

National Clinical Programme for Paediatrics and Neonatology



PAEDIATRICS



Model of Care for Neonatal Services in Ireland



Feidhmeannacht na Seirbhíse Sláinte
Health Service Executive

Clinical Strategy and Programmes Division



**FACULTY OF
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Foreword

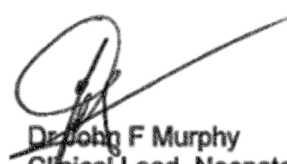
Neonatology is one of medicine's great success stories of the past 30 years. Over the last decade, the rapid progress in morbidity and mortality reduction has continued. The clinical case mix has altered with an increasing emphasis on intensive care for extremely preterm infants and term infants requiring therapeutic hypothermia and persistent pulmonary hypertension of the newborn (PPHN).

This model of care for neonatology is the product of wide consultation with professional groups and parents who either provide or receive its services. The Programme met with neonatologists, paediatricians, neonatal nurses and health and social care professionals (HSCPs) who provide care to newborn babies. Discussions were held with parents whose babies receive care through the Irish Neonatal Health Alliance and the Irish Premature Babies Association. The views of all groups were considered in the development of this document, with the overall aim of designing systems that will provide quality care to every baby.

The organisation of neonatal services in Ireland is changing in response to managed clinical networks. The roles of medical and nursing staff have also changed with the implementation of the European Working Time Directive (EWTD) and the expanded role of the neonatal nurse through increased numbers of advanced neonatal nurse practitioners. Health and social care professionals must be included as part of the multidisciplinary neonatal team. It is imperative that Irish newborn care is in a position to embrace these international advances.

The three key components of national neonatal service delivery are infrastructure, manpower, and operating systems. The service delivery recommendations in this document have been benchmarked against international standards. Implementation strategies have been considered, with an emphasis on sustainability, as the model of care must be fit for purpose not just now but into the future. This is particularly important in neonatology, a specialty that is rapidly changing and advancing. The systems put in place need to be both reactive and proactive.

This document addresses the delivery of neonatal services in Ireland, and the integration between tertiary (Level 3), regional (Level 2) and local (level 1) neonatal units. It proposes how the three categories of the neonatal service should function. It describes how the current neonatal services operate nationally. It outlines how neonatology should change and advance with reference to best international practice. It provides a vision for the future of neonatology and describes how that vision can be implemented. It proposes the blueprint for a neonatal model of care for Ireland. The model is guided throughout by the triad of Quality, Access and Cost.



Dr. John F. Murphy
Clinical Lead, Neonatology Programme

1. Executive Summary

- 1.1 This model of care is intended to ensure sustainability in neonatal services in Ireland, and has three core objectives:
- Improve safety and quality in the delivery of baby-centred care
 - Improve access to the appropriate services
 - Improve cost-effectiveness of services delivered
- 1.2 The key values of a neonatal unit are: high quality clinical care, good governance, a stable effective workforce, a culture of teaching and training, succession planning, and being approachable, understandable and honest with parents.
- 1.3 The annual number of births is a major driver of activity in all neonatal units. In 2013, there were just under 68,000 births.
- 1.4 There are nineteen neonatal units in Ireland, which are classified according to number of births into local, regional and tertiary neonatal units. There are 11 local units, 4 regional units and 4 tertiary units. There are 300 neonatal cots in total: 193 special care, 52 high dependency care and 55 intensive care.
- 1.5 Neonatal care for a normal newborn infant is based on three key areas: screening, nutrition and immunisation.

