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Editorial: Neonatal networks

RUTH ASHMORE

Bronchopulmonary dysplasia in 2013

AOIFE McMORROW, DAVID SWEET

Database development, monitoring and improvements in neonatal outcome

ANDREW LYON

The neonatal experience – loss and grief without a bereavement

PAULA STEELE, ALEX MANCINI

Case report: Vulval mass

RAGHAVAN MAHESH BABU

Supporting skin-to-skin care

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EDITORIAL

- Neonatal networks in the new NHS England landscape **78**
Ruth Ashmore

REVIEW ARTICLE

- Bronchopulmonary dysplasia in 2013 **80**
Aoife McMorrow, David G. Sweet

CLINICAL PRACTICE

- Supporting skin-to-skin care in the neonatal unit **89**
Helen Cowan, Tammy Lilley

EDUCATION

- The neonatal experience – loss and grief without a bereavement **92**
Paula Steele, Alex Mancini
- Addressing learning needs in neonatal care: an overview of resources for self-directed learning **102**
Julia Petty

CASE REPORT

- Vulval mass in the newborn period **96**
Raghavan N. Mahesh Babu

MANAGEMENT

- Database development, monitoring and improvements in neonatal outcome **98**
Andrew Lyon

REGULAR FEATURES

- Focus **86**
- Obituary **87**
- Innovating for Life Awards **88**
- In the news **94**
- Conference report **108**
- Conference planner **110**
- New products **113**



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Infant is an independent, peer-reviewed bimonthly journal for the multidisciplinary team that cares for sick or premature babies in their first year of life. The journal contains authoritative articles written by experts in their field, covering a wide range of subjects that reflects the varied roles of the professionals working in this area. Practically and clinically based, *Infant* supports neonatal and infant paediatric nursing and medical practice and develops professional education and health promotion skills. All opinions expressed in the articles published in *Infant* are those of the authors and not necessarily those of the publishers.

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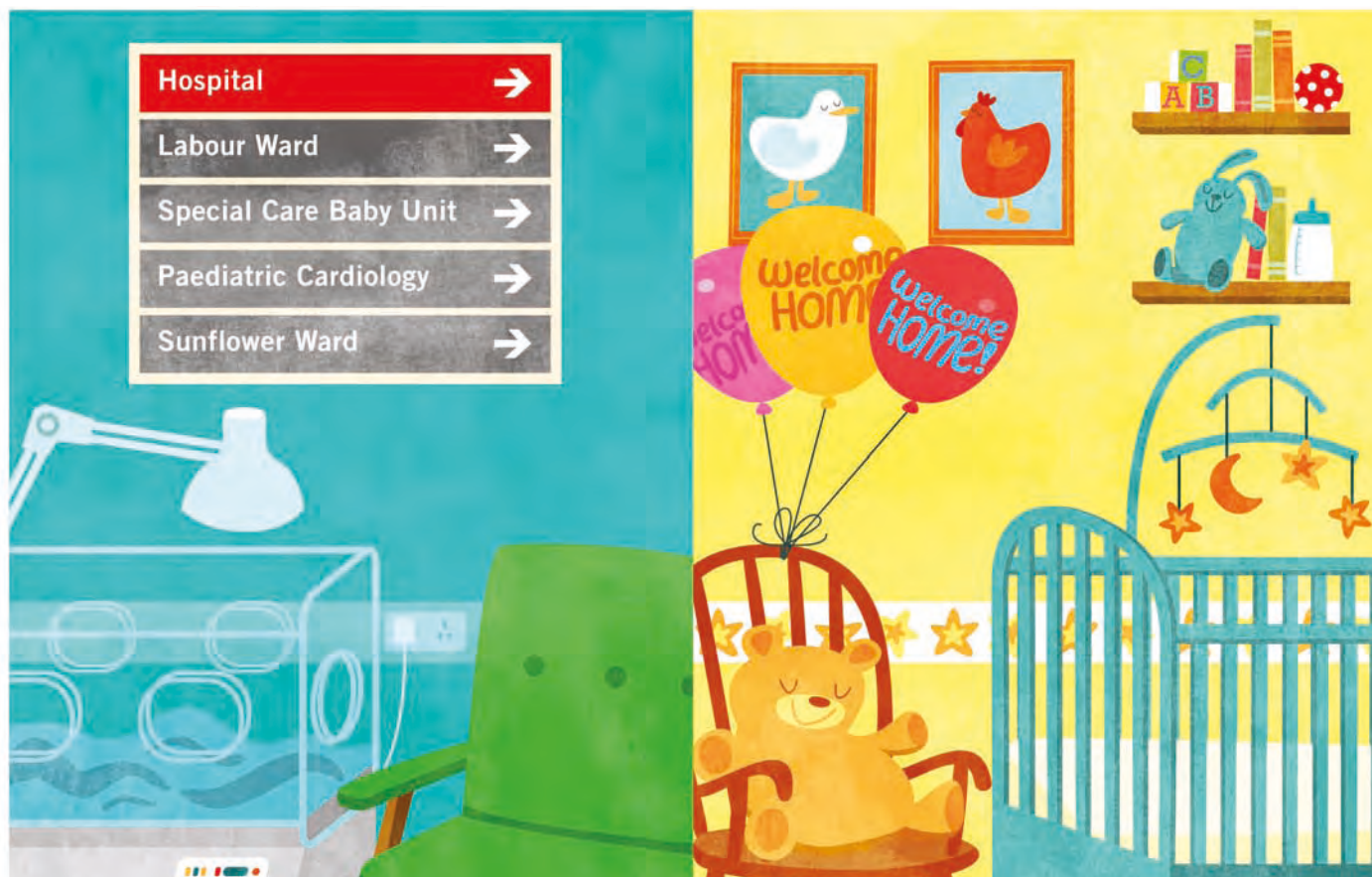
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Neonatal networks in the new NHS England landscape

The 1st April 2013 marked the largest single reorganisation of the NHS since its inception in 1948. The Health and Social Care Act has changed the landscape of the NHS by:

- giving groups of GPs the responsibility for commissioning and budgets to buy care for their local communities
- moving most of the responsibilities of the Department of Health (DH) to a new independent body called NHS England.

This reform has also meant a review of the form and function of clinical networks. Neonatal networks were developed as a result of recommendations from the DH's National Strategy for Improvement¹; 2013 marks the 10th anniversary of their formal adoption by the neonatal community as a vehicle for delivering improvements. Their future was further supported by the publication of the Neonatal Toolkit² in 2009 and the subsequent NICE Specialist Quality Neonatal Standards in 2010³.

However, over the last year the future of networks has been uncertain and the neonatal community has expressed much concern about their survival. Many staff involved in supporting the networks have taken opportunities provided by the NHS reforms to either leave the NHS or move to new roles, creating some uncertainty and challenges in maintaining a focus on outputs and potential loss of knowledge and capacity.

The good news is that NHS England has recognised that clinical networks are an NHS success story that have been responsible for some significant sustained improvements in the quality of patient care and outcomes. Moving forward there will be a variety of enabling networks, some that will be hosted by NHS England and others supported and hosted by providers. Their primary focus will be on delivery of innovation and improvement, at pace and scale, and delivering transformational change.

Extending clinical leadership in the NHS has been a guiding principal of the coalition government's reforms of the NHS. Networks have been identified as a key mechanism to support clinical leaders in delivering major improvements in quality and outcomes for patients. They have received a stay of execution and now need to ensure they continue to add value and improve outcomes for patients. In a period of continued austerity it will be vital to ensure they add value to patient outcomes, support families and clinicians.

Networks in the NHS have varied in their formality, function and funding structures. Professional groups have often created informal clinical networks as a way of diffusing knowledge, learning and best practice, supporting professional development and to drive implementation of new ways of working.

The NHS England supported networks will be called Strategic Clinical Networks (SCNs). Their aim is to bring primary, secondary and tertiary care clinicians together, while simultaneously working with social care, the third sector and patients to act as 'engines' for change across complex systems of care, maintaining and improving quality and outcomes. These will cover a number of specific disease groups and life course areas.

The Way Forward: Strategic Clinical Networks⁴, published by the NHS Commissioning Board (now NHS England) outlined the range and role of clinical networks in the new health system. The simple message is that where clinicians, commissioners or providers can see the value of working in networks they should be encouraged and valued, but they need to show added value and improve outcomes for patients. There will be a range of networks performing different functions, which include (TABLE 1):

1. Twelve clinical senates that will bring together a range of professionals to take an overview of health and healthcare for local populations and provide a source of strategic independent advice and leadership.
2. A small number of prescribed SCNs that are established and supported by NHS England to advise commissioners, support strategic change projects and improve outcomes.
3. Local professional networks supporting pharmacy, eye health and dental care within the 27 area teams of NHS England.
4. Operational Delivery Networks (ODNs) (neonatal networks) that are focused on coordinating patient pathways between providers over a wide area to ensure access to specialist resources and expertise.
5. Fifteen Academic Health Science Networks (AHSNs) that will support the rapid spread of research, innovation and encourage wealth creation.

Each of these networks will support NHS England to deliver the quality agenda around the five domains of the NHS Outcomes Framework⁵. This will ensure a consistent focus on improving

NHS Outcomes Framework				
Senates	Strategic clinical networks	Local professional networks	Operational delivery networks	Other local networks
<i>The concious and guiding intelligence</i>	<i>Engines for change and improvement across complex care systems</i>	<i>Gathering frontline knowledge and expertise</i>	<i>Mapping patient pathways to ensure access to specialist support</i>	<i>AHSNs: Masters of science and evidence-based practice</i>
Multi-professional	ie cancer, CVD, maternity and children, mental health/dementia/neurological conditions	ie pharmacy, eye health, dental	eg adult critical care, neonatal intensive care, trauma, burns, paediatric NM, paediatric IC	eg AHSNs, research networks

TABLE 1 The different types of network, NHS England 2013.

Key: CVD = cardiovascular disease, AHSN = academic health science networks, NM = neuromuscular, IC = Intensive care.

the quality of care and outcomes supported by the NHS Change Model⁶.

In December 2012 further guidance was published on the way forward for ODNs⁷, it set out transitional arrangements for 2013-14. ODNs will focus on operational delivery, with the strategy being defined nationally. The ODNs will ensure outcomes and quality standards are improved and evidence-based and networked patient pathways are agreed. Hosted by provider trusts they will focus on an operational role, supporting the activity of provider trusts in service delivery, improvement and delivery of a commissioned pathway, with a key focus on the quality and equity of access to service provision. It is anticipated that this will allow for more local determination, innovation and efficiency across the pathway. Their key principal will be the delivery of 'right care' principles by incentivising a system to manage the right patient in the right place at the right time. Success factors for ODNs will be:

■ improved access and egress to/from services at the right time

■ improved operating consistency

■ improved outcomes

■ increased productivity

Commissioners will clearly define pathway standards through the national service specification, articulating what the outputs of the ODNs will be and measuring their performance through an accountability agreement. The funding in this transition year will be from top slicing the Commissioning for Quality and Innovation (CQUIN) payments across the defined geographical area by the specialised commissioning team. The long-term aim is to include the funding with the tariff. This may well take some time to work through, so some imaginative footwork will be required to ensure the costs are contained in reference costs.

Governance arrangements will be required and, at the time of writing, a national template is being worked on to support the host providers, ensure

stakeholder engagement and guarantee that the key role of the network in being an 'honest broker' will not be lost and babies and families remain at the centre of clinical care.

What the ODNs will look like in 12 months' time will be different in each of the geographical patches, but there is no doubt that the future will be about working leaner and smarter together in the interest of improved outcomes for babies and families. The NHS reforms are all about putting clinicians, patients and families at the heart of improvements and this is an opportunity to ensure the networks continue to thrive and flourish in the new NHS. Their success will depend on all staff valuing and working together.

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Bronchopulmonary dysplasia in 2013

Advances in perinatal medicine over the last few decades have resulted in the survival of many more preterm babies who are at risk of long-term complications of prematurity. This review will discuss the changing characteristics of bronchopulmonary dysplasia over time and look at progress in current management strategies, considering both prevention and treatment of established lung disease.

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Advances in perinatal care in the last few decades have reduced mortality for premature babies born at less than 32 weeks' gestation. This has led to an increasing number of survivors with long-term complications of prematurity. Bronchopulmonary dysplasia (BPD) is the major pulmonary complication of preterm birth and is an important cause of morbidity and mortality in this group of infants.

Background and definition

Before the 1960s and the introduction of neonatal mechanical ventilation, preterm babies who developed respiratory distress syndrome (RDS) either died in the first week of life or survived without respiratory sequelae. BPD, or chronic lung disease, was first described by Northway and colleagues in 1967 in preterm babies who developed oxygen dependency beyond the first 28 days of life¹. They described the clinical, radiological and histological changes in the lungs of babies who had initial RDS and were treated with oxygen and high-pressure mechanical ventilation. These babies were mature by today's standards, with a mean gestation of 34 weeks and birthweight of 2.4kg. The pathological appearance of the lungs and bronchi was characterised by airway inflammation, fibrosis and smooth muscle hypertrophy.

Over the last four decades, advances in the management of preterm babies including antenatal steroids, surfactant therapy, gentle ventilation techniques, postnatal steroids and improved nutritional strategies, have altered the population of babies affected by BPD. As a result, the definition of BPD has needed to evolve over time. BPD is now infrequent among babies born greater than 1200g or



FIGURE 1 A chest radiograph of a baby with BPD born at 26 weeks' gestation (corrected to 36 weeks) showing diffuse bilateral haziness with areas of atelectasis and over inflation.

30 weeks' gestation. In the 'new BPD' there is lung developmental arrest occurring before alveolarisation, which normally begins around 30 weeks' gestation. The lungs become remodelled with larger and fewer alveoli, resulting in a reduced surface area for gas exchange (**FIGURE 1**). Alveolar and lung vascular development are closely related and the developing pulmonary microvasculature is also likely to be affected².

The consensus definition of BPD from the US National Institutes of Health (NIH) categorises severity based on the level of respiratory support required at 36 weeks' postmenstrual age³ (**TABLE 1**). Walsh et al proposed physiological criteria in an attempt to standardise the definition of BPD and reduce the variation in observed rates between centres. In this definition, babies between 35-37 weeks' corrected gestation who are treated with mechanical ventilation, continuous positive airway pressure (CPAP) or supplemental oxygen concentration of 30%, and have oxygen

Keywords

bronchopulmonary dysplasia, preterm, non-invasive support, lung protection

Key points

McMorrow A., Sweet D.G.

