	95.8	64.6	51.5	64.3	94.5	79.7
Rate of routine transfers/1000 births <32 weeks	190.7	196.2	193.5	225.0	226.2	193.1	200.3	139.2	162.5	180.7	190.7

Table 4 Mean clinical risk index for babies (CRIB) scores of transferred and not transferred babies by year

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	Total
Mean CRIB scores of all transferred babies	3.1	2.4	2.6	2.7	2.6	2.6	2.2	2.3	2.3	2.2	2.5
Mean CRIB scores of all babies not transferred	2.7	2.5	2.7	2.6	2.4	2.6	2.4	2.3	2.3	2.1	2.5

DISCUSSION

In 1999, Parmanum *et al*¹ carried out a national census of the availability of neonatal intensive care in the UK, and found that most perinatal centres were regularly unable to meet in-house demands for neonatal intensive care. They found that a large number of inappropriate and unplanned neonatal transfers were taking place, and there was wide geographical variation in the extent to which supply met demand. Bennett *et al*¹⁰ identified the maternal morbidity, potential risks and pregnancy outcome of women in the same cohort. These papers highlighted a need to increase neonatal intensive care capacity and change the structure of perinatal services. Although data from the UK does not suggest that the problems with supply and demand adversely affect survival,^{11,12} there are clearly quality issues especially in terms of effects on the families.

During the 10 years of the study, many organisational changes occurred including the Calman reforms to medical training, the European Working Time Directive, the introduction of advanced

neonatal nurse practitioners and, most recently, the introduction of networks. It was hoped that the net effect of all of these changes would improve matching of supply and demand, and that the number of inappropriate transfers would decrease. However there seems to have been no clear positive effect from any of these changes. Instead it is our view that the steady rise in the demand for neonatal intensive care has driven events surrounding which babies are moved and where. We have not provided figures for the numbers of intensive care cots available during the period because, as most will recognise, the number of functioning cots varies day by day as a consequence of variation in overall patient dependency and the availability of staff, especially nursing staff. We chose not to apply statistical tests to these data as we felt these might lead to spurious conclusions regarding the association of the various datasets shown. We felt it was more appropriate for readers to draw their own inferences.

The British Association of Perinatal Medicine produced a set of standards in 2001² and recommended the formation of managed

Figure 1 Intensive care activity by year shown with annual live birth rate.

What is already known on this topic

- Transferring neonates is costly—in terms of both equipment and staff.
- Many babies are inappropriately transferred for non-clinical reasons.

What this study adds

- The number of transfers has not changed over a period of significant organisational change.
- The numbers of inappropriate transfers have remained unacceptably high over a 10-year period reflecting an inability of neonatal services to respond to a rising demand.

clinical networks as the preferred option for service provision, which was endorsed by the Department of Health in a review of neonatal intensive care services.³ The implementation of managed clinical networks will, by definition, increase the demand for tertiary neonatal cots. The UK has substantially fewer neonatal intensive care cots than the USA (0.67/1000 live births *v* 3.3/1000 live births, respectively¹³) and there remains a need to increase intensive care capacity, along with the reorganisation of services.

There has always been general acceptance that it is appropriate to transfer some babies for intensive care. This pattern of service has allowed for the development of centres of excellence, and allows intensive care cot use to be maximised. The CSAG report⁶ defined good practice points regarding the appropriateness of transfers, mentioned earlier, and the second CSAG review of intensive care recommended that the number of inappropriate transfers should not be more than 10% of the total number of transfers.¹⁴ We found that inappropriate transfers accounted for 22.6% of the total number of transfers over the period studied. The total number of postnatal transfers was similar to those reported in recent studies from other regions of the UK³ and again did not show a sustained rise in transfer activity. With the increased centralisation of neonatal intensive care that is implicit to the introduction of managed clinical networks it may be that the existing definition for “inappropriate transfer” will need to change to reflect the new structure of the service. In future it may well be seen as “appropriate” to transfer a relatively healthy premature baby to a smaller hospital in a network to optimise the use of resources in the tertiary centre. It is likely that the public will not willingly accept such a practice, and hence it will be important to clarify as a matter of some urgency the standards to which networks should operate.