Screening	Nutrition	Immunisation
Clinical examination	Feeding advice	BCG
Hearing test	Lactation nurse input	Provision of information
Blood spot screening test	Discharge weight	
Hip ultrasound (high risk cases)		
Oxygen saturation		

- 1.6 The neonatology workload in the tertiary paediatric hospitals is increasing, and the current allocation of consultant sessions is inadequate.
- 1.7 The National Neonatal Transport Programme provides a comprehensive 24/7 service, and is an essential component of an integrated neonatal clinical network. An efficient and effective retrotransfer service is required to facilitate transfer of stable infants from the tertiary neonatal units back to the local or regional units.
- 1.8 Neonatal nursing is fundamental to the delivery of neonatal care. There are 4 categories of neonatal nursing: Intensive care, High Dependency care, Special care, and Surgical.
- 1.9 The recommended ratios for neonatal nursing are: 1:1 in intensive care, 1:2 in high dependency care and 1:4 in special care.

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- 1.10 There are approximately 540WTE neonatal nurses nationally, and the current deficit is estimated at approximately 10% (54WTE). There needs to be increased numbers of advanced neonatal nurse practitioners and clinical nurse specialists.
- 1.11 Health and social care professional services are essential in neonatal units, including dietetics, pharmacy, physiotherapy, medical social work, occupational therapy, speech and language therapy, and clinical psychology. Clinical engineers are required for ongoing maintenance of equipment in units. These areas have been underresourced previously, and need to be increased.
- 1.12 Level 1 (local) neonatal units provide routine neonatal care to term infants, and special care to infants ≥ 32 weeks gestation. *Infants of 30-31 weeks gestation can be cared for in Level 1 units if the appropriate staffing complement is available, i.e. 1:2 high dependency nursing ratios, middle grade and consultant staff.*
- 1.13 Level 2 (regional units) provide routine neonatal care to term infants, special care, high dependency care and short-term ventilation to infants >27 weeks gestation.
- 1.14 Level 3 (tertiary units) provide the full spectrum of neonatal care to term and pre-term infants who are critically unwell. There should be sufficient clinical throughput to maintain clinical skills and expertise, with a minimum of 100 infants BW <1500 g and/or 100 infants requiring assisted ventilation / CPAP.
- 1.15 Tertiary neonatal centres must coordinate retinopathy of prematurity screening.
- 1.16 Neonatal services should be integrated across hospital groups to form clinical networks, with each unit clear about the services provided and appropriately resourced.
- 1.17 Neonatal resuscitation is an essential function of all units providing acute neonatal services, and should be standardised and improved.
- 1.18 Therapeutic hypothermia is a complex treatment and should only be undertaken in tertiary neonatal units. The NNTP have developed a candidacy checklist that should be completed in all suspected cases of neonatal encephalopathy.
- 1.19 A national register of infants undergoing therapeutic hypothermia should be established.
- 1.20 All infants BW <1500 g should have a neurodevelopmental assessment at 2 years. The Bayley III assessment is an accepted tool providing clinically useful information.
- 1.21 Units caring for pre-term infants must be capable of safely and effectively providing parenteral nutrition until enteral feeding can be established.
- 1.22 Extracorporeal membrane oxygenation (ECMO) is a life support in which venous blood is oxygenated outside the body and returned to the patient. There are approximately

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5 infant ECMO cases in Ireland annually, with infants transferred to Sweden for this treatment at a cost of approximately €133,000 per infant. A working group should be established to examine the feasibility of ECMO provision in Ireland.

- 1.23 A coordinated approach to national manpower planning is needed.
- 1.24 The number of consultant neonatologists in the tertiary neonatal units, and the tertiary paediatric hospitals, is inadequate and should be increased.
- 1.25 Paediatric radiology services are a priority support service requirement for any unit looking after newborn infants. Deficits in units outside Dublin and Cork should be addressed.
- 1.26 All units should have a culture of teaching and training. Making neonatal research sustainable into the future remains a challenge, which is dependent on adequate funding and development of a culture of participating in research activities within all units.
- 1.27 The recognition of Neonatology as a separate specialty on the Medical Council register is at an advanced stage. After five years, the trainee will receive the CCST in Neonatology. If the trainee also wishes to be on the General Paediatrics register, a further one year's training in general paediatrics will be required. It is hoped to commence the neonatal fellowship programme in July 2016, with the recruitment of 3-4 neonatal fellows.
- 1.28 Clinical governance structures should be positioned within the clinical governance structure of each hospital and hospital group. There should be an assigned medical director and nursing director and monthly department meetings.
- 1.29 Agreed national standards should be implemented in all units. The Programme have developed a range of algorithms that provide a standard way of treating commonly occurring conditions in neonatal units.
- 1.30 Performance indicators in neonatology fall under four categories: infrastructure, staffing, processes and outcomes.
- 1.31 All units should contribute to the Vermont Oxford Network (VON) collaboration to record outcomes in infants BW <1500g and benchmark performance.