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1. BPD is an important cause of morbidity and mortality in preterm infants.
2. Strategies to prevent BPD begin with good antenatal care and lung protection strategies from the initiation of breathing at birth.
3. Non-invasive respiratory support should be used preferentially to avoid mechanical ventilation induced lung injury.
4. BPD is a chronic condition requiring a multidisciplinary approach to management.

saturations of 90–96% are diagnosed with BPD without additional testing. Babies requiring supplemental $\text{FiO}_2 < 0.3$ require an oxygen reduction test to determine if they have BPD or not⁴.

Epidemiology

The incidence of BPD is inversely related to both birthweight and gestational age, with up to 75% of extremely low birthweight (ELBW) babies (<1000g) affected in some studies⁵. BPD is uncommon in babies born after 30 weeks' gestation and the incidence in babies greater than 1500g birthweight has been reported to be as low as 5%⁶. Although the overall incidence is approximately 20% of all ventilated newborns, wide variability exists among centres. This may reflect the numbers of babies with extreme prematurity, variations in patient management and regional differences in the definition of BPD. These differences have led to speculation that some BPD could be preventable with implementation of specific quality improvement initiatives aimed at reducing lung injury⁷.

Pathogenesis

BPD has a multifactorial aetiology (**FIGURE 2**). Preterm babies have immature lungs and may also have encountered additional challenges such as chorio-amnionitis. Many of these factors can play a part in the development of BPD by influencing lung architecture or by triggering an inflammatory response during a critical stage of lung growth. Inflammatory lung injury may be followed by abnormal repair and remodelling which results in the histological changes found in BPD⁸. There may also be a genetic predisposition as BPD is more common if there is a family history of reactive airways disease. Racial and gender differences can also affect the severity of the disease⁵.

Antenatal and postnatal infection or inflammation are also important factors in the development of BPD. BPD was typically associated with maternal chorioamnionitis in many cohort studies, however more recently some studies have shown no difference or a decreased risk and therefore the relationship may depend on the interplay between inflammation exposure and additional risk factors such as volutrauma^{9,10}. Neonatal sepsis is strongly correlated with BPD with coagulase-negative Staphylococcal infection as strongly associated with BPD

Gestational age	<32 weeks	>32 weeks
Time of assessment	36 weeks PMA or discharge	>28 days, but <56 days' postnatal age or discharge
No BPD	>21% oxygen for <28 days	>21% oxygen for <28 days
Mild BPD	Room air	Room air by 56 days
Moderate BPD	<30% oxygen	<30% oxygen to 56 days
Severe BPD	>30% oxygen or respiratory support	>30% oxygen or respiratory support

TABLE 1 Definition of BPD by gestational age for babies receiving oxygen treatment for longer than 28 days, according to US National Institutes of Health (NIH).

Key: PMA = postmenstrual age.

as infection with other gram positive and gram negative organisms¹¹.

Mechanical ventilation may cause damage if the lungs are inadvertently stretched by using high tidal volumes (volutrauma). Even a small number of large volume breaths can cause lung damage, especially in non-compliant surfactant-deficient lungs, although BPD is seen most frequently in babies who need prolonged mechanical ventilation. Mechanisms of ventilator-induced lung injury (VILI) also include high airway pressure (barotrauma), alveolar collapse and re-expansion (atelectotrauma) and increased inflammation (biotrauma). Injury may occur during the initial delivery room stabilisation, when there is a fine balance between inflating the lungs using positive pressure ventilation while attempting not to overdistend them.

The presence of a haemodynamically significant patent ductus arteriosus (PDA) is also associated with an increased risk of BPD. Damage to the lung endothelium from a left-to-right shunt in addition to the increased need for ventilatory support due to pulmonary fluid overload, may be the reason for this. However PDA ligation increases the risk of BPD rather than reducing it¹².

Prevention of BPD

Prevention of BPD begins with optimising antenatal care of women at risk of delivering prematurely followed by careful early respiratory management of the preterm baby, including strategies for lung protection.

Antenatal

BPD prevention begins with good obstetric care. There are circumstances where pregnancy can be prolonged with the correct treatment, such as progesterone for short cervix or antibiotics for preterm prelabour rupture of membranes, although there is no evidence that these directly

affect the risk of BPD. Administration of antenatal corticosteroids is now the standard of care for women who are at high risk of delivering prematurely in order to assist fetal lung maturation. The use of antenatal steroids reduces the rate of death and RDS by 50%, however does not improve rates of BPD. In animal studies, antenatal steroid exposure reduces the amount of collagen in the lung extracellular matrix and this may theoretically predispose the lung to an increased risk of stretch-related damage¹³.

Postnatal

Ventilation strategies and pharmacological treatments play a role in prevention of BPD, and lung protection should be implemented from initiation of breathing in the delivery suite.

Strategies for lung protection

One approach to attempt to reduce BPD is to avoid intubation and mechanical ventilation altogether by using non-invasive respiratory support as much as possible. Recent trials comparing initiation of early CPAP rather than intubation and surfactant show that the babies who commenced CPAP from birth had no increased risk of BPD or death, and were less likely to be in oxygen at 28 days¹⁴. Initial CPAP followed by rescue surfactant administration as part of the INSURE approach (INtubate-SURfactant-Extubate) has been associated with lower rates of BPD, compared with initial CPAP followed by surfactant administration and continued ventilation¹⁵. A large clinical trial from the Vermont-Oxford Network compared three different approaches to initial respiratory management of preterm babies. They were randomised to one of three groups:

1. Intubation, surfactant and ventilation
2. Intubation, surfactant and extubation to CPAP
3. CPAP with selective surfactant treatment.

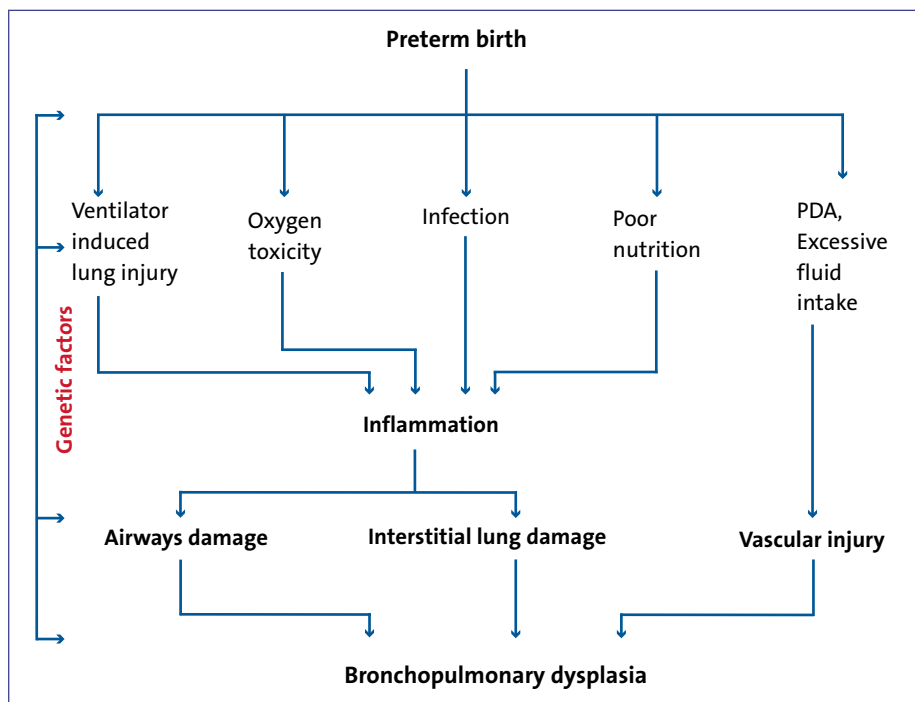


FIGURE 2 The pathogenesis of BPD. Key: PDA = patent ductus arteriosus.

In this trial the outcomes of death or BPD were not different between groups, but qualitatively favoured the CPAP groups¹⁶. New techniques are being evaluated to deliver surfactant to preterm babies on CPAP using a narrow-bore tracheal catheter (minimally invasive surfactant therapy) and this appears to be a feasible alternative to intubation¹⁷. Nasal intermittent positive pressure ventilation (NIPPV) was shown in small trials to have benefits over nasal CPAP in terms of reducing extubation failure; however a recent large randomised trial of over 1,000 babies has concluded that NIPPV does not confer additional benefit or risk for survival to 36 weeks without BPD¹⁸.

When mechanical ventilation is necessary, the overall aim is to provide 'gentle' ventilation ie to give the smallest amount of respiratory support needed to adequately oxygenate and ventilate, in order to minimise the risk of lung damage caused by VILI. Many clinical trials have attempted to identify the optimal mode of mechanical ventilation for preventing BPD. High frequency oscillation ventilation and conventional ventilation are equivalent in terms of BPD prevention¹². However lower rates of BPD are found when using volume-targeted ventilation rather than pressure-limited modes¹⁹. Volume-targeted strategies aim to deliver a consistent tidal volume in order to reduce lung damage from overdistension and stabilise pCO₂. When

mechanical ventilation is needed, a short inspiratory time should be used (0.24-0.4 seconds), in addition to minimising peak inspiratory pressures (14-20cmH₂O), using moderate positive end-expiratory pressure (4-6cmH₂O) and targeting tidal volumes (3-6mL/kg)^{20,21}. Tolerating a moderately higher PaCO₂ (permissive hypercapnia) has shown a trend towards reduction of BPD without significant adverse effects²².

Avoidance of hyperoxia

Oxygen is one of the most frequently used drugs in the NICU, however it is clear that high inspired oxygen concentrations contribute to the development of BPD³. The goal of oxygen therapy is to deliver adequate oxygenation to the tissues without causing oxygen toxicity. The appropriate level of oxygenation for preterm babies to maximise survival without causing significant morbidity remains unknown and is the subject of ongoing clinical trials. Results from the NeOPRoM Collaboration, a prospective meta-analysis of five large randomised trials of oxygen saturation targeting will be published in 2014, and should offer some guidance. Currently a wide variation in oxygen saturation target levels exists among centres but is generally 90-95%²³. Lower targeted saturations can reduce retinopathy of prematurity (ROP) and, to a lesser extent, BPD but are associated with increased mortality, particularly in extremely preterm babies.

Methylxanthines

Caffeine therapy improves successful extubation and reduces BPD (36% vs 47%)^{24,25}. The mechanism by which caffeine decreases the incidence of BPD is unknown, although it is likely to be due to the fact that babies on caffeine can be extubated more quickly, resulting in less VILI.

Systemic corticosteroids

Postnatal steroids, of which dexamethasone has been the most studied, remain a controversial therapy to reduce BPD. Steroids were previously widely used to facilitate extubation, however their use has declined due to concerns about adverse effects on head growth and worse long-term neurodevelopmental outcomes. Follow-up studies from some of the original randomised trials have shown an increased incidence of neurological sequelae with early use (<8 days)²⁶. However dexamethasone is very effective for weaning from mechanical ventilation and reducing BPD if used 'moderately early' (7-14 days) or 'delayed' (>3 weeks)^{27,28}. Given the evidence of both benefits and potential adverse effects of postnatal steroids they should be used on a case-to-case basis rather than prescribed routinely and the dose and duration of any course of steroid treatment should be minimised. The higher the risk of BPD, the more likely the benefit of steroids will outweigh the risks²⁹. Recent case series have suggested that even tiny doses of dexamethasone may be effective at facilitating extubation³⁰.

Antioxidants

Vitamin A (retinol) is required for promotion of growth and differentiation in many organs, including the lung. Preterm babies have low vitamin A levels at birth, and this has been associated with an increased risk of BPD¹². Intramuscular vitamin A therapy reduces BPD in ELBW babies, with one additional infant surviving without BPD for every 14-15 treated³¹. The need for intramuscular injections, perceived small clinical benefit and lack of improved neurodevelopmental outcomes have limited use of this treatment. There is no apparent benefit of vitamin E or the enzyme superoxide dismutase in BPD prevention.

Nutrition

Nutrition has a direct effect on the developing lung and postnatal

malnutrition compromises lung growth. Preterm babies are often fluid restricted, as excessive fluid intake in the first ten days after birth increases the risk of BPD. However babies with established BPD have increased nutritional demands and may need between 20-40% more calories³². Nutritional management of very low birth-weight (VLBW, <1500g) babies should therefore be addressed from the first day of life.

Nitric oxide

Inhaled nitric oxide therapy does not improve pulmonary outcome in preterm babies with hypoxic respiratory failure, nor is it beneficial in well preterm babies in terms of promotion of lung angiogenesis to prevent BPD, and therefore its use in this population is not recommended³³.

Surfactant therapy

Surfactant therapy has dramatically improved respiratory outcomes in ELBW babies, although has not in itself led to a decrease in BPD.

Mast cell stabilisers

Cromolyn sodium is a mast cell stabiliser that is used in the management of asthma. Clinical trials have not shown any benefit in the prevention of BPD.

Azithromycin

Azithromycin and other macrolide antibiotics have both anti-inflammatory actions in addition to their antibiotic properties. They are used to treat ureaplasma infections, which can be found in chorioamnionitis and have been studied as potential therapies for BPD prevention. In a randomised trial of VLBW babies, treatment with azithromycin compared with placebo showed no benefit, except in a subgroup of babies who were infected with ureaplasma and had reduced incidence of BPD³⁴. A further larger trial is planned to determine the role of azithromycin in BPD prevention (TINN2 trial).

Treatment of established BPD

Despite best efforts, a number of babies become stuck on prolonged respiratory support and supplemental oxygen related to lung injury incurred during the course of their hospital stay. Beyond a certain point, the focus will change from prevention of BPD to consideration of management of established BPD, and in many centres this is done in collaboration between neonatology teams,

pulmonologists and sometimes cardiologists. Treatments are directed at trying to optimise lung mechanics, improve pulmonary blood flow and prevent further lung injury.

Nutrition

Malnutrition can worsen BPD by compromising lung growth. In addition, some medications used in BPD management (eg steroids and diuretics) can have adverse effects on growth. Feeding difficulties in these babies, such as swallowing difficulties and gastro-oesophageal reflux (GOR) can further affect nutritional status. Provision of adequate calories is critical. Infants who have established BPD continue to have increased calorie expenditure around 25% above their usual needs, and 30-65% have growth failure soon after initial hospital discharge³².

Diuretics

Diuretics are often used in babies with established BPD to decrease pulmonary oedema and improve lung function. A systematic review of furosemide showed no or inconsistent effects and therefore use of systemic loop diuretics is not recommended³⁵. There has been more success shown, in terms of improved pulmonary function, using the combination of thiazides and spironolactone in babies with moderate BPD, however there is no evidence to show that it improves long-term outcomes³⁶.