It is 10 years since Field *et al*¹⁵ called for a change in the way neonatal transfers were performed, and since then a number of dedicated neonatal transport teams have been established, partly due to the anticipated need for more neonatal transfers with the restructuring of neonatal services. Our paper has made no attempt to measure the quality of transport services over the period. Dedicated transport teams are expensive to run with the need for relatively large numbers of well-trained staff and equipment,¹⁶ and therefore they must be used wisely. The former Trent Health Authority is a large geographical area in the UK, and we have shown that only 2294 flying squad “urgent” transfers occurred over nearly a 10-year period, which equates to about two flying squad transfer every three days. Currently three neonatal transfer teams are operating in the geographical area covered by the Trent Neonatal Survey. It

would seem sensible to consider planning such services across populations that exceed that of a single network. One option would be for much greater centralisation of neonatal transport services, in a system similar to that in some other countries.^{17, 18}

Recent data¹⁹ have shown a considerable rise in the number of preterm births in Denmark, and our study has shown a similar pattern for Trent.⁹ These data suggest neonatal intensive care capacity will need to increase further if the transport services, however structured, are to function in an organised rather than dysfunctional fashion. The key issue in achieving this will be recruitment and retention of nursing staff.

CONCLUSION

Transfer of newborns continues to be heavily influenced by issues of access and availability rather than clinical need. We speculate that the persistently high numbers of inappropriate neonatal transfers reflect the lack of intensive care capacity, particularly in tertiary referral centres. The organisation of neonatal transport services needs to give greater consideration to the optimum size of catchment area to maximise the efficient use of resources.

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REFERENCES

- 1 **Parmanum J**, Field D, Rennie J, *et al*. National census for the availability of neonatal intensive care. *British Association for Perinatal Medicine. BMJ* 2000;**321**:727–9.
- 2 **British Association of Perinatal Medicine**. *Standards for hospitals providing neonatal intensive and high dependency care and categories of babies requiring neonatal care*, 2nd edn., London: British Association of Perinatal Medicine 2001.
- 3 **Department of Health**. *Report of the Neonatal Intensive Care Services Review Group*. London: Department of Health, 2003.
- 4 **Gill AB**, Bottomley L, Chatfield S, *et al*. Perinatal transport: problems in intensive care capacity. *Arch Dis Child Fetal Neonatal Ed* 2004;**89**:F220–3.
- 5 **Kempley ST**, Sinha AK. Census of neonatal transfers in London and the South East of England. *Arch Dis Child Fetal Neonatal Ed* 2004;**89**:F521–6.
- 6 **Clinical Standards Advisory Group**. *Neonatal intensive care: access to and availability of specialist services*. London: HMSO, 1993.
- 7 **International Neonatal Network**. The CRIB (clinical risk index for babies) score: a tool for assessing initial neonatal risk and comparing the performance of neonatal intensive care units. *Lancet* 1993;**342**:193–8.
- 8 **Report of the Working Group of the British Association of Perinatal Medicine and Neonatal Nurses Association**. Categories of babies requiring neonatal care. *Arch Dis Child* 1992;**67**:868–9.
- 9 **Trent Neonatal Survey Annual Reports—1995–2004**. Available from: Department of Health Sciences, University of Leicester, 22-28 Princess Road West, Leicester).
- 10 **Bennett CC**, Lal MK, Field DJ, *et al*. Maternal morbidity and pregnancy outcome in a cohort of mothers transferred out of perinatal centres during a national census. *BJOG* 2002;**109**:663–6.
- 11 **Field D**, Draper ES. Survival and place of delivery following preterm birth: 1994–96. *Arch Dis Child Fetal Neonatal Ed* 1999;**80**:F111–15.
- 12 **Tucker J**, Parry G, McCabe C, *et al*. Patient volume, staffing, and workload in relation to risk-adjusted outcomes in a random stratified sample of UK neonatal intensive care units: a prospective evaluation. *Lancet* 2002;**359**:99–107.
- 13 **Thompson LA**, Goodman DC, Little GA. Is more neonatal intensive care always better? Insights from cross-national comparison of reproductive care. *Pediatrics* 2002;**109**:1036–43.
- 14 **Clinical Standards Advisory Group** 1995. *Neonatal intensive care: access to and availability of specialist services*. London: Royal College of Paediatrics and Child Health, 1996.
- 15 **Field D**, Milligan D, Skeoch C, *et al*. Neonatal transport: time to change? *Arch Dis Child Fetal Neonatal Ed* 1997;**76**:F1–2.
- 16 **Fenton AC**, Leslie A, Skeoch CH. Optimising neonatal transfer. *Arch Dis Child Fetal Neonatal Ed* 2004;**89**:F215–19.
- 17 **Rashid A**, Bhuta T, Berry A. A regionalised transport service, the way ahead? *Arch Dis Child* 1999;**80**:488–92.
- 18 **Agostino R**, Fenton AC, Kollee LAA, *et al*. Organisation of neonatal transport in Europe. *Prenat Neonatal Med* 1999;**4**(Suppl 1):20–34.
- 19 **Langhoff-Ross J**, Kesmodel U, Jacobsson B, *et al*. Spontaneous preterm delivery in primiparous women at low risk in Denmark: population based study. *BMJ* 2006;**332**:937–9.