2. Introduction

Neonatal services in Ireland have mostly developed in response to need, rather than from any defined plan. Births in Dublin are concentrated in three maternity hospitals and together with Cork University Maternity Hospital account for over half of the country's births each year. The main driver for development has been the country's high birth rate, as well as a desire by clinicians and management to improve services and available treatments for babies under their care in hospitals. These efforts have been largely pursued independently by each hospital. In 2009, the European Foundation for the Care of the Newborn Infants published their report '*Too Little Too Late*' on neonatal services across Europe. This European Union (EU) benchmarking report recommended that Irish neonatal services should be planned in order to guarantee steady and sustainable progress.

There have been a number of important collegiate efforts to advance neonatal care, which included the Neonatal Subcommittee of the Royal College of Physicians of Ireland (RCPI), Irish Perinatal Society (IPS), Irish Paediatric Association (IPA), Irish Nurses and Midwives Organisation (INMO), and external links with the British Association of Perinatal Medicine (BAPM) and the Royal College of Paediatrics and Child Health (RCPCH). While these groups provided useful advisory and advocacy roles, they did not have executive powers. Management and health planners could, if they so wished, ignore the advice and suggestions of the groups. This disconnect led to the specialty lagging behind international best practice.

2.1 National Clinical Programme for Paediatrics and Neonatology

The National Clinical Programme for Paediatrics and Neonatology (NCPPN) was established in 2011 as a collaboration between the RCPI and the Health Service Executive (HSE). Two clinical leads were appointed: Prof. Alf Nicholson (Paediatrics) and Dr. John Murphy (Neonatology). The clinical leads are supported by the programme managers (Grace Turner and Claire Browne) and the multidisciplinary NCPPN working group. The Programme reports to the Neonatal Clinical Advisory Group in RCPI, the HSE National Clinical Advisor and Group Lead for Acute Hospitals (Dr. Colm Henry), and the HSE National Director for Clinical Strategy and Programmes (Dr. Aine Carroll). These progressive steps ensure that healthcare professionals are involved in healthcare planning and decision making, which in turn improves patient outcomes.

Prof. Brendan Drumm, the first Chief Executive Officer of the HSE, highlighted the lack of clinical involvement in Irish health service management over the previous decades. The national clinical programmes arose from these concepts. The role of clinicians in determining national standards, identifying new clinically important goals, and devising implementation strategies is now facilitated through the Programme, recognising that clinical leaders are essential for high performing neonatal services. This represents the best way to pursue quality improvement in neonatology.

3. Rationale

This model of care is intended to ensure sustainability in neonatal services in Ireland. It defines how neonatal services should be delivered, so that babies get the right care, at the right time, in the right place by the right staff. Expertise, capacity, access and reproducibility are the four pillars of good neonatal practice. The model must respond to emerging innovations and be able to evaluate and implement quickly into clinical practice. A new connectivity must be created between all neonatal units across the country. The NCPPN has made it possible to drive change in a way that is accepted and understood by both service users and healthcare professionals.

4. Aims and Objectives

The primary role of neonatology is to provide excellent care to all newborns. The type and amount of care needed depends on background health and wellbeing, and ranges from routine care in a local unit (level 1) to neonatal intensive care in a tertiary unit (level 3).