Management of pulmonary hypertension

There is a lack of consensus for when to screen babies who have BPD for pulmonary hypertension, however the incidence is reported to be up to 43% and the condition carries significant mortality³⁷. The severity of pulmonary hypertension correlates with the severity of BPD. Treatment options that are occasionally considered include sildenafil and bosentan, usually given under the direction of a paediatric cardiologist or pulmonologist.

Home oxygen therapy

Low flow supplemental oxygen can be administered at home and facilitates earlier hospital discharge for babies requiring oxygen, most of whom are not ready to go home until their oxygen requirement is $\leq 0.5\text{L/min}$. The benefits of oxygen therapy are to prevent pulmonary hypertension, reduce intermittent desaturations, reduce

airway resistance and optimise growth³⁸. Careful consideration of the suitability of families for home oxygen is needed, including a smoker-free household, ability to operate oxygen cylinders and training for when to seek assistance. The duration of oxygen therapy varies but most babies can discontinue treatment by their first birthday.

β agonists

Salbutamol inhalation may result in short-term improvement for babies with BPD during an exacerbation by increasing compliance and reducing pulmonary resistance. However, when used for chronic management of BPD there is no significant effect on duration of the disease.

Passive immunisation

Respiratory syncytial virus (RSV) can cause severe and sometimes fatal respiratory infections in babies with BPD. Palivizumab is a recombinant monoclonal antibody against RSV that can be administered intramuscularly to confer passive immunisation and decrease the incidence of hospital readmission and morbidity in babies with BPD. The current UK Department of Health guidelines advise prophylaxis with palivizumab for children less than two years' old who have received treatment for BPD within the previous six months.

Long-term outcomes

The majority of babies with BPD now ultimately survive. It is a chronic illness that persists long after hospital discharge, with effects that can be seen into adulthood. Apart from pulmonary disease, BPD has other multisystem complications that affect growth, cardiovascular status and neurodevelopment. Following discharge infants often require frequent hospital readmission for respiratory illnesses, which are most common in the first two years of life. Babies with severe BPD are at high risk of long-term pulmonary and neurological sequelae. Even when controlling for gestation, BPD is an independent risk factor for neurodevelopmental impairment. VLBW infants with BPD have greater language delay in addition to more marked fine and gross motor impairment³⁹. Recently published follow-up of children with BPD until eight to nine years of age has shown significantly abnormal lung function compared with term controls⁴⁰.

Conclusion

BPD remains a major complication of preterm birth and presents an ongoing challenge for the future. Progress in prevention and management strategies has been made and in the future neonatologists will aim to avoid mechanical ventilation in many more babies and improve non-invasive ventilation techniques. New ideas to prevent BPD show promise, such as the administration of surfactant with added budesonide as an anti-inflammatory agent. Continued research to develop management strategies will hopefully lead to a sustained improvement in the outcomes of preterm babies in the future.

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Developing a new identity at Royal Bolton

FOCUS

BY Simon Power, Consultant, NICU,
Royal Bolton NHS Foundation Trust



Staff at the new Royal Bolton NICU (above). The old neonatal unit at Bolton (inset).

In December 2006, after a lengthy consultation, the Joint Committee of Primary Care Trusts decided on a new model of care for women, children and newborn infants in the Greater Manchester district. Following an appeal, an Independent Reconfiguration Panel set up by the Secretary of State for Health endorsed the decision and in August 2007 work began on one of the largest reconfiguration projects in NHS history.

As part of that reconfiguration, three centres at Bolton, Central Manchester and Oldham would provide neonatal intensive care. Integral to these changes was the decommissioning of the neonatal intensive care unit (NICU) at Salford Royal Hospital.

The Royal Bolton Hospital NICU officially opened in November 2011 and perhaps now, more than a year from that opening, it is a time to reflect on the huge changes staff have witnessed since

that decision in 2006.

For some years Bolton had enjoyed a reputation as a district hospital with a thriving paediatric and neonatal unit. Infants of extreme prematurity were cared for in Bolton, though capacity was limited to three intensive care cots and there was no facility for inhaled nitric oxide therapy or therapeutic hypothermia. In addition, there was no separation of medical staff rotas between paediatrics and neonates at any level from junior trainee to consultant and infants were nursed in a unit that was structurally sub-optimal. Space between intensive care cots was limited and the environment not conducive to the provision of best care for infants or their parents.

Following completion of building work in October 2010, staff and babies moved into their new facility, adjacent to the old area and designed to BAPM standards. The benefits to parents were evident



immediately. There was real space around the cots and with all intensive care spaces curtained, an opportunity for a level of privacy previously impossible in the old unit. In addition, facilities for gas and power supply to each cot were hugely improved along with state-of-the-art lighting and hand washing equipment.

Having the opportunity to move into the new unit before activity increased was helpful. It enabled Bolton and Salford staff to familiarise themselves with the new layout in perhaps a less intense environment and the transition proceeded in an unremarkable fashion.

However, this first phase of transition to NICU status was, in retrospect, only a warm-up for the definitive phase, namely

the closure of Salford Royal NICU and the transfer of a proportion of both Salford staff and infants to Bolton.

Clearly the challenges of merging two neonatal units cannot be underestimated. Each unit historically offered excellent care to its vulnerable patients but they offered this care in different ways. Some of these differences were obvious, for example those regarding ventilators and ventilation strategies, clinical guidelines and documentation. Some differences however were subtler, such as the approach to management of junior medical and nursing staff, the organisation of ward rounds and the management of infants establishing feeds on special care.

Whatever the nature of the differences they all tended toward the same effect – a sense of unsettlement and frustration among staff. This sense of unease was most acutely felt among the nursing staff and in particular the nursing staff transferring from Salford. This is perhaps unsurprising as it was the Salford NICU that was decommissioned and its staff who were

obliged to relocate. This is not in any way to underestimate the frustration felt by nursing staff who had worked in Bolton for many years, some of whom felt their practice was excessively questioned by incoming colleagues. For a while there was a culture of a divided unit along ‘old’ Bolton and Salford lines.

An additional pressure felt by the nursing staff as a whole was the Trust’s move away from 12-hour shifts, obliging staff to only work the shorter eight-hour shift. For some nurses, this meant more shifts and more journeys to work and it was particularly unpopular among staff with longer distances to travel. The timing of this move was unfortunate and it has since been reviewed with a return to the longer shift planned for 2013.

Perhaps as a result of these frustrations, within the first 12 months of the formal opening a significant proportion of the original Salford nursing staff applied to move elsewhere, along with a smaller proportion of Bolton staff. Though regrettable, the vacancies that have arisen

as a consequence have been filled with new nursing staff that come with no experience of Salford or the historic Bolton and in some way, the loss of experienced staff has been countered by an excellent in-house development programme for new starters.

It takes some time for a new unit to develop its own identity. Both Bolton and Salford had strong identities prior to the merger and from the challenges staff have experienced, our new identity continues to grow.

Now, over a year on from our formal opening, we can look to the future with huge optimism and excitement. Our intensive care activity has more than doubled over the last 12 months and our clinical incident rates are falling, following a peak noted shortly after the merger. We have an excellent team here at Bolton, committed to providing the best possible care for our infants and their families. And the way forward is in one respect very simple – to continue to focus on the delivery of this best possible care in our world-class environment.

A tribute to Christine Israel



Christine Caroline Israel, born 4th July 1953, died 30th March 2013.

Chrissie, as she was known to all her friends and colleagues, trained as an enrolled nurse in 1971 at Musgrove Park Hospital, Taunton before moving to Manchester where she started her career in neonatal nursing in 1977 in the neonatal unit at St Mary’s Hospital. During her time working in Manchester, Chrissie joined the North West Flying Squad. In 1981 Chrissie was awarded a Florence Nightingale Scholarship and she travelled throughout the USA and Canada studying neonatal transportation, the management of hypothermia and discharge of the preterm infant.

In 1985 she moved to Bristol where she worked at St Michael’s Hospital until 1996. She was awarded a Royal College of Nursing Scholarship in 1987 and once again travelled to the USA studying parents’ experiences of neonatal units. In 1989 she began working as a research nurse on the Avon Premature Infant Project alongside Dr Neil Marlow, during which time she co-authored ‘The Parent-Baby Interaction programme’.

Chrissie moved to Southmead Hospital, Bristol, in 1996 where she undertook the conversion course becoming a Registered

Nurse. During her time working at Southmead Chrissie continued her passion for research participating in the Premature Infant Parenting study alongside Professor Andrew Whitelaw. Chrissie was passionate about developmental care interventions.

In October 2006 Chrissie was awarded the Neonatal Nurse Lifetime Achievement Award in the BLISS Baby Charter Neonatal Awards for her long-term dedication to the neonatal profession.

Chrissie was well known in the world of neonatal nursing, she worked tirelessly to improve the care of premature infants and their families and was an active member of the Neonatal Nurses Association and BLISS and a valued member of the *Infant* editorial board. Chrissie will be sadly missed by all who knew her both professionally and personally. As a nurse she strove for excellence and always said she felt privileged to be part of the families’ lives. The legacy she has left behind will remain – she really was the perfect neonatal nurse.

By Su Monk

Clinical Matron, Child Health
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 Practical advice for healthcare professionals from

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We are pleased to announce the winners of the 2012-13 Innovating for Life Awards. *Infant* journal has joined forces with Cow & Gate to present the second Innovating for Life Awards, designed to reward innovation and creativity within maternity and neonatal teams to improve the care of infants.

Thank you to everyone who took part in the awards. We received some excellent entries and are delighted to announce the winners and shortlisted entries.

Winner of the neonatal category:

Audio-visual display monitor highlighting five infection control standards

Lead applicant: Ula El-Kafrawy, Consultant Neonatologist, Royal Bolton Hospital, Bolton
 An audio-visual display monitor highlighting five infection control standards, namely, thorough hand washing, rolling up sleeves to the elbows, and removing jackets, jewellery and watches. Team members:

- Dr Robert Taylor, Medical Physicist, Salford Royal Hospital, Manchester
- Dr Natalie Francis, Spr Paediatrics, Royal Manchester Children's Hospital
- Emaan Boussabaine, Medical Student, Imperial College, London
- Maysoon Badrideen, Medical Student, University of Liverpool

Winner of the midwifery category:

The establishment of a complementary therapy clinic for post dates low risk women

Lead applicant: Tara Pauley, Midwife, Hinchingbrooke NHS Trust, Cambridgeshire

The establishment of a complementary therapy clinic for post dates low risk women to attend, facilitating the onset of labour and reducing numbers of medical inductions.



Dr Robert Taylor and Dr Ula El-Kafrawy of the winning neonatal team.

Shortlisted entries in the neonatal category:

'I See You' parent communication website

Lead applicant: Susie Holt, Paediatrician, Wirral University Teaching Hospital, Wirral

'I See You' is a baby to parent communication website to help parents stay in touch with their baby during the difficult months spent receiving treatment on the neonatal intensive care unit.

Kangaroo Care – Knowledge, Innovation and Training (The Kangaroo-KIT)

Lead applicant: Dr Jennifer McGowan, Neonatal Researcher, School of Nursing and Midwifery, Medical Biology Centre, Belfast

An educational intervention for parents and staff to promote early skin-to-skin holding and kangaroo care for high-risk preterm infants.



The winners of the neonatal category of the 2012-13 Innovating for Life Awards were presented with their award at Royal Bolton Hospital on 22 April 2013. The presentation was attended by Consultant Neonatologist, Dr Ula El-Kafrawy and Medical Physicist, Dr Robert Taylor from the winning team, as well as Consultant Neonatologist and Medical Editor of *Infant*, Dr Anthony Emmerson and Helen Williams from Cow & Gate.

Steve Davies, Interim Programme Director at Bolton NHS Foundation Trust, gave a brief speech at the presentation on the importance of innovation. He said: "Infection control is particularly important in a neonatal unit, so it is great to have awards such as this to support good ideas."

From left to right, Dr Anthony Emmerson, Dr Ula El-Kafrawy, Steve Davies, Dr Robert Taylor and Helen Williams.

Supporting skin-to-skin care in the neonatal unit

This article describes a project aimed at increasing the number of babies receiving skin-to-skin care in the neonatal unit by highlighting the benefits of kangaroo care to parents and staff and introducing a number of simple measures.

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Kangaroo care (KC) is a technique of holding a newborn, low birthweight or premature infant in an upright position, skin-to-skin, against the chest of the mother or other family member (**FIGURE 1**). Rey and Martinez first described KC in Columbia in the early 1980s¹ where lack of equipment and problems of high mortality and abandonment were common, especially among low birthweight infants. They found that infant mortality and morbidity reduced substantially with KC. Subsequently many 'high tech' neonatal nurseries have adopted KC as the benefits for mothers and their infants are well recognised². In this setting, skin-to-skin care is more often intermittent than continuous³.

Evidence-based benefits of KC

There are many reported benefits of KC. Many studies have looked at the benefits of skin-to-skin care on parent-infant bonding and attachment. A causal relationship between early physical contact and subsequent security of attachment between infant and mother has been found⁴ and following KC, parents are more sensitive to their infants with increased 'affectionate touch' between parent and infant and between spouses⁵.

It has long been noted that KC increases a mother's milk production and helps in the establishment and maintenance of breastfeeding⁶⁻⁸. In a systematic review on efficacy and cost-effectiveness of interventions to promote or inhibit breastfeeding, it was noted that skin-to-skin contact increases the duration of breastfeeding prior to, and for one month after, discharge from hospital⁹.

Other studies have shown decreased variation in heart and respiratory rates, improved oxygenation, less bradycardia, fewer and shorter apnoeic episodes and



FIGURE 1 Kangaroo care with the father.

more stable skin and core temperatures (through conduction of heat from the parent)¹⁰⁻¹².

Setting up the project

In 2011, a group of interested nurses and allied health care professionals set up a working group to raise the profile of KC and to increase the number of babies receiving skin-to-skin contact. The inspiration for the project came from attendance at two key events: the Baby Friendly Hospital Initiative for Neonatal Wards conference and workshop in Uppsala, 2011 and a Yorkshire and Humber Health Innovation & Education Cluster (HIEC) meeting.

Skin-to-skin care was already encouraged on the unit and a guideline was in place (**FIGURE 2**), but it was used on an *ad hoc* basis rather than being in regular and consistent practice. The hospital was working towards Baby Friendly accreditation at this time and the benefits of skin-to-skin care on lactation were discussed with mothers. Baby Friendly

Keywords

kangaroo care; skin-to-skin care; breastfeeding and lactation; developmental care

Key points

Cowan H., Lilley T. Supporting skin-to-skin care in the neonatal unit. *Infant* 2013; 9(3): 89-91.

