

ABC of preterm birth Organisation and delivery of perinatal services

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Over the past 30 years advances in antenatal and perinatal care have improved outcomes for preterm infants greatly. In the United Kingdom the neonatal mortality rate for very low birth weight infants (birth weight < 1500 g) fell from about 50% in 1975 to less than 20% in 1995. Additionally, the incidence of preterm stillbirth has fallen so that it seems that many more preterm infants are born alive than would have been the case 20-30 years ago.

With these advances in care comes a higher demand for perinatal services, particularly for intensive care for preterm infants. Services such as neonatal intensive care, however, have a low throughput of patients, use complex and technical equipment, and are expensive. Organising the delivery of these services is not simple.

Levels of care

The level of additional care that preterm infants need varies. Broadly, the level of care is inversely related to the gestational age and birth weight.

- Special care—for example, gastric tube feeding, temperature maintenance, and respiratory monitoring for apnoea
- High dependency care—for example, continuous monitoring, supplemental oxygen, and parenteral nutrition
- Intensive care—for example, mechanical ventilation, exogenous surfactant, and other organ support (such as the use of inotropes).

Most infants born after about 32 weeks of gestation or with a birth weight > 1500 g need special care only while they establish oral feeding and grow to sufficient maturity so that they can be safely discharged. Often the infant's mother is a major carer. Neonatal nurseries may have transitional care facilities to allow mothers to stay with their infants, particularly when they are establishing breast feeding.

Less mature (or less well) infants may need high dependency care for days or weeks before progressing to special care status. Commonly, these infants need supplemental oxygen treatment for mild respiratory distress syndrome or parenteral nutrition until enteral feeds are established.

Few preterm infants need intensive care. Those that do are mostly the 0.5% of infants who are born before 30-32 weeks' gestation. Often these infants need ventilatory support for respiratory distress syndrome or intensive haemodynamic monitoring and management. Intensive care for these infants is expensive, needing input from a skilled multidisciplinary team and costly facilities and equipment. These resources are limited.

A census of the neonatal intensive care units in the United Kingdom in 1996 found that one quarter lacked the recommended minimum of one medical specialist with prime responsibility for newborn infants. Nearly 80% of the intensive care units in the census did not have enough trained nurses.

Planning the service

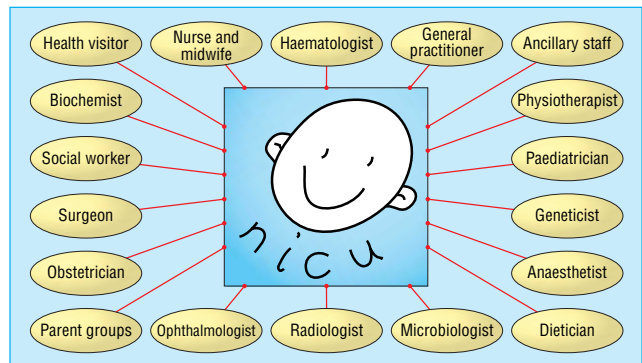
The challenge for health service planners is to use scarce resources efficiently while making neonatal intensive care facilities widely accessible. The most common service model for achieving this balance is based upon networks of affiliated



In intensive care preterm infants undergo mechanical ventilation



Infants in special care are often fed using a nasogastric tube containing maternal expressed breast milk



The multidisciplinary team contributes to infant and family centred care



Limited resources in intensive care must be used efficiently

neonatal units serving a defined geographical region. In some places—for example, in North America and Australasia—formal perinatal networks are well established. In others, such as the United Kingdom, there are formal regional networks and other groupings of more loosely affiliated units.

Units in the networks give a range of levels of care. Configurations of the networks vary according to local demography and geography. The regional neonatal intensive care units in rural and remote areas may serve a smaller population that is dispersed more widely than units in urban areas that are densely populated.

The aim of tiered networks of perinatal units is to ensure that the population in the region has local access to facilities that can at least provide special care. Fewer units in the region will provide high dependency care. In most regions, only one or two units will have the full range of medical intensive care services, although in the United Kingdom several smaller district hospitals in each region may provide intensive care. Centres that cover several regions usually have tertiary cardiology and surgical services.