The overall aim of the NCPPN, and this model of care, is based on three core objectives:

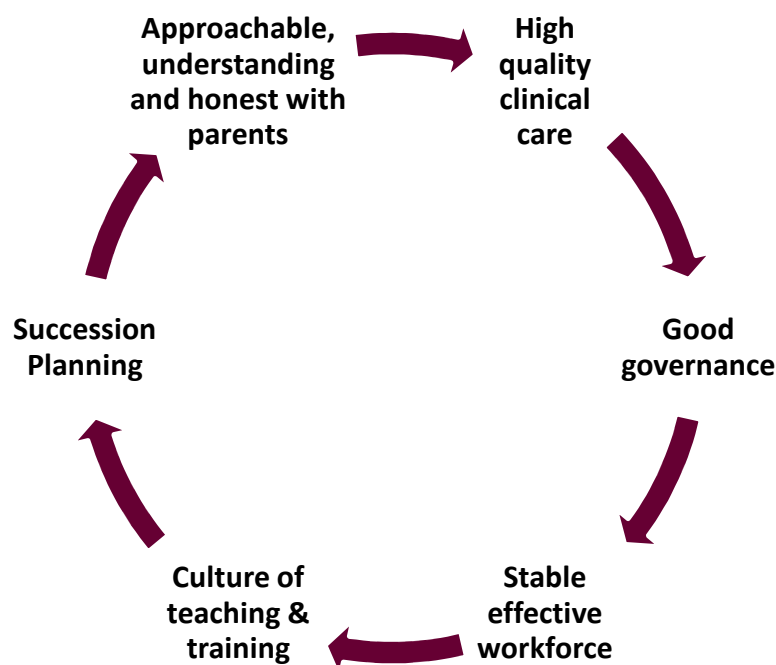
- Improve safety and quality in the delivery of baby-centred care
- Improve access to the appropriate services
- Improve cost-effectiveness of services delivered

Wide consultation with healthcare professionals, management and parents has been central to the development process. All neonatal units were visited at the outset of this process by the national clinical leads. The purpose of these visits was to collect demographic and operational data, to listen to staff, and to find out about each unit's vision for the future. Staff were asked to identify what was working well and what activities could be improved, with informal dialogue and a wide range of views sought. Following this, more formal meetings were held with neonatologists from the four tertiary units, which focused on current and future workloads, referral patterns, challenges in infrastructure, manpower requirements, and standardisation of care. The interface between foetal medicine and neonatology was explored. The importance of the National Neonatal Transport Programme (NNTP) and its extension to a 24/7 service was emphasised. Attempts were made to predict the impact of the new hospital groups on service delivery.

A mechanism for implementation is required; this will allow policy to change service provision. This has been a major choke point up to now, with a lack of cohesion between healthcare professionals and management.

5. Values

The key attributes of a neonatal unit are high quality clinical care, good governance, a stable effective workforce, culture of teaching and training, succession planning, and being approachable, understandable and honest with parents.



6. International and National Best Practice in Neonatology

Neonatal intensive care has evolved rapidly over the last 50 years, and has been very effective in reducing mortality and morbidity in newborn infants. Being a relatively new specialty, it has benefited from a foundation in new concepts of basic science and clinical research, and has also embraced emerging medical technologies. From the outset, neonatology has appreciated that expertise and clinical activity should be concentrated in a small number of centres. When a unit has a high clinical throughput the clinical staff become skilled in the management of all complex eventualities. It is recommended that a tertiary neonatal unit should be managing at least 100 very low birth weight infants (BW <1500g) annually, and should be undertaking at least 2000 days of respiratory support defined as endotracheal ventilation, nasal CPAP or nasal high flow. The unit should also be capable of providing parenteral nutrition.

The British Association of Perinatal Medicine (BAPM) has consistently reviewed standards for optimum neonatal care over the past 30 years. Their 2014 framework document again emphasises that neonatal intensive care should only be undertaken in large neonatal units. Studies from a number of countries, including the United States and Australia, have all reported that neonatal units with the highest levels of activity have better outcomes. The current BAPM guidelines suggest neonatal networks that include neonatal intensive care

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units (NICUs) admitting less than 50 infants BW<1500g should develop plans to amalgamate with other units to increase clinical throughput.