1. An ongoing project to raise the profile of kangaroo care and to increase the number of babies receiving skin-to-skin contact is described.
2. The introduction of a few simple measures has led to an increase in the number of babies receiving kangaroo care.
3. Future plans include further training, education workshops and addressing the way forward for babies requiring humidity.

Kangaroo care may be considered if none of the following contraindications apply:

- physiological instability
- need for frequent suctioning
- frequent apnoeic episodes
- oxygen requirement greater than 50%
- chest drain *in situ*
- umbilical catheter *in situ*
- need for continuous sedation or paralysing agents
- NEC or suspected NEC
- gastroschisis or omphalocele (prior to treatment)
- need for humidity

FIGURE 2 Criteria for suitability for kangaroo care, according to the unit guideline (2009).

standards require that KC will be encouraged and that local guidelines to ensure best practice regarding frequency and duration of skin-to-skin contact are available¹³.

The working group commenced a service evaluation of all areas of the neonatal unit and transitional care ward to establish the background number of babies receiving skin-to-skin care. The aim was to stage the introduction of measures and audit throughout the project.

Initial measures



FIGURE 3 Laminated card displayed at the cot.

All parents received the Bliss skin-to-skin booklet in their admission pack. Written information has been found helpful and valuable for parents who find retaining spoken information difficult at stressful times¹⁴.



FIGURE 4 Kangaroo care sticker for the baby's chart.

A laminated card was designed – ‘I’m ready for kangaroo care’ (**FIGURE 3**) – that was displayed in a baby’s cot space when it was deemed appropriate. This served as a reminder to the nurse that KC was appropriate for the baby in their care and to the parents of that baby, that kangaroo care could be something they could expect from their baby’s care that day. It also informed other parents in the room that KC was something that they could look forward to, as it has been shown that parents find it important to be able to envisage what their future might hold¹⁴.

Kangaroo stickers were also designed (**FIGURE 4**), with a space for recording the length of time the baby received skin-to-skin contact; the stickers were stuck onto the baby’s chart, which helped in the audit trail.

Ward rounds

Teamwork and good communication empowers all staff and is important for the effectiveness of new practices¹⁵. Perhaps one of the most significant steps of this initiative was the early inclusion of the senior medical team and their contribution to the decision to include suitability for KC as part of the ward round discussion. This multidisciplinary approach involved all staff and parents on the ward round allowing discussion of any concerns, from any party, as to the suitability or the practicality of KC. The decision was recorded in the medical notes, nurse handover sheet and observation charts so that all staff were aware of the decision and could provide medical support, if necessary. Previously the nurse alone had made this decision.

Research shows parents are more satisfied with their communication with doctors when they are included in ward round discussion¹⁴ and Baby Friendly guidelines¹³ highlight the importance of involving the parents as partners in care.

Studies have shown that parents want to be given the opportunity to discuss KC and want to be supported to hold their babies skin-to-skin¹⁴. Involving the parents in the decision-making process about when their baby may be ready for KC was fundamental to the project. Wall space was allocated for posters and

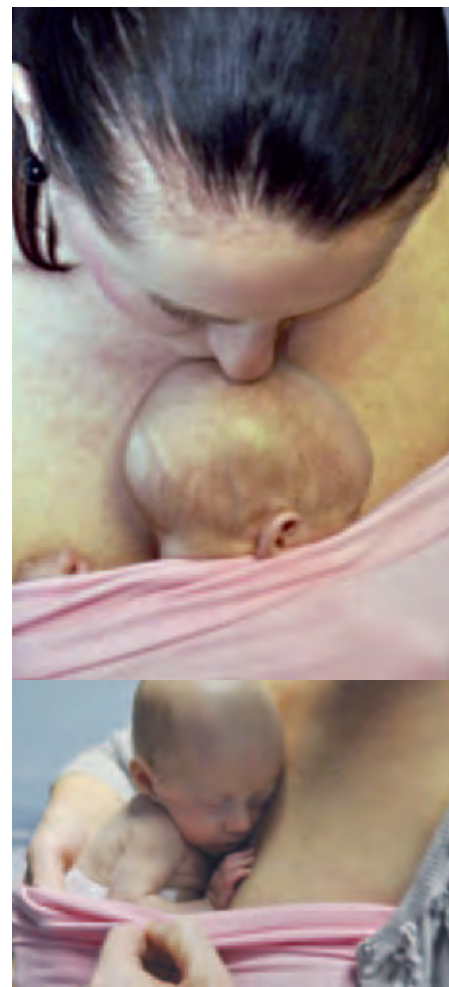


FIGURE 5 A ‘boob tube’ designed for use during kangaroo care.

photographs of KC in progress – parents say they like seeing storyboards and photograph albums from babies who have previously been on the unit¹⁴. This encouraged parents to ask about KC for their own baby. Even if their baby was not quite ready for skin-to-skin care, the parents could look forward to the expectation of KC.

Further measures

The unit embraced the Baby Friendly initiative to ensure comfortable chairs were available for extended periods of KC. Chairs specifically for KC were sourced and purchased; currently there is at least one chair for each room on the neonatal unit. The chairs are on wheels so that they can easily be moved from room-to-room; they recline and generally encourage long periods of skin-to-skin care.

The Best Beginnings Small Wonders DVD has been made available to all staff and parents on the neonatal unit. A chapter in this DVD depicts KC, encouraging parents to ask about KC with their baby. Information in this format has

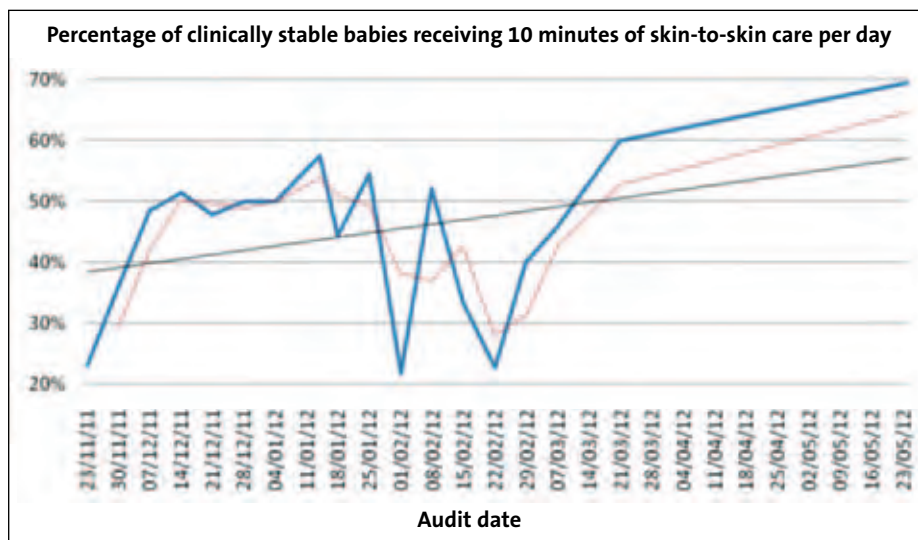


FIGURE 6 The number of babies receiving at least 10 minutes of skin-to-skin care per day.

been found to be useful to parents; to see and hear other parents talk about their experiences familiarises them with the neonatal environment and helps them to visualise what their future may hold¹⁴. It was envisaged that the DVD would introduce parents to the concept of KC, as something they could enjoy with their baby once it was stable, although use of the DVD in this project has yet to be audited.

During the course of the project, it was found that not all women feel comfortable with being 'exposed' during KC and that often they report feeling insecure with their baby in the KC position. To address these issues, 'boob tubes' were designed, sourced and made in various sizes (**FIGURE 5**). These were made from an unadorned, stretchy material and are entirely suitable for the skin of preterm babies.

Results

At the start of the project in November 2011, 20% of clinically stable babies received skin-to-skin care. Six months later, this figure had risen to nearly 70% (**FIGURE 6**). From weekly audits, it was found that in the high-dependency unit almost 100% of babies received daily skin-to-skin care. In the intensive care unit fewer babies received it, probably because these babies are not always stable enough or meet the criteria for skin-to-skin care (**FIGURE 2**). Perhaps most surprisingly, the lowest numbers were found in the special care baby unit, although the feeling is that babies here tend to be cuddled rather than receive skin-to-skin care.

Anecdotally it was found that KC provided a familiar continuum for parents as their baby is moved around the different

areas of the neonatal unit. It has been reported that parents find the moving of their baby stressful¹⁴ – different routines, different staff, etc. With KC, the parents find they can carry on with their routine of skin-to-skin care in any area of the unit and it is equally supported.

Ongoing measures

Skin-to-skin care is now included in the induction training for new staff, including medical staff, highlighting just how important KC is as a therapeutic intervention on the unit and how it is supported by the team. Senior nursing staff and senior management also provide support, which helps to raise the profile of the project. Workshops have been developed for new and existing staff that want to update their confidence and skills in KC.

A KC awareness event is being planned – including teaching for all staff and workshops discussing the practicalities of KC, especially for ventilated babies. Staff who are confident in facilitating skin-to-skin care will make themselves available to support and mentor others. In doing this, it is hoped that all staff will gain confidence and competence in facilitating KC. The expectation is that the number of babies receiving KC will further increase, especially sicker, ventilated babies.

Preterm infants require close control of their thermal environment. It has been observed that during skin-to-skin care, body temperature can remain stable because the transfer of heat from parent-to-child balances the heat loss from a baby outside an incubator¹⁶. However, water loss during KC is higher than in incubator care, where the use of humidity can reduce

dehydration. A baby requiring a humidity-controlled environment therefore needs careful consideration by the senior medical team before KC can be initiated. The KC guideline will be reviewed to address the situation for babies requiring humidity.

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The neonatal experience – loss and grief without a bereavement

Loss and grief are feelings experienced when reality clashes with an expected future. For many parents of preterm and sick newborns, there is often a sense of loss and grief even if their baby does not die. To complement the existing skills of staff on a neonatal unit, a training day has been designed specifically to look at these issues; to enable staff to have a heightened level of awareness of how a parent may be feeling and to increase their confidence in supporting them.

Most parents find being in a neonatal unit frightening and threatening at a time when they are already extremely anxious and distressed. They may feel scared, disempowered, vulnerable and perhaps inadequate for not knowing how to help their baby. They may have little opportunity to feel that they are parents to their baby¹.

Providing support for parents is an important part of caring for critically ill babies. It is important to welcome and involve parents and try to help them feel at ease in an alien and very frightening environment. Staff should do whatever they can to help parents feel that they have some control over what happens to their baby. Parents should be listened to and professionals should try to understand their values, priorities and concerns^{2,3}. It is important to acknowledge the extreme stress and the sadness of the situation for the parents and also the difficulties caused by the nature of the pressures of the neonatal unit.

Communication is probably the single most important component of effective care. It underpins and colours everything that staff can offer. Excellent clinical care can be overshadowed by poor communication; failures of communication cause dissatisfaction and can lead to complaints about health care. Good communication builds trust and parents need to feel able to trust the staff who are caring for their baby⁴.

Parents are acutely aware and in tune with the different layers of communication, not just between parents and staff but also among staff. One parent highlighted the importance of this:

“...when there was a good flow of communication through the team, that’s when we were confident that our son was getting the best possible care”.

Parents have reported how they ‘hang on’ to every word a doctor or nurse says about their baby and therefore healthcare professionals should think about how they communicate in all of their interactions with vulnerable parents.

A sense of loss

For many parents of preterm and sick newborn infants, there is often a sense of loss and grief even if the baby does not die. The loss of the final trimester of pregnancy, the loss of the ‘normal’ birth experience, the joy of going home with a healthy newborn baby, the loss of privacy and a sense of not being in control. There is often a sense of a lost opportunity, particularly if the



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baby develops long-term health problems or a disability.

Some parents may experience many months on the neonatal unit living with the uncertainty of the future for their baby and their family. They may feel a sense of loss regarding their own identity and in their relationships, as the focus is now completely on their baby.

The parents' perspective – a workshop

It is essential for all healthcare professionals working within this environment to have an awareness and understanding of how parents of the babies they are caring for may be feeling^{2,5,6}.

Family-centred care should be offered – a package of care which incorporates ‘looking after’ the family as a whole. With this in mind the authors, Paula and Alex, have collaborated with Child Bereavement UK (CBUK) to facilitate a one-day workshop that looks at the neonatal experience from the perspective of a parent. With particular emphasis on feelings of loss and grief, the workshop aims to enable healthcare professionals to have an

increased awareness and understanding of the parents' experience, to help increase their confidence in supporting parents through their neonatal journey.

The workshop is designed to be suitable for all neonatal nurses, doctors and other healthcare professionals working within neonatal units. It may also be appropriate for those working in antenatal departments, labour wards and postnatal wards. It explores key areas of neonatal care including:

- Loss and grief
- Communication
- Impact on the professional caregiver
- Moral and ethical issues around palliative and end-of-life care.

The workshop explores feelings and emotions where there has been a multiple pregnancy and one baby is critically unwell and the other baby/babies are well and at home⁷. There may also be the reality of one twin having died *in utero* or shortly after birth. Parents have reported that they often yearn for staff to acknowledge the baby who has died, rather than say nothing and assume that everyone has forgotten about that baby.

Complex needs and palliative care

Neonatal palliative care focuses on the best interests of the baby, while at the same time supporting the whole family, including siblings and grandparents holistically⁸⁻¹⁰.

A baby may require palliative care for any length of time: from a few minutes, to weeks or even months. Again, communication underpins every element of care and the success of palliative care in practice will primarily be determined by the ability to give and receive information and to respond appropriately¹¹.

Parallel planning for both life and death can be very confusing and difficult for parents to comprehend. Actively managing the possibility of improvement by providing interventions aimed at recovery, while recognising the possibility that the baby may not make any further progress, may deteriorate and die – parents must adjust to a future of uncertainty with a baby who may have many complex needs or may not survive¹¹.

Impact on the family

The family unit becomes fragmented; often parents are juggling with other children at home, visiting their baby on the NICU and having to deal with difficult circumstances at the same time. Existing children 'lose' their parents to the alien world of the NICU and a baby they may never have met.

This whole experience affects the way they parent their baby on the neonatal unit as well as other children at home. They cannot be in control of their baby's life and parents often feel disempowered and helpless. This workshop addresses how professionals can empower families and help them to be as involved as possible, ensuring that families are central to any decision making process^{12,13}.