Hospitals that can give only special care for newborn infants should arrange that preterm babies are delivered elsewhere. Mothers who will probably deliver early—for example, because of onset of spontaneous preterm labour or worsening maternal pre-eclampsia—should be transferred to the nearest unit in the network with high dependency or intensive care facilities.

Hospitals with only special care facilities must, however, have the equipment and appropriately trained staff for basic resuscitation and stabilisation of ill or very preterm infants unexpectedly born there. Robust mechanisms must be in place for the postnatal transfer of these infants to a unit with high dependency or intensive care services.

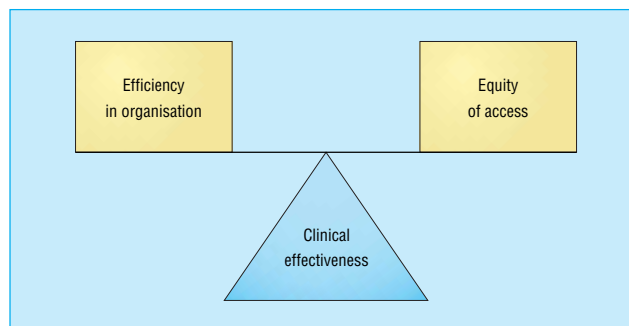
Transfers from regional centres

Regional neonatal intensive care units aim to work at near full capacity for most of the time so that expensive resources are not underused. However, demand for intensive care for preterm infants in individual units varies and is unpredictable. For example, preterm multiple birth can cause a sudden and unexpected increase in need for intensive care facilities. When a unit is already operating at or near to full capacity, mothers or preterm infants must sometimes be transferred to another unit for intensive care.

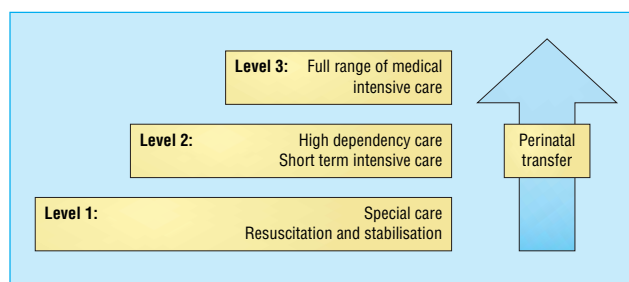
Unfortunately, such transfers from regional perinatal units often occur because of shortages of nursing staff. Mothers and infants may be transferred at short notice to a centre far from home. Such transfers are poor practice and undermine a family centred policy of care. The ongoing development of services for preterm infants and their families must deal with this issue.

Organisation and outcomes

The way that perinatal services are organised and delivered may have a substantial impact on important clinical outcomes, such as mortality or disability rates. Preterm infants who are cared for in the largest intensive care units, where staff can develop and maintain their skills, may have better outcomes than infants cared for in smaller, less busy units. In these large units, however, staff may become overworked and stressed so that mortality and morbidity of infants may increase. These considerations are central to the ongoing debate over whether intensive care services for preterm infants should be further centralised. In the United Kingdom, where neonatal intensive care units are often smaller than in other countries, this debate is especially relevant.



Planners try to achieve a balance between efficiency and accessibility to services



Neonatal units can provide varying levels of care. The tiered perinatal care network allows the population in the region to at least have access to special care facilities locally

Recommendations of the British Association of Perinatal Medicine for essential resuscitation and stabilisation

- Incubator care
- Monitoring of vital signs
- Venous access—fluids and drug administration
- Artificial ventilation
- Portable x ray facilities
- Drainage of a pneumothorax
- Administration of surfactant



Multiple births can suddenly stretch resources in neonatal intensive care units

It is difficult to compare neonatal units (or health services) in different countries to determine if any differences in outcomes are caused by the way care is given rather than other factors. Larger perinatal centres care for a higher proportion of smaller and less mature infants, and these infants will have a higher risk of adverse outcomes because of the severity of their illness at birth. Using a validated risk adjustment tool, such as the clinical risk index for babies II, makes comparisons between centres fairer.