Whenever possible, pre-term low birth weight infants should be transferred in utero. In the case of referrals made after birth, the retrieval should be undertaken by a trained, experienced neonatal transport team. Tertiary units should be staffed by a consultant neonatologist at all times, and comply with standards for nurse to baby ratios as follows:

- NICU 1:1
- HDU 1:2
- Special Care 1:4

The nursing role should be augmented with the appointment of advanced neonatal nurse practitioners. There should be dedicated health and social care professionals.

A tertiary neonatal intensive care unit should conform structurally to international standards. Adequate space is important to reduce cross-infection between babies, and there are minimum acceptable distances between intensive care cots. There must be isolation facilities to cohort infected infants. There must be high quality hand washing facilities.

7. Current Service Provision

7.1 Definitions of Intensive Care, High Dependency and Special Care Days

Intensive Care Day
<ul style="list-style-type: none"> ▪ Any day where a baby receives any form of mechanical respiratory support via a tracheal tube ▪ BOTH non-invasive ventilation (e.g. nasal CPAP, SIPAP, BIPAP, vapotherm) and Parenteral Nutrition (PN) ▪ Day of surgery (including laser for ROP) ▪ Day of death ▪ Any day where any of the following are received: <ul style="list-style-type: none"> - Presence of an umbilical arterial line - Presence of an umbilical venous line - Presence of a peripheral arterial line - Insulin infusion - Presence of a chest drain - Exchange transfusion - Therapeutic hypothermia - Prostaglandin infusion - Presence of relogie tube - Presence of epidural catheter - Presence of silo for gastroschisis - Presence of external ventricular drain - Dialysis (any type)
High Dependency Day
<p>Where a baby does not fulfil the criteria for intensive care, where any of the following apply:</p> <ul style="list-style-type: none"> ▪ Any day where a baby receives any form of non-invasive ventilation (e.g. nasal CPAP, SIPAP, BIPAP, HHFNC) ▪ Any day where any of the following are received: <ul style="list-style-type: none"> - Parenteral nutrition - Continuous infusion of drugs (except prostaglandin and/or insulin) - Presence of a central venous access device or long line, e.g. PICC - Presence of a tracheostomy - Presence of a urethral or suprapubic catheter - Presence of trans-anastomotic tube following oesophageal atresia repair - Presence of nasopharyngeal airway or nasal stent - Observation of seizures / cerebral function monitoring - Barrier nursing - Ventricular tap
Special Care Day
<p>Where a baby does not fulfil the criteria for intensive care or high dependency care, where any of the following are required:</p> <ul style="list-style-type: none"> ▪ Oxygen by nasal cannula ▪ Feeding by nasogastric tube, jejunal tube or gastrostomy ▪ Continuous physiological monitoring (excluding apnoea monitors only) ▪ Care of a stoma ▪ Presence of an intravenous cannula ▪ Phototherapy ▪ Special observations of physiological variables (at least 4 hourly)

Table 1: BAPM Categories of Care, August 2011

7.2 Demographics and Activity

The annual number of births is a major driver of activity in all neonatal units. Between 2001 and 2011, the number of births increased by 29% (see Table 2).

1971	1981	1991	2001	2011	2012	2013
67,551	72,158	52,718	57,854	74,650	72,000	67,995

Table 2: Annual Number of Births in Ireland

However, birth rates can be difficult to predict. It had been expected that the number of births would fall significantly in the face of the recent recession, but so far the decrease has only been small. In 2012, the birth rate was 15.6 per 1,000 which had reduced from a peak of 16.8 per 1,000 in 2008. It will continue to be difficult to predict the number of births for the next five years particularly as the recession eases. This poses challenges for manpower planning in the context of this model of care.