Acknowledging that professionals may also experience difficult and sometimes painful feelings, the workshop provides opportunities for group discussions and exploration.

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CBUK supports families and educates professionals when a child dies or when a child is bereaved. Currently it trains around 5,000 professionals each year across health care, social care, education, the emergency services and the voluntary sector.

The neonatal experience – loss and grief without a bereavement
Future workshops include:

- Thursday 20 June 2013, Birmingham
- Friday 6 December 2013, CBUK Head Office, Bucks

For further details visit: www.childbereavement.org.uk/training/ourcourses



Bliss fund to improve family facilities in neonatal units.

Bliss launches £250,000 fund to improve family facilities

Bliss, the special care baby charity, is working with the True Colours Trust to launch a new grants programme to support the development of family-friendly facilities on neonatal units throughout the UK. Together they will provide over £250,000 over the next two years to support direct improvements on neonatal units.

The Bliss Baby Charter Grants Fund supported by the True Colours Trust will invite any neonatal unit that has completed the Bliss Baby Charter Audit to apply for a small grant (up to £1,000) or large grant (up to £10,000) to help improve facilities for parents and families of premature and sick babies. The audit is used by hospitals to look at key aspects of a unit's support for the

whole family to help staff make family-centred care a reality.

The grant will allow units to purchase small items such as lockers, comfortable chairs and breast pumps, as well as support the refurbishment of parent bedrooms, the creation of parent kitchens, and the opening of quiet rooms for sensitive discussions, which would often fall outside usual NHS budgets.

The first round of small grants will be in May 2013, with further rounds open monthly. The first round of large grants will be in June 2013 and then on a quarterly basis.

For more information about the scheme please contact Zoe Chivers at Bliss on 0207 378 1122 or email zoe@bliss.org.uk

Why do premature babies have an increased risk of ADHD?

Preterm babies have an increased risk of developing attention deficit hyperactivity disorder (ADHD) and other psychiatric problems, including anxiety, social difficulties and autism. Dr Jonna Kuntsi and her team, at King's College London, are investigating why. They hope their work will eventually allow earlier identification of children's difficulties, so they can get help sooner and pave the way to better therapies.

Children with ADHD tend to be overactive and impulsive, with a short attention span. They may seem restless, are easily distracted and often fidget constantly.

They can have trouble with schoolwork

and underachieve academically. They can also have problems forming positive relationships with friends and family. Estimates suggest around two thirds of children with ADHD find their problems persist into adult life, when they can experience additional, sometimes severe, difficulties.

"We hope to boost understanding of how premature birth puts babies at increased risk of developing ADHD, by looking for changes within the brain in adolescents who were born early," explains Dr Kuntsi.

The team has been awarded a project grant of approximately £170K by the charity Action Medical Research.

Obese mums put baby at risk

A study published in *BJOG* has shown that obese or overweight women have a higher chance of adverse maternal and neonatal outcomes.

A team from Queen's University and the Belfast Health and Social Care Trust monitored more than 30,000 mothers-to-be over an eight-year period. Obese women were three times as likely to have a stillbirth, premature delivery or a newborn requiring neonatal care, as women of normal weight. The results show that there is also an increased risk of hypertensive disorder, gestational diabetes, induction of labour, caesarean section, postpartum haemorrhage and macrosomia. Unsuccessful breastfeeding and other postnatal problems were also found to be more prevalent in overweight and obese women.

Listening to bereaved parents

Working with Sands and Bliss, researchers at the National Perinatal Epidemiology Unit (NPEU) at the University of Oxford are carrying out a study of the maternity care experience of parents who have recently had a stillborn baby or a baby who has died in the neonatal period. The study is funded by the Department of Health.

The results will provide up-to-date information about care and the experiences and perceptions of women and their partners and will be used to help improve maternity services for families who experience such a loss.

Because it is not possible to survey all bereaved parents whose baby died in 2012, a sample group of women have been invited to take part in the study. The Office for National Statistics (ONS) has used birth and death registration records to select women to take part in the survey and is mailing letters and questionnaires to these women. The names and addresses of the women, although known to the ONS, are not known to the researchers.

The first invitations to take part were sent to women in October 2012 and NPEU researchers Maggie Redshaw and Rachel Rowe were pleased that many women felt able to respond to the survey. The second wave of invitations has recently gone out.

There is more information about the study at www.npeu.ox.ac.uk/listeningtoparents

Birth and Beyond Supporter training

The first volunteers of NCT's peer support project have completed their training and received their Open College Network (OCN) accreditation certificates.

NCT has trained over 50 volunteers to help support hundreds of pregnant women and new parents from hard to reach communities. The Birth and Beyond Community Supporters (BBCS) project is a voluntary peer support scheme, helping to reach out to new and expectant parents at risk of isolation. The three-year pilot project is funded by the Health and Social Care Volunteering Fund (Department of Health).

The project is training black and minority ethnic parents in the West Midlands and East Lancashire, young parents from service families in North Yorkshire and asylum seekers and refugees in West Yorkshire, to help support other parents in their



Pictured, from left, Angellah Kyamumi, Fatou Kanyi Sallah and Kiran Neha receiving their certificates.

community. In each area a local project manager will recruit and train women as community peer supporters. The plan is to train more than 240 peer supporters, 60 in each of the four areas.

The training involves:

- developing listening skills

- learning about confidentiality, appropriate relationships and boundaries
- finding out about local services and support organisations so that the volunteers can accompany parents to clinics or group meetings.

Diet survey reveals wide gaps between recommendations and practice

In March, the Department of Health (DH) published results from the Diet and Nutrition Survey of Infants and Young Children (DNSIYC) 2011.

DNSIYC is a one-off survey providing detailed information on the food consumption, nutrient intakes and nutritional status of infants and young children aged 4 to 18 months. The survey complements the National Diet and Nutrition Survey (NDNS) rolling programme, which covers children and adults aged from 18 months upwards. DNSIYC involved an interview, a four-day diet diary, blood samples and estimates of breast milk intake, fluid intake and body composition; 2,683 children took part in the survey between January and August 2011. The government uses the results to

develop public health policy, monitor diet and nutrition patterns and assess whether these meet expert recommendations.

Key findings

Breastfeeding: 22% had never been breastfed. Of those who were breastfed, 57% were not breastfed beyond three months of age.

Breast milk substitutes: 32% of infants aged four to six months consumed follow-on formula. The DH recommends that breast milk substitutes should not be introduced before a child is six months old.

Complementary feeding: complementary foods were introduced before the age of three months for 10% of children, and before five months for 75% of children.

The DH recommends introduction of complementary foods at around six months of age.

Cow's milk: children aged below one year generally consumed no more than a quarter of a pint of whole milk per day; 15 per cent of those aged four to six months consumed whole cow's milk. The DH recommends that cow's milk should not be introduced as a main drink until after 12 months.

Energy: 75% of boys and 76% of girls exceeded their estimated requirement for energy.

See the full report at www.gov.uk/government/news/statistical-press-notice-diet-and-nutrition-survey-of-infants-and-young-children-2011

Best Beginnings phone apps

Two mobile phone apps for pregnant women and mothers of babies up to six months' old will be launched in July by the charity Best Beginnings.

Called Bump Buddy and Baby Buddy, the apps have been created by a team of healthcare experts and parents. The apps provide evidence-based information in a bite-size format and support women's

emotional and physical transition to parenthood. The charity hopes the free apps will provide a tool for young women from more disadvantaged sectors of society.

Best Beginnings welcomes feedback from professionals using the apps on how best to integrate them into mainstream maternity services.

For further information email: apps@bestbeginnings.org



The Bump Buddy phone app.

Vulval mass in the newborn period – a case report

This report describes the case of a female infant presenting with a large mass protruding from her vulva. Clinical assessment and examination under anaesthesia confirmed the diagnosis of prolapsed ureterocele. Prolapse of a ureterocele and its presentation as a vulval mass is an extremely rare condition.

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A female Caucasian baby was born at term by elective caesarean section with no neonatal difficulties. Antenatal left-sided hydronephrosis was detected at 32 weeks of gestation with an antero-posterior diameter of the left renal pelvis of 29mm. The ureter on the same side was also dilated. Two days after birth, renal ultrasound showed a normal right kidney and hydronephrosis of the left kidney with a pelvic diameter of 23mm. The left ureter was dilated up to the bladder and a ureterocele was also detected. The baby girl was discharged home pending paediatric urology assessment.

At six days' old, the baby was admitted to the neonatal unit with a fairly large vulval mass. The mass was 6 x 3cm in size, cylindrical in shape and dark purplish-pink in colour (**FIGURE 1**). Examination under anaesthesia by a perinatal urologist confirmed the presence of a prolapsing ureterocele that was pulling down the bladder neck. The prolapse was gently reduced and de-roofing of the ureterocele was undertaken. The patient required a suprapubic catheter and a urethral catheter for a few days following surgery. Creatinine was mildly elevated for a few days after surgery.

Six weeks after surgery, a renal ultrasound investigation showed a normal right kidney and a dilated upper moiety of the left kidney. The proximal half of the left ureter was dilated up to 10mm and there was cortical thinning of the left upper moiety. A dimercaptosuccinic acid (DMSA) scan confirmed poorly functioning upper moiety of the left kidney. The infant underwent left heminephrectomy at three months of age. Currently, at the age of 26 months, the child is doing very well.



FIGURE 1 A long, cylindrical, pink mass prolapsing from the vulva of a six-day-old girl.

Keywords

vulval mass; ureterocele; antenatal hydronephrosis

Key points

- Babu R.N.M.** Vulval mass in the newborn period – a case report. *Infant* 2013; 9(3): 96.
1. This case describes the occurrence of a vulval mass in the newborn period, with good eventual outcome.
 2. Careful history taking and a detailed physical examination can help to determine the most appropriate investigations and course of management.

Discussion

A ureterocele is a congenital swelling occurring in the lower region of the ureter at the opening to the bladder. It is often associated with a duplicated collecting system where two ureters drain their respective kidney instead of one. The swollen area forms a sac-like pouch, which causes obstruction to the flow of urine resulting in dilatation of the ureter and sometimes the renal pelvis. The differential diagnoses of a vulval (intralabial) mass in a female infant should include:

- urethral prolapse
- vaginal introital cyst (epidermal inclusion cyst, Skene's duct cyst)
- imperforate hymen
- urogenital sarcoma (sarcoma botryoides)
- genital prolapse.

Ureteroceles occur in approximately 1 in 4,000 individuals and are more common in the Caucasian population. A prolapsing ureterocele presenting as a vulval mass is an extremely rare condition.



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HEALTHCARE

Database development, monitoring and improvements in neonatal outcome

Health care requires the collection and use of data, whether on paper or in an electronic record. Apart from direct clinical care, there are many secondary uses of data that are important for funding, monitoring quality, audit and research. This article describes why all involved in health care must be involved in the use of data and how this can be used to improve quality of care and hopefully outcome for the newborn baby.

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The collection and use of data are integral to the care of patients. The clinical record is of primary importance and is vital for the ongoing management of a patient. There are, however, many other important reasons why all involved in health care must be involved in the collection and use of data.

Why collect data?

Providing quality care is a core principle of modern health care. A definition of quality is doing 'the right thing, at the right time, in the right way, for the right person – and having the best possible results'¹. This means that healthcare providers have a duty to examine their practice and, where appropriate, implement change. This can only be achieved by using data collected during the process of health care. There is no single measure of quality. Effectiveness, access and timeliness, capacity, safety, patient-centredness and equity are key domains that are used to evaluate and monitor quality of health care².

These areas of quality measurement have been included in the UK Department of Health (DH) Toolkit for High Quality Neonatal Services³. There are eight principles covering the major areas of activity within the neonatal care pathway, with data collection highlighted as an essential part of the service. The Toolkit gives examples of the metrics that should be measured; the data being used to monitor service structure, service process, health outcomes and network outcomes. There is a requirement for Trusts to support the clinical team in collecting and using data to monitor quality through

use of the toolkit.

The British Association of Perinatal Medicine (BAPM) has published standards for hospitals involved in the care of the newborn baby⁴. Units must comply with the principles set out in the DH Toolkit. Data collection is, again, highlighted as essential for monitoring quality and performance standards.

Since 2003, neonatal care in England has been organised in networks and a similar model is being developed throughout the UK. Each network has its own protocols for optimum management of the sick newborn baby, with an appropriate division of work between intensive care units, local neonatal units and special care nurseries. The National Audit Office report published in 2007⁵, found that this reorganisation had improved the coordination, effectiveness and consistency of services. However, the report concludes that: 'The lack of robust evidence on outcomes makes it difficult to reach an objective view of the quality of the service'. Among the recommendations, was the need to improve the collection of data and use of information to establish the efficiency and effectiveness of the service, particularly in calculating the long-term impacts of different types of care. It was recommended that all units, as a priority, contribute fully to the National Neonatal Audit Programme (NNAP) minimum dataset. It was also recommended that network managers work with units to reduce duplication of data collection.

All budgets are under increasing pressure. The use of data to justify and monitor funding is now a vital function of

Keywords

neonatal care; electronic patient record; secondary use of data

Key points

Lyon A. Database development, monitoring and improvements in neonatal outcome. *Infant* 2013; 9(3): 98-101.

1. All staff involved in clinical care of the newborn have a responsibility to collect and use data.
2. Trusts should provide appropriate resources for data collection and analysis.
3. A single electronic patient clinical record, linked across the N3 network, allows the collection of once-only standardised data.
4. All units must contribute to national benchmarking that is linked to appropriate clinical improvement programmes.

all Trusts. Staffing levels need to be linked directly to intensity of workload. BAPM has published definitions of levels of care that are directly related to staffing requirements and the calculation of these requires daily collection of a large dataset. In England and Wales, funding is based on 'payment by results' requiring the calculation of daily healthcare related groups (HRG) for all babies. This is achieved using the Neonatal Critical Care Minimal Dataset (NCCMDS) which, although similar, has differences to that used to calculate BAPM care levels.

Commissioning of neonatal services is changing, with a move from Specialised Commissioning Groups to core responsibility of the NHS Commissioning Board. A quality assurance process will be linked to the NHS Outcome Framework. A Neonatal Clinical Reference Group will provide fixed objective and performance measures that can be beneficial for providers, commissioners and users to assess progress towards quality standards. Commissioners and the public have a right to know that a service is not only well run, with good quality care and outcomes, but also that it is efficient and not wasting money.