The United Kingdom Neonatal Staffing Study used a risk adjustment tool to determine if size of neonatal unit, staffing level, and unit workload had an effect on mortality and disability rates for infants that were admitted to neonatal intensive care. The study found that clinical networks seemed to be operating adequately, with the sickest infants often being cared for in larger units. After risk adjustment, mortality and morbidity outcomes were similar in large, medium, and low volume units. However, nearly all units cared for more infants than their recommended capacity at some point during the study. Importantly, evidence showed that infants who were admitted when neonatal intensive care units were getting busier had a significantly greater risk of dying. This evidence supports the idea that the overall performance of staff in intensive care units deteriorates as workload rises.

Conclusion

Perinatal health services must use limited resources efficiently to optimise the delivery of care for preterm infants and their families. This balance can be achieved by giving different levels of care in tiered clinical networks of neonatal units that serve a defined geographical area. Demands for professionals who provide neonatal intensive care to become more specialised indicate that there will be continued pressure towards centralisation of these services.

This centralisation may exacerbate the adverse workload effect seen in busier units. Additionally, centralised services would be especially difficult for families whose preterm infants need several weeks of care in a centre far from home. Before the configuration of specialist services for preterm infants is altered, associated maternity services and the acceptability of the changes to the parents and families of preterm infants for whom the service works must be considered.

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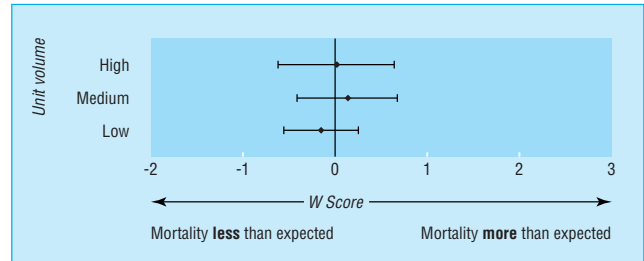
The ABC of preterm birth is edited by William McGuire, senior lecturer in neonatal medicine, Tayside Institute of Child Health, Ninewells Hospital and Medical School, University of Dundee; and Peter W Fowlie, consultant paediatrician, Perth Royal Infirmary and Ninewells Hospital and Medical School, Dundee. The series will be published as a book in spring 2005.

Competing interests: For WMcG's competing interests see first article in the series.

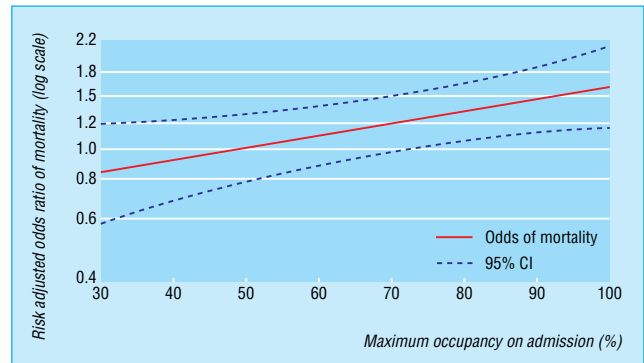
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Components of the clinical risk index for babies II

- Sex
- Birth weight
- Gestation
- Base excess
- Temperature on admission to neonatal unit



Risk of death for infants in high, medium, and low volume neonatal intensive care units in the United Kingdom



Risk of death for infants in neonatal units according to occupancy of unit on admission

Further reading

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The line drawing showing the tiered perinatal care network is adapted from material from the British Association of Perinatal Medicine. The photograph of a woman with triplets is reproduced with permission of the *Courier* (Dundee). The figures showing risk of death for infants in high, medium, and low volume neonatal intensive care units in the United Kingdom and risk of death for infants in neonatal units according to occupancy of unit on admission are adapted from Tucker J. *Lancet* 2002;359:99-107.