7.3 Categories of Neonatal Unit

The distribution of births across the nineteen maternity units readily allows for categorisation into tertiary, regional and local units. Table 3 details the number of births in each maternity unit in Ireland in 2013:

Hospital	No. of Births	Hospital	No. of Births
NMH Holles St.	8994	Wexford	1990
Rotunda	8843	Portlaoise	1983
Coombe	8209	Cavan	1915
Cork University Maternity	8344	Kilkenny	1815
Limerick	4652	Letterkenny	1798
Drogheda	3648	Castlebar	1697
Galway	3141	Sligo	1544
Mullingar	2461	Tralee	1500
Waterford	2215	Clonmel	1200
Ballinasloe	2044	Total	67,995

Table 3: 2013 Births by Maternity Unit

Table 4 groups the units according to annual number of births:

Number of Births	Number of Neonatal Units
<2000	6
2000-3000	7
3000-4000	1
4000-5000	1
5000-6000	0
6000-7000	0
>8000	4

Table 4: Categorisation of Units by Annual Births

In summary, there are eleven level 1 units, four level 2 units, and four level 3 units. All neonatal units are co-located with the nineteen maternity units. There are 300 neonatal

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cots nationally, consisting of 193 special care cots, 52 high dependency cots, and 55 intensive care cots, with over 11,000 neonatal admissions in Ireland each year. The four tertiary neonatal units are:

- National Maternity Hospital Holles Street
- Rotunda Hospital
- Coombe Women and Infants University Hospital
- Cork University Maternity Hospital

By comparison, in the United Kingdom there are a total of 218 neonatal units: 182 in England, 15 in Scotland, 14 in Wales and 7 in Northern Ireland. There are a total of 3,894 neonatal cots, of which 83% (3,243) are in England. Table 5 details the annual number of admissions to special care / intensive care in each neonatal unit:

Hospital	No. of Admissions	Hospital	No. of Admissions
Holles Street	1,508	Tralee	344
Rotunda	1,323	Wexford	340
Cork	1,208	Ballinasloe	340
Coombe	1,095	Sligo	336
Drogheda	500	Clonmel	305
Waterford	450	Castlebar	276
Limerick	400	Portlaoise	270
Letterkenny	384	Kilkenny	250
Galway	377	Mullingar	250
Cavan	350		

Table 5: Annual Admissions to Special Care / Intensive Care

In addition, there is considerable neonatal activity in the tertiary paediatric hospitals which is summarised in Table 6. There were 666 cases of neonatal anaesthesia (<28 days) in 2013, of which 79% were performed in Dublin.

Number of infants ventilated / on CPAP	560
Number of postnatal transfers	100
Number transferred to Crumlin / Temple Street	273

Table 6: Annual Clinical Activity in Tertiary Neonatal Units and Newborn Services in Crumlin / Temple Street

7.4 Staffing in the Tertiary Neonatal Units

Consultant staffing in neonatology in Ireland has been consistently low compared to other first world countries. The workforce complement is also not responsive to rapid, unpredicted increases in workload. The surge in births from 2001 onwards caused significant problems for neonatal intensive care units as mechanisms were not in place to respond to increased clinical demands. The workload increased by 30%, but the number of healthcare professionals remained the same. National planning for neonatology must address these historic staffing difficulties, ensuring that the four tertiary neonatal units are adequately staffed will not require a large amount of funding.