Resources for data collection are expensive and, for purposes other than direct patient care, there is often a perception that data collection detracts from the care of the baby. However, what is clear is that everyone associated with the care of the newborn has a duty to be involved in the collection and use of data, not only for direct patient care but for the monitoring of quality and efficiency of the service. It is no longer acceptable to assume that good care is delivered; this must be demonstrated by showing adherence to various quality measures. Ongoing funding of a service depends on showing that quality standards are achieved. Requests for extra resources will only succeed if supported by strong data showing how quality outcomes and efficiency can be improved.

How are data collected?

Paper-based clinical records vary in quality and completeness. However, free text notes are often the best way of capturing the clinical picture as well as the opinions of those involved in the care of the baby. Where there are large volumes of notes, finding information can be difficult and extraction of data for use in quality monitoring, audit and research is time

consuming and involves duplication of effort. Electronic records make searching and summarisation of data easier, helping to inform clinical staff. Data entry can be slower than with paper notes, especially if free text is used extensively. However, the power of electronic systems is their ability to collect standardised data that can be easily extracted for multiple purposes.

Interfaces with other hospital systems, such as maternity and laboratory services, reduce duplication of entries and improve the quality of data available to the clinical team. Linking with child health systems not only improves clinical care, but also allows analysis of long-term outcomes. Software systems must be able to communicate with each other through appropriate industry-standard messaging.

Electronic systems must help improve care by directing staff with important reminders and checks. Users can be alerted that data essential for important datasets – such as those used for funding, quality monitoring or research – have missing items. In this way, these systems improve clinical care, data quality and completeness⁶.

Many units contribute to datasets collected separately to that used in clinical care. Examples include the Trent Neonatal Survey, where funded nurses gather the data from the clinical notes, and the Vermont Oxford Network (VON) database, which relies on units to collect and submit a specific dataset. In these cases, the quality and completeness of the data are good because few people are involved in collection, the rules are very specific and the users are experienced in the definitions of the data items. However, the cost and resource implications are major.

The alternative is to analyse data that have been collected routinely at the time of clinical care. This avoids duplication and demand on resources but, because there are many users of varying experience entering data, there are frequent problems with quality and completeness. Systems can help with checks and reminders but there remains much variation in quality. However, routinely collected data have been found to be accurate in assessing some population-based statistics⁷.

Replacing all paper with an electronic system is expensive in terms of both software and hardware. Ease of use at the bedside is important, but may require a large investment in infrastructure to accommodate the technology. In neonatal

care, full electronic medical records tend to be used in larger intensive care units. Experience across the UK has shown that the combination of paper with an electronic clinical summary system works effectively. Because electronic data is easy to use, there is a tendency to keep expanding the dataset collected. However, staff may not see any advantage in this as the system does not save them time (in terms of data entry) and they do not perceive any advantage over paper records. It is important that users understand why all data items are collected, particularly if these are not directly related to patient care. Completeness and quality can only be achieved if all items are well defined (avoiding ambiguity in what needs to be collected) and staff 'buy in' to data collection.

The N3 Network (NHS Internet Gateway, NHS net) is a secure, national, high-speed, broadband network that has allowed the secure sharing of clinical information across the UK. Many babies are transferred to other units during a period of neonatal care – the ability to share a single clinical record improves quality of care as well as allowing the collection of a standardised dataset that can be used for national benchmarking and analysis of outcomes.

The Badger Neonatal Clinical Information System (BadgerNet, Clevermed Ltd) is used by neonatal units across the UK. It comprises a single patient record on the N3 network that includes all neonatal and transport episodes of care. Data security is of prime importance, with users only able to access the records of babies that they have permission to see – usually because they are involved in their clinical care.

What is collected and how is it used?

Data are of limited use unless turned into information that can be used to inform and to improve. The Data Protection Act (1998) states that: "Data shall be obtained only for one or more *specified* purposes and shall not be further processed in any manner incompatible with those purposes". The Act also states that data shall be: "Relevant and not excessive in relation to the purposes for which they are processed". These points are further emphasised in the Caldicott Principles, which apply to the handling of patient-

identifiable information and are included in the NHS confidentiality code of practice.

The data needed for clinical care will be dictated by the condition and needs of the patient. Use for purposes other than direct clinical care (secondary use of data) has to be considered carefully, keeping in mind the Data Protection Act and the Caldicott Principles. Data used for secondary analysis must be completely anonymous. If patient identifiable data are required, there must be signed informed patient (parent) consent, as for example in research studies, or obtaining of specific permission. Section 60 of the Health and Social Act 2001 (subsequently section 251 of the NHS Act 2006) allows use of patient identifiable information to support essential NHS activity, without the consent of patients but only where, in the interests of patients or the wider public, consent is not a practicable alternative and where anonymous information will not suffice.

It is clear that data must only be collected for specific purposes and should, except in exceptional circumstances, be anonymised. Trusts must have policies in place to ensure that data, particularly patient identifiable data, are not stored or used inappropriately. All users have a duty to adhere to local policies, the Data Protection Act and Caldicott Principles.

Local use of neonatal data

Units, and their Trusts, use data for a number of purposes including quality assessment, audit, workload monitoring and finance. Data are downloaded to other datasets, eg NCCMDS (for funding in England and Wales), Scottish Birth Record and Neonatal Intensive Care Outcomes Research and Evaluation (NICORE) in Northern Ireland. Standard reports used repeatedly should be part of an electronic system and be easily available to users. There are many possible types of reports; **FIGURE 1** gives examples of output that can be created, showing numbers of admissions within a chosen date range broken down by gestation and type. Electronic systems must support unit audit programmes by facilitating easy data downloads, however this requires local resources for the handling and reporting of data.

The commissioning of neonatal services now includes a range of quality measures. The Neonatal Clinical Reference Group will publish standards in addition to other local standards that may exist. Quality

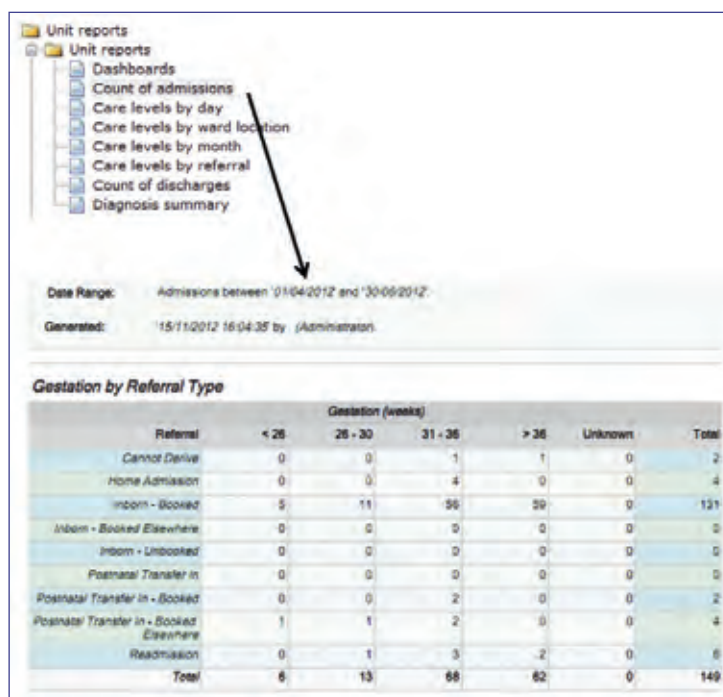


FIGURE 1 An example of a unit report with possible output (BadgerNet).

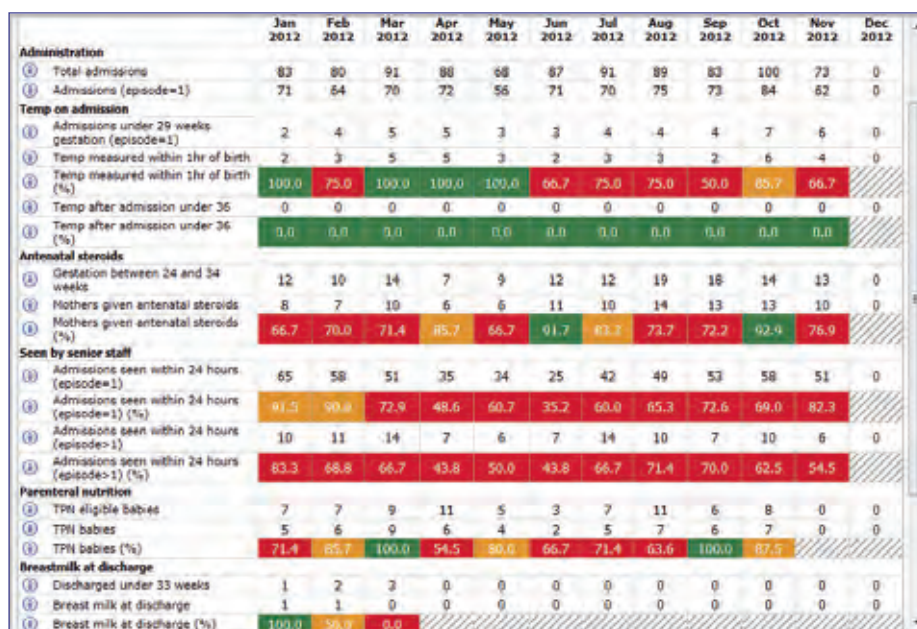


FIGURE 2 An example of a neonatal unit dashboard (BadgerNet).

standards include measures of process of care (eg the number of babies screened at appropriate time for retinopathy), as well as outcome (eg gestation specific mortality). These should all be evidence-based and shown to improve quality of care and outcome for the newborn baby. Units must monitor how well they are achieving these standards. It is important that the information is fed back quickly so that all staff can be engaged in real-time quality improvement. 'Dashboards' are ideal for displaying data in a way that is easy to understand and with colour coding, show at a glance how well a unit is doing. **FIGURE 2** shows an example

dashboard. The levels at which the colours appear can be set by the unit. Clicking on any of the numbers gives a list of the babies that make up the data in that cell.

Increasingly a neonatal service does not work in isolation and data need to be compared across networks and regions (where commissioning may cross several networks), as well as nationally. For purposes of comparison or benchmarking, it is vital that standardised datasets are used so that 'like is compared with like'. Use of a single patient record shared across the N3 network, as with BadgerNet, allows standardisation of data. The content of the dataset is determined

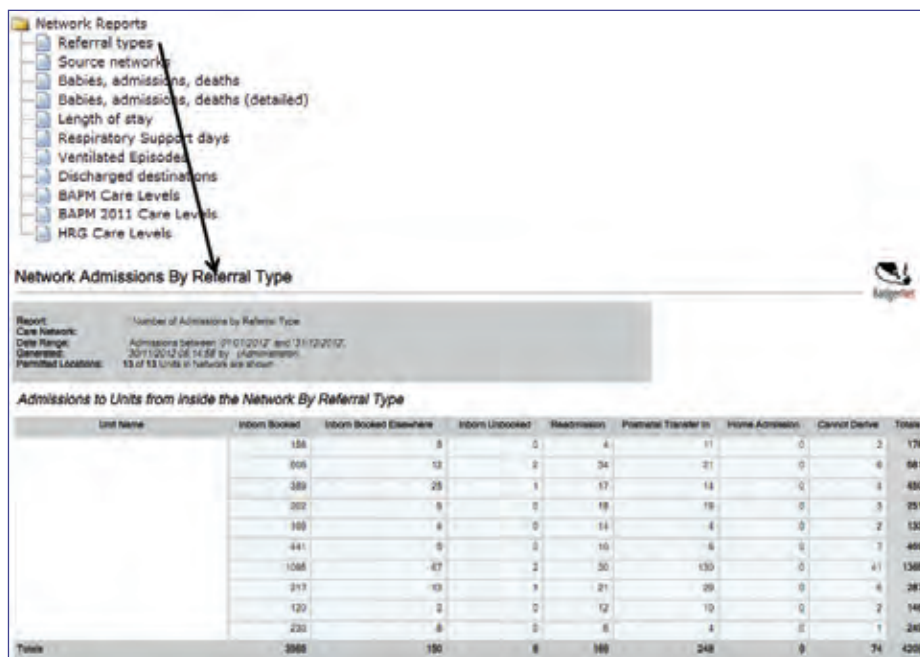


FIGURE 3 An example of a network report with possible output (BadgerNet).

by the reporting requirements. BAPM have previously published a minimum neonatal dataset for annual reports, which is currently under revision.

Network and regional use of data

There is a need to monitor the function and outcome of the units making up the network, as well as the networks that make up a region. There are nationally defined standards but networks will also determine their own 'rules' around where and how certain groups of babies are to be managed. The transfer of babies outside the network will need to be monitored. An example of a network report is shown in FIGURE 3; network dashboards have also been defined. It is important that units, networks and commissioners work with software providers to ensure data collection is meaningful and useful reports can be developed, with minimal duplication of effort.

With unit data linked across the N3 network it will be possible to monitor patient flows across network boundaries in real-time. 'Exception reporting' is also possible. This gives information in real-time of how units are performing, eg the notification of ventilated babies who have not been transferred to an appropriate unit as determined by the network protocols. There may be many reasons why this occurs, but such reporting allows

real-time investigation with potential benefits for the patient.

National use of data

The NNAP addresses several questions relating to quality of care and produces an annual report showing unit comparisons. Quality improvement programmes are being developed to investigate and address problems with outliers. As well as clinical outcome measures, this programme attempts to include parent and family-oriented data. NNAP data can be collected as part of routine clinical care.

Many units subscribe to national and international datasets such as the Neonatal Data Analysis Unit (NDAU) in the UK and Vermont Oxford in the USA. These large datasets allow, not only benchmarking, but also more detailed modelling of data looking at various factors that may be responsible for differences in outcome across units and other population groups. They are good at showing population changes over time. Although it may not be possible to prove a hypothesis, the large amount of data can be used to generate hypotheses leading to important areas of future research.

A mechanism for data collection across the UK provides a platform for collection of research data, either from routinely collected data, or from some extra information collected at the time of clinical care (for those units participating

in a research project). The data can continue to be collected if a baby moves to another unit, as this is all part of the single patient record.

Conclusion

There is an increasing amount of data collected as part of the clinical care of a patient. Everyone involved in health care must keep good clinical notes and has a responsibility to be involved in the use of data to measure quality and efficiency of care. There are responsibilities associated with the secondary use of clinical data that all users must understand and adhere to. Systems must be in place that analyse and report data with rapid and meaningful feedback to clinical teams. There is a need to support the use of information, not only as part of local care, but also at a network and national level. Effective national benchmarking linked to appropriate clinical improvement programmes will help the quality of care and the outcome for the all babies cared for by a neonatal service.