Staff Category	Current (WTE)	Proposed (WTE)
Consultant neonatologists	20	28-32
Registrars	32	40
Senior House Officers	28	36
Neonatal Nurses	290	320
Dietitians	2.5	4
Pharmacists	1.7	4
Physiotherapists	2.5	4
Occupational Therapists	1	4
Speech & Language Therapists	1	4
Clinical Psychologists	0.5	4
Social Workers	2	4
Clinical Engineers	4	6

Table 7: Current and Proposed Neonatal Staff Numbers in 4x Tertiary Neonatal Units

7.5 Care of the Normal Newborn Infant

This constitutes a substantial workload in neonatology, based on three principles:

Screening	Nutrition	Immunisation
Clinical examination Hearing test Blood spot screening test Hip ultrasound (high risk cases) Oxygen saturation	Feeding advice Lactation nurse input Discharge weight	BCG Provision of information

Newborn screening has become increasingly more sophisticated and now incorporates clinical, radiological, biochemical and electrophysiological components. A routine external examination is carried out at delivery or within the first 48 hours. Particular attention is given to the detection of conditions such as cleft palate, cataract, anal atresia, developmental dysplasia of the hip (DDH), and congenital heart disease, which can be easily overlooked.

All newborn infants should have a hearing screening test prior to discharge, and have their oxygen saturation checked using pulse oximetry on either foot. The newborn blood spot screening test is performed on day 5 for breast-fed infants and day 4 for bottle-fed infants. This test detects hypothyroidism, metabolic disorders and cystic fibrosis. 20% of newborn infants are at risk of DDH, which equates to approximately 15,000 ultrasound scans annually. At present, this service is limited and even not provided in some parts of the country. There is a clear need to extend this service to provide targeted screening in all areas. Infant feeding, via breast or bottle, should be assessed and monitored. Infants are weighed both at birth and on discharge. Currently, only nine out of nineteen units have a lactation nurse service. All infants should receive the BCG vaccination, and parents provided with information on the national infant immunisation programme. The BCG vaccination is given in Dublin and some areas outside of Dublin, but not others.

7.6 Neonatal Services in the Tertiary Paediatric Hospitals

The provision of neonatology services to Our Lady's Children's Hospital Crumlin and Children's University Hospital Temple Street is challenging, with demand greatly exceeding capacity. Workload has increased for a number of reasons:

- Increased survival of very pre-term infants has increased need for neonatal surgery for conditions such as necrotising enterocolitis
- All neonatal neurosurgery has transferred to Temple Street
- Increased numbers of infants undergoing cardiac surgery in Crumlin
- More requests for consultant neonatologist opinion or involvement in management from general and other specialist paediatricians when babies under 6 weeks are admitted
- Current diagnostic and consultative role in paediatric intensive care unit may extend to interventions such as ventilation, chest drains and vascular access

The workload is significant, with neonatologists providing medical supervision and care for all newborns transferred for surgery, as well as clinical input to all newborns referred for subspecialist care, e.g. nephrology, gastroenterology, etc. Neonatologists are also involved in the care of infants admitted with intercurrent illness such as respiratory syncytial virus infection, gastroenteritis, septicaemia and meningitis. In 2013, there were 774 infant (under 6 weeks) admissions in Temple Street. Of these, 170 underwent surgery. There were 831 infant admissions in Crumlin for the same period, with 166 of these undergoing surgery. This also generates a substantial workload for health and social care professionals in Crumlin and Temple Street as these neonates will remain in the paediatric hospitals for follow-up care. The outpatient follow-up required is considerable.

Hospital	Admissions <6 weeks of age	Number Receiving Surgery	Consultant Sessions (WTE)
Temple Street	774	170	1.5
Crumlin	831	166	1.2
Tallaght	200	15	0
TOTAL:	1805	351	2.7

Table 8: Neonatal Admissions to Paediatric Hospitals and Consultant Sessions

Neonatologists primarily based in the three Dublin maternity hospitals visit the tertiary paediatric hospitals. Crumlin has 1.2WTE consultant sessions, and Temple Street has 1.5WTE consultant sessions. The number of neonatology sessions is insufficient in these hospitals, and will be further exacerbated when the new children's hospital opens with the expected increase in referrals and new 18-bed neonatal intensive care unit. Prior to this, it is also expected that a proportion of infants attending Tallaght will be redirected to Crumlin or Temple Street.