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Conflict of interest

Andrew Lyon is a retired Consultant Neonatologist who now works with, and receives payment from, Clevermed Ltd.

Addressing learning needs in neonatal care: an overview of resources for self-directed learning

This article explores the rationale behind the need for self-directed learning resources for health professionals working within the neonatal specialty, in the context of current healthcare education. It also discusses what makes a learning tool useful in relation to the facilitation of independent learning. Finally, given that, compared to other areas of health, the range and availability of neonatal-specific learning tools is limited, the paper draws together a pool of accessible educational resources for self-directed learning in neonatal care.

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The specialty of neonatal nursing requires a grasp of a wide range of knowledge and skills across all dependency levels in order for practice to be supported by sound underlying rationale and understanding. Formal neonatal nurse training within higher education institutions (HEIs) coupled with bedside, clinical-based teaching enables neonatal nurses to become 'qualified in specialty' (QIS) and beyond^{1,2}. However, given the current higher education climate with a decrease in classroom time and concurrent increase in emphasis on self-directed learning, there is a clear need for neonatal nurses to access educational resources. Moreover, any health professional working within this specialty requires acquisition of and familiarity with subject-specific information to impart knowledge to support the care they deliver.

Following on from a discussion of why resources are needed, this article discusses who would most benefit from self-directed learning in this area and explores what makes a learning resource effective. Finally, the article summarises those resources that are available in the neonatal field.

Why is there a need for learning resources in neonatal care?

Face-to-face lectures along with clinical exposure have traditionally been used to teach knowledge to post-basic learners about their chosen specialty. Such conventional methods are suited to those who favour more formal settings and who prefer to learn directly from subject

experts³. However, this can lack the flexibility that is necessary for today's *trained* nurse who requires continuous professional development (CPD) in line with a wider cultural shift towards more flexible work and study patterns. In addition, there may be a lack of opportunity to attend structured, pre-arranged study days due to time constraints at the workplace. The demands of caring for very sick neonates along with shortages of staff and reduced availability of study leave have meant more limited training opportunities in the clinical area. The current situation has nurse educators seeking alternative means of teaching CPD for specialty-related knowledge, with a move to an emphasis on self-directed, flexible learning.

The increasingly limited resources to deliver essential curriculum within HEIs further highlights the increased emphasis on the importance of self-directed study within nursing and healthcare programmes. As direct contact hours reduce, self-directed time has increased and post-basic students, even those inexperienced or new to neonatal care, are expected to know what to learn in the absence of any specified curricula for independent learning content. Therefore, self-directed neonatal-specific learning tools are essential to fill this self-directed time⁴.

In addition, there is now more of an emphasis on the importance of combining formal education with independent, flexible study within higher education as well as pre- and post-registration

Keywords

neonatal education; learning resources; self-directed learning

Key points

Petty J. Addressing learning needs in neonatal care: an overview of resources for self-directed learning. *Infant* 2013; 9(3): 102-107.

1. Neonatal nurses need access to self-directed educational resources to enrich their knowledge base and augment classroom and clinical-based teaching.
2. Health professionals working with neonates and their families require subject-specific knowledge to support best practice and care delivery.
3. Although limited, 'open access' neonatal-specific learning resources are available.

healthcare programmes⁵⁻⁹. The value of combining self-directed study, including recent innovations in online programmes, with both classroom and clinical teaching has been highlighted within the educational literature in line with a 'blended' approach to learning^{10,11}, where resources are developed to 'scaffold' classroom-led curricula content^{12,13}. However, structured self-directed learning resources specifically in neonatal care that are openly accessible and available to all, are limited.

How does an education resource facilitate learning?

Central to self-directed study is *guided learning*, ie the *facilitation of*, rather than, simply *giving* information. This is fitting with the work of Knowles¹⁴, based on the premise that learning should occur when learners undertake independent enquiry and are motivated to learn with a need to know as relevant to their own area of experience, in this case neonatal care. Following this thread, in order to be effective, learning tools should capture the important elements of the adult learner as shown in **TABLE 1**.

Literature pertains to the need for guided facilitation to support adult education^{16,17}. The benefits of 'directing' the learner towards lines of enquiry are well documented as is the promotion of interaction with a given tool that challenges learners to participate and engage in learning rather than just receive information passively^{18,19}. This has been shown to increase learner motivation and interest and so facilitate knowledge acquisition. For example, literature on the use and benefits of quizzes and tests as learning aides support this form of active learning^{18,19}. A recent literature review concluded that interactive self-regulated testing can be a valuable learning strategy that can be incorporated into self-directed programmes of study²⁰.

Also linked to the increased effectiveness of learning tools is active learning through interaction using multimedia formats. Literature on the use and benefits of interactive approaches using a range of technologies and media is emerging as important and increasingly popular within certain areas of health care, again to increase interest, stimulation, engagement and motivation²¹⁻²⁵. However, tools for neonatal care have not been explored in

Element of the self-directed adult learner ¹⁵	Feature of the learning resource
Self-concept and self-direction	Learning is more self-directed, eg independent enquiry by suggesting useful resources, reading material, websites and other resources.
Experience as a resource for learning	Makes reference to the learner's clinical area where the experience is more real and relevant.
Readiness to learn	Focuses on subjects that have immediate relevance to the learner's own field.
Orientation to learning	Comprises gathering of knowledge for immediate application, eg examples of cases with real problems that learners can relate to.
Motivation to learn	Incorporates feedback in response to interaction, eg informal quizzes, guided units on specific topics. Use of multimedia to stimulate. Range of means used to teach.
Relevance	Clearly states aims and objectives and applicability to a given specialty.

TABLE 1 Elements of self-directed learning resources.

this way. Using a variety of media to teach, serves to accommodate the different learning styles of adult learners. By this, to have optimum effect learners should have access to a range of different mediums depending on their preference for learning, albeit traditional or online platforms or a combination of both. Ideally, learning resources that teach a specialty should be accessible for all: the concept of 'open access'. This should also apply nationally, and even globally, so that all health professionals can learn from and share knowledge with each other, wherever they work within the world²⁶. However, it should be remembered that information should be relevant, not only to the specialty, but also to context, country and culture. Learners must be aware of practice differences and indeed resource limitations in certain countries that affect the applicability and cultural relevance of any given learning tool. Overall, in the same way that all neonates and their families deserve the same standard of care, as long as this care is culturally appropriate and the resource limitations are acknowledged and/or managed as much as possible, the aims of any learning resource should also be the same.

Who needs neonatal learning resources?

The following groups may benefit from neonatal-specific learning resources:

- Neonatal nurses undertaking neonatal programmes of study at post-basic level within the 'blended' mode of learning.

- Nurses who are not on a programme of study but who wish to revise their neonatal theory and rationale for practice.
- Nurses who are new to the area of neonatal care, particularly those who have trained in other specialties (eg adult or children's nursing and midwifery) or those with little previous neonatal exposure during training.
- Other allied health professionals with a different professional background who work with neonates as part of their role (eg physiotherapists, occupational therapists, speech, language or feeding specialists).

It could be argued that anyone working in clinical neonatal practice requires ongoing education in the name of life-long learning¹, again stressing the importance of open access resources.

What resources are available to health professionals working with neonates?

Given that neonatal-specific resources and literature in this field are limited, where can nurses and health professionals working in neonatal care look for their self-directed learning? The following selection of resources is in accordance with the important elements of a learning resource (**TABLE 1**). It should be emphasised that the learning tools included aim to enhance *knowledge* and increase understanding of the underlying *rationale* for care of the neonate. They are not aimed at teaching *skills*, which need to be learnt in the clinical area while caring for neonates

Resource	URL and further details
E-journals	
Infant	Open access for articles older than two years. More recent issues available via subscription. www.infantgrapevine.co.uk
Journal of Neonatal Nursing	Subscription required. www.journalofneonatalnursing.com
Advances in Neonatal Care	Subscription required. http://journals.lww.com/advancesinneonatalcare/pages/default.aspx Also available as an Apple® iPad application.
ADC: Fetal and Neonatal Edition	Open access on selected articles on fetal, neonatal and topics: http://fn.bmj.com/content/98/2/F103.full
ADC: Education and Practice Edition	Open access articles on neonatal and paediatric education and practice-based topics: http://ep.bmjjournals.com/cgi/collection/unlocked
The Cochrane Library	Full text systematic reviews on all areas of health including neonatal care: www.thecochranelibrary.com/view/0/index.html
International Journal of Epidemiology	Selected issues are open access. http://ije.oxfordjournals.org
Research and Reports in Neonatology	An open access journal on neonatal health: www.dovepress.com/research-and-reports-in-neonatology-journal
The Internet Journal of Pediatrics and Neonatology	www.ispub.com/journal/the-internet-journal-of-pediatrics-and-neonatology/archives.html#sthash.PVZBrGn2.ihhA65W5.dpbs
International Breast Feeding Journal	An open access journal published in the UK: www.internationalbreastfeedingjournal.com
Directory of open access journals – health related topics	A full directory of all open access journals: www.doaj.org/doaj?func=subject&cpid=20&uiLanguage=en Access My Library (from the home page search 'neonatal'): www.accessmylibrary.com
INTECH	Open access journals and books: www.intechopen.com/search?q=neonatal
Neonatal web-based learning resources	
Knowledge for Neonatal Nursing Practice	A self-directed learning tool with 'think points', multimedia, quizzes with feedback, reading lists and downloadable fact sheets: www.cetl.org.uk/learning/neonatal/neonatal_care.html
Antenatal and Newborn Screening E-learning	The UK National Screening Committee's CPD website for England: http://cpd.screening.nhs.uk/elearning
Developmental care	'Practice points' to download and pertinent issues central to developmental care: www.neonataldevelopmentalcare.com/Resources/index.html
Global audience e-learning	
HEAT resources	Free-to-access training modules written by African authors in collaboration with the Open University, covering areas of healthcare including maternal, newborn and child health. www.open.ac.uk/africa/heat/heat-resources
WHO	A range of maternal and neonatal health fact sheets: www.who.int/mediacentre/factsheets/en/index.html#N
Jhpiego	Learning packages for global health – mother and newborn: http://reprolineplus.org/resources/trainer-educator/learning-resource-packages
COINN	Educational resources page: www.coinnurses.org/edu_resources.php
Neonatal-specific websites	
Stanford Newborn Nursery website	A website using multimedia and covering a range of neonatal conditions and care (USA-based). Home page: http://newborns.stanford.edu Professional education link: http://newborns.stanford.edu/RNMDEducation.html Photo gallery: http://newborns.stanford.edu/photogallery/galleryindex.html Videos: http://newborns.stanford.edu/photogallery/galleryindex.html#video Audio files: http://newborns.stanford.edu/PhotoGallery/GalleryIndex.html#audio
Medscape nurses education website	USA-based learning website for nurses (search 'neonatal' and view all neonatal-specific learning resources): www.medscape.org/nurses
Neonatology on the web	Clinical resources for neonatology and perinatology: www.neonatology.org/neo.clinical.html

Resource	URL and further details
Neonatal-specific websites <i>continued</i>	
National bodies:	
NNA	www.networks.nhs.uk/nhs-networks/neonatal-nurses-association
BAPM	www.bapm.org/publications
NICE	Search for 'neonatal' on the home page and view all neonatal-specific NICE documents: www.nice.org.uk/Search.do?searchText=neonatal&newsearch=true&x=15&y=15#/search/?reload
RCOG	www.rcog.org.uk/womens-health/clinical-guidance/results?filter0=&filter1%5B%5D=35&op.x=14&op.y=13
Family and parent resources	
NHS Choices website	Care of the healthy newborn baby (click on the 'Your newborn' tab): www.nhs.uk/conditions/pregnancy-and-baby/pages/pregnancy-and-baby-care.aspx Sick and preterm special care neonates: www.nhs.uk/conditions/pregnancy-and-baby/pages/baby-special-intensive-care.aspx
Bliss	Advice and care issues in relation to preterm and small neonates: Home page: www.bliss.org.uk Parent link: www.bliss.org.uk/help-for-families List of guidelines for health professionals: www.bliss.org.uk/order-publications/#hp
Contact a Family website	Information on a range of neonatal and infant conditions for parents and professionals: http://www.cafamily.org.uk/professionals
Tommy's	A charity website providing information for health professionals on research into preterm birth prevention and stillbirth: www.tommys.org/page.aspx?pid=345
Together for Short Lives	A children's palliative care website: www.togetherforshortlives.org.uk/professionals/resources

TABLE 2 (opposite and above) E-learning in neonatal care: selected open access web-based resources.

Key: ADC = Archives of Disease in Childhood; HEAT = Health Education and Training; WHO = World Health Organization; COINN = Council of International Neonatal Nurses; NNA = Neonatal Nurses Association; BAPM = British Association of Perinatal Medicine; NICE = National Institute for Health and Clinical Excellence; RCOG = Royal College of Obstetricians and Gynaecologists.

and families first hand. In addition, the resources are separate from those provided for sole use by students taking formal programmes of study within HEIs.

Books

Neonatal books are available for purchase – the majority are now in electronic form, often at a reduced price. Some extracts are available free of charge. Selecting a book for reference purposes should be gauged by country of work as practice points and units of measurement may differ. It must be remembered that books will not have the most current research due to the time period necessary to complete publication.

Journals

Journal subscriptions offer a more up-to-date view of the neonatal field including recent innovations and work. Printed or online subscriptions are available and some journals are given through membership of an association (eg members of the British Association of Perinatal Medicine receive *Infant* and have free online access to articles). Some journals offer back issues

free of charge (eg *Infant*, *Archives of Disease in Childhood*, *International Journal of Epidemiology*). All residents of the UK can access The Cochrane Library for free; at the time of writing, there are 305 systematic reviews listed in neonatal-specific topics.

Accredited programmes

Accredited programmes of study usually have an associated cost. There are no UK-based courses/accredited resources in neonatal care. Those that do exist are based mainly within the USA, eg modules developed by March of Dimes and the National Association of Neonatal Nurses (NANN)²⁷. The USA-based journal *Neonatal Network* has a series of continuing education topics that can be completed and submitted as part of subscription to the journal. Free learning modules are available to resource-limited countries²⁸, such as those from Save the Children and the World Health Organization (WHO). The free-to-access Health Education and Training (HEAT) programme, created by the UK Open University and developed in partnership

with African health experts, covers a range of neonatal topics via modules on the OpenLearn website (**TABLE 2**).

E-learning

Without a doubt, the use of technology enabled (TE) learning through online and/or computer-assisted platforms can accommodate different needs and work patterns. TE learning can either replace or blend with classroom-based teaching and learning within all spheres of higher education, including health¹¹. Certainly within higher education, the place for learning technology is rapidly growing and can be a cost effective means of teaching¹⁰. In health, e-learning has become increasingly essential and the body of literature to support this is expanding^{29,30}. However the development and use of e-learning in neonatal care is limited. The UK National Screening Committee's Continuing Professional Development website for England has e-learning, open access tools on various topics around newborn screening that can be accessed via free registration. Another



FIGURE 1 Knowledge for neonatal nursing practice: a neonatal learning tool. An example of the contents of a unit. Available from: www.cetl.org.uk/learning/neonatal/neonatal_care.html. Developed by Julia Petty and Natasa Perovic.

tool, written and developed by the author and Natasa Perovic (Learning Technologist), is a web-based neonatal-specific, open access, learning tool that comprises various distinct units (**FIGURE 1**). The tool was developed to harness the six core elements of self-directed learning theory outlined in **TABLE 1** (self-direction, experience, readiness, orientation and motivation to learn and relevance). Each unit contains learning objectives, 'think points', information slides incorporating a range of multimedia, reference lists, suggested further reading, fact sheets and interactive quizzes with feedback (**FIGURE 1**).

Websites

There are numerous websites that can be accessed through any search engine but caution should be taken to identify reputable sites that are preferably endorsed and nationally agreed/available. **TABLE 2** details specific sites that serve to relay evidence-based, nationally agreed, UK-based information and guidelines. In addition, international sites are included with general useful information combining the use of multimedia. Again, learners should always bear in mind the contextual relevance of any site and whether it applies to their own workplace.

Family/parent resources

Health professionals can learn much from websites aimed at parents and families.

TABLE 2 lists those where guidelines and information can be freely downloaded.

Mobile applications

Finally, in the age of innovation in mobile learning, 'apps' are emerging that are available, either free of charge or for a small cost, for use on smart phones and tablets. Neonatal-specific apps to date, tend to be brief calculation-based tools designed to work out drug calculations and tube sizes for use at the bedside. The majority of these are USA-based and again this must be considered when referring to any practice guideline. There is a useful quiz-based application focusing on theory, with questions and answers on a range of neonatal topics (Neonatal Nurse®). Another UK-developed application designed for use at the bedside (NeoCalc®), uses a neonate's weight to calculate and assist in a range of specific procedures, eg endotracheal tube length, fluid requirements and emergency drugs. Using mobile phones at the bedside may be questionable but away from the clinical area, these tools may serve as a useful reminder of specific facts and procedures.

Conclusion

There is an important need for those working with neonatal populations and their families to keep abreast of current knowledge. Skills, of course, are best learnt within the clinical area and by simulated learning in practice-based training. But, in

relation to the theory of neonatal care, knowing where to access subject-specific knowledge can be difficult, as is identifying what resources are of most value to enhance knowledge. This article highlights a number of useful and accessible resources to broaden life-long learning within this specialty. However, it is clear that there is a real need for further development of more open access resources for the neonatal specialty that fulfill the needs of self-directed learning in a flexible and innovative way.

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Cardiff meeting sparks debate

On Friday 1 February 2013, the Hilton Hotel in Cardiff greeted delegates for the conference *Achieving Improved Outcomes in Neonatology – A Practical Approach*

Now in its third year, meticulously planned to cover current 'hot topics' by its founder, Dr Cora Doherty, the conference was attended by a record number of delegates. Nurses, doctors and allied health professionals involved in neonatal care, enjoyed a packed programme of high quality presentations which systematically addressed the theme of the conference.

The appetites of some had been whetted by the associated conference, *Achieving Improved Outcomes in Neonatology – the Research Perspective*, which had been held the previous afternoon. There the latest developments in several neonatal research areas had been presented together with direction on running multicentre studies and instituting research projects.

The main conference focused on key topics in neonatology which were addressed by an international consortium of experts. Not all shared the same opinion on certain topics, which made for lively debates in the post presentation 'Q&A' sessions. Should CPAP or high flow oxygen therapy be used from birth in premature infants, in the move away from invasive interventions? Will we see the universal use of high flow therapy on infant resuscitation equipment in the near future? Such topics

received much interest from the audience and precipitated considerable discussion of current evidence and practice in this area.

Further debate and contemplation arose regarding the management of patent ductus arteriosus (PDA), with evidence-based medicine supporting conservative, rather than medical or surgical management. Methods of reducing infection and identifying sepsis were compared between units during the discussions. It was evident that the application of best practice in the prevention of infection remains a major goal in neonatology units worldwide. The dependence upon optimal nutrition to augment the long-term outcome of preterm infants is a key factor in the management of neonates. Success in this area was demonstrated by the implementation of a network feeding guideline.

The collation of presentations highlighted advances in neonatology in recent times and demonstrated how such advancements have had a profound influence on preterm survival and outcome. However, the overriding message of the conference was that, while our knowledge has improved in many areas of neonatology, despite this progress there are still several areas that are yet to be fully understood and their definitive management agreed. Ongoing advances in these areas and new topics will, no doubt, be the hotly debated subject matter of next year's meeting in Dublin.



Delegates enjoying the post-conference reception.

The conference ended with a drinks reception in the atrium of the Hilton Hotel and a first class performance by the girl choristers of the Cathedral School under the expert direction of conductor Simon Lovell Jones.

By Rachel Hayward

Paediatric Registrar, Wales Deanery
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23 MAY 13

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A study day for those working in neonatal care. Topics include:

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31 MAY 13

SNNG Annual Conference

Scottish Neonatal Nurses Group annual conference and exhibition. Topics include:

- Tissue viability
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- Management of gender anomalies
- Role of the family nurse partnership
- Bliss nurses and support worker roles

Venue: Crowne Plaza Hotel, Glasgow

Cost: £75 (SNNG members £65)

Contact: Tel: 01412 012756
fiona.tait1@nhs.net
www.snng.org.uk

5 JUNE 13

Neonatal Surgery: Where is the Cutting Edge?

Topics include:

- neonatal skin injury
- congenital diaphragmatic hernia
- necrotising enterocolitis

Venue: St George's Hospital, London

Cost: Doctors £50, Nurses £35

Contact: Dinah Korsah
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Venue: Ramada Plaza Belfast, Ireland

Cost: £75

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19-21 JUNE 13

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www.apagbi2013.co.uk

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11th World Congress of Perinatal Medicine

The conference addresses global challenges in maternal and child health: a call to improve outcome through pragmatic implementation of evidence-based care.

Venue: Moscow, Russia

Cost: €200-500

Contact: info@mcaevents.org
www.mcaevents.org/t/01/wcpm2013-1/index.aspx

20 JUNE 13

The Neonatal Experience – Loss and Grief Without a Bereavement

Venue: Imperial House, Birmingham

Cost: £50

Contact: Child Bereavement UK
 Tel: 01494 568910
conferences@childbereavementuk.org

1-2 JULY 13

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A course for clinicians working with preterm and newborn infants reflecting the recommendations of the Toolkit for High Quality Neonatal Care.

Venue: Imperial College London

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1-2 JULY 13

Reason Conference

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4 JULY 13

Supporting Parents Through Pregnancy Loss and Death of a Baby

Venue: Child Bereavement UK, Buckinghamshire

Cost: £99

Contact: Child Bereavement UK
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training@childbereavementuk.org

8 JULY 13

Neonatal Ventilation Update: Hot Topics & Workshops

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Venue: Park Plaza, London

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5-6 SEPTEMBER 13

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Contact: info@mcaevents.org
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5-8 SEPTEMBER 13

Eighth International Neonatal Nursing Conference

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12 SEPTEMBER 13

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**For informal enquiries please contact Del Brown,
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**Please apply online at
www.enherts-tr.nhs.uk/About The Trust/About Work For Us
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¹ Shah N. et al. *J Clin Anesth*. 2012 Aug;24(5):385-91. ² Castillo A et al. Pediatric Academic Societies Annual Meeting. 2007. ³ Baquero H et al. *Acta Paediatrica*. 2011.
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Solution for infusion and oral solution

Peyona®
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Treatment of primary apnoea of premature newborns

Peyona® 20 mg/ml solution for infusion and oral solution (caffeine citrate). Please refer to Summary of Product Characteristics (SmPC) before prescribing

Prescribing Information. Presentation Peyona® is a clear, colourless, aqueous solution at pH=4.7. Each 1 ml ampoule contains 20 mg of caffeine citrate (20 mg of caffeine citrate is equivalent to 10 mg caffeine). **Indications** Treatment of primary apnoea of premature newborns.

Dosage and Administration The recommended dose regimen in previously untreated infants is a loading dose of 20 mg caffeine citrate per kg body weight administered by slow intravenous infusion over 30 minutes, using a syringe infusion pump or other metered infusion device. After an interval of 24 hrs, maintenance doses of 5 mg/kg body weight may be administered by slow intravenous infusion over 10 minutes every 24 hrs. Alternatively, maintenance doses of 5 mg/kg body weight may be administered by oral administration, such as through a nasogastric tube every 24 hrs. The dose expressed as caffeine base is one-half the dose when expressed as caffeine citrate (20 mg caffeine citrate are equivalent to 10 mg caffeine base). In preterm infants with insufficient clinical response to the recommended loading dose, a second loading dose of 10-20 mg/kg maximum may be given after 24 hrs. Higher maintenance doses of 10 mg/kg body weight could be considered in cases of insufficient response. Where clinically indicated, caffeine plasma levels should be monitored. The diagnosis of apnoea of prematurity may need to be reconsidered if patients do not respond adequately to a second loading dose or maintenance dose of 10 mg/kg/day. When given IV, caffeine citrate should be administered by controlled IV infusion. Caffeine citrate can be either used without dilution or diluted in sterile solutions for infusion such as glucose 50 mg/ml (5%), or sodium chloride 9 mg/ml (0.9%) or calcium gluconate 100 mg/ml (10%) immediately after withdrawal from the ampoule. Caffeine citrate can be administered by intravenous infusion and by the oral route. The product must not be administered by intramuscular, subcutaneous, intrathecal or intraperitoneal injection. **Duration of treatment:** The optimal duration of treatment has not been established. Treatment is usually continued until the infant has reached a post-menstrual age of 37 weeks, by which time apnoea of prematurity usually resolves spontaneously. Caffeine citrate administration should be stopped when the patient has 5-7 days without a significant apnoeic attack. If the patient has recurrent apnoea, caffeine citrate administration can be restarted with either a maintenance dose or a half loading dose, depending upon the time interval from stopping caffeine citrate to recurrence of apnoea. Because of the

slow elimination of caffeine in this patient population, there is no requirement for dose tapering on cessation of treatment. As there is a risk for recurrence of apnoea after cessation of caffeine citrate treatment monitoring of the patient should be continued for approximately one week.

Contraindications Hypersensitivity to active substance or excipients. **Special Warnings and Precautions** Other causes of apnoea should be ruled out or properly treated prior to initiation of treatment with caffeine citrate (see SmPC for full details). Baseline plasma concentrations should be measured in neonates born to mothers who consumed large quantities of caffeine prior to delivery or newborns previously treated with theophylline. Extreme caution in newborns with seizure disorder. Caffeine has been shown to increase heart rate, left ventricular output, and stroke volume therefore caution should be exercised in newborns with known cardiovascular disease. **Caution in newborns** with impaired renal or hepatic function or suffering gastro-oesophageal reflux. Careful monitoring for development of necrotising enterocolitis. Caffeine citrate causes a generalised increase in metabolism, which may result in higher energy and nutrition requirements during therapy. The diuresis and electrolyte loss induced by caffeine citrate may necessitate correction of fluid and electrolyte disturbances. **Interactions** Inter-conversion between caffeine and theophylline occurs in preterm neonates; these active substances should not be used concurrently. Caffeine has the potential to interact with active substances that are substrates for CYP1A2, inhibit CYP1A2, or induce CYP1A2. However, caffeine metabolism in preterm neonates is limited due to their immature hepatic enzyme systems (see SmPC for full details). **Pregnancy and Lactation** Caffeine in animal studies, at high doses, was shown to be embryotoxic and teratogenic. These effects are not relevant with regard to short term administration in the preterm infant population. Caffeine is excreted into breast milk and readily crosses the placenta into the foetal circulation. Breast-feeding mothers of neonates treated with caffeine citrate should not ingest caffeine-containing foods, beverages or medicinal products containing caffeine (see SmPC for full details). **Undesirable effects** The known pharmacology and toxicology of caffeine and other methylxanthines predict the likely adverse reactions to caffeine citrate. Effects described include central nervous system (CNS) stimulation such as irritability, restlessness and jitteriness, and cardiac effects such as tachycardia, hypertension and increased stroke volume. These effects are dose related and may necessitate measurement of plasma levels and dose reduction. The adverse reactions described in short and long term published literature are: *Common:* infusion

site phlebitis, infusion site inflammation; *Rare:* hypersensitivity reaction; *Not known:* sepsis, hypoglycaemia, hyperglycaemia, failure to thrive, feeding intolerance, irritability, jitteriness, restlessness, brain injury*, convulsion*, deafness* (*more frequent in placebo group), tachycardia, also associated with increased left ventricular output and increased stroke volume, regurgitation, increased gastric aspirate, necrotising enterocolitis (see SmPC for full details), urine output increased, urine sodium and calcium increased, haemoglobin decreased, thyroxine decreased. Caffeine may suppress erythropoietin synthesis and hence reduce haemoglobin concentration with prolonged treatment. Transient falls in thyroxine (T4) have been recorded in infants at the start of therapy but these are not sustained with maintained therapy. **Pharmaceutical Precautions** None. After opening the ampoule, the product should be used immediately. For storage conditions of the diluted medicinal product see SmPC. **Special precautions for disposal and other handling** Aseptic technique must be strictly observed throughout handling of the medicinal product since no preservative is present. For single use only. Discard any unused portion left in the ampoule. Do not save unused portions for later administration. No special requirements for disposal. **Legal category** POM. **Packs and Prices** Basic NHS price of £172.50 per pack of 10 x 1 ml ampoules. **Marketing Authorisation Number** EU/1/09/528/002. Full prescribing information is available from the Marketing Authorisation Holder Chiesi Limited, Cheshire Royal Business Park, Highfield, Cheadle, SK8 3GY. **Date of Preparation** April 2012.

Adverse events should be reported. Reporting forms and information can be found at www.mhra.gov.uk/yellowcard. Adverse events should also be reported to Chiesi Limited. (address as above) Tel: 0161 488 5555

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