7.7 National Neonatal Transport Programme

The National Neonatal Transport Programme (NNTP) has been in operation since March 2001. For thirteen years, the service operated between the hours of 9am-5pm, until December 2013 when the service was extended to 24/7. With the daytime only service, the NNTP undertook approximately 300 retrievals per year. This increased to over 600 transports in the first year of 24/7 service. A key benefit of the service being available 24/7

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is that it reduces the number of non-NNTP transfers to a minimum. The NNTP is delivered by the three Dublin tertiary neonatal units on weekly rotation. Staffing consists of one consultant neonatologist, 1 nurse coordinator, 6 neonatal registrars, and 6 neonatal nurses with clinical engineering support. The NNTP reports to an oversight committee, and the budget is held by the National Ambulance Service.

The NNTP is an essential component of an integrated neonatal clinical network. Most retrievals are undertaken by ambulance (94%) but, in the event of extreme urgency or long distance, air transport is available by service level agreement between the HSE and the Air Corps for air ambulance services. The NNTP have developed a specific transport module for air transport that integrates with the aircraft (helicopter or fixed wing). The pathway for referral is well established, with the referring hospital contacting a hotline number and providing clinical details which are recorded on a standardised referral form. Initial advice is provided to the referring hospital, a team is mobilised within 45 minutes, and the referring hospital is given an estimated time of arrival. When the team arrives, they take over the clinical management of the infant, with priority given to stabilisation and preparation for transport. The team remains in contact with the consultant neonatologist on call in the tertiary neonatal unit.

An efficient and effective retro-transfer service is required to facilitate transfer of infants back to their local hospital once stable. Currently, local units have to collect the infant from the tertiary unit, but this is not sustainable as it places units under considerable pressure to divert resources to transporting the baby back from the tertiary unit. The advantages of a centralised retrotransfer programme include:

- Facilitates transfer of infants back from tertiary units to their local hospital in an optimum and timely fashion, and reduces 'bed blocking' in tertiary units
- Reduces travel and time burden placed on parents and families
- Enables staff in local units to become familiar with the infant and its management plan prior to discharge home
- Eliminates current workload on local units who are sent to collect infants from tertiary units, instead it facilitates the ability of local units to take infants back
- Improves patient flow, creating space in the tertiary neonatal units for new referrals

8. The Neonatal Multidisciplinary Team

8.1 Neonatal Nursing

Neonatal nursing is fundamental to the delivery of neonatal care. The outcome for infants in any neonatal unit is dependent on the availability of sufficient numbers of skilled neonatal nurses. The four fundamental skills required for good neonatal nursing care are:

1. Ability to detect and act on subtle changes in a newborn's condition
2. Accurate recording of physiological and fluid balance data
3. Technical proficiency in a wide range of procedures
4. Ability to perform cardio-pulmonary resuscitation

Categories of Neonatal Nursing Care

Intensive Care	High Dependency	Special Care
<ol style="list-style-type: none"> 1. Assisted ventilation, and during the first 24 hours post-extubation 2. On CPAP and <5 days old 3. Birthweight <1000g and on CPAP 4. Gestation <29 weeks and <48 hours old 5. Clinically unstable infant 	<ol style="list-style-type: none"> 1. On CPAP and >5 days old 2. Birthweight <1000g but not requiring any respiratory support 3. Receiving parenteral nutrition 4. Birthweight <1500g and receiving oxygen 5. Neonatal abstinence syndrome requiring treatment 6. Neonatal apnoea requiring constant monitoring 	<ol style="list-style-type: none"> 1. Preterm infants >32 weeks gestation 2. Term infants with transient tachypnoea of the newborn requiring oxygen and/or IV fluids 3. Infants requiring tube feeding 4. Infants requiring phototherapy 5. Retrotransfers from the tertiary centre that are stable and convalescent

Table 9: Case Criteria for Neonatal Nursing Categories

A fourth highly specialised category is neonatal surgical nursing (see table 10). The two neonatal surgery units in Ireland are located in Crumlin and Temple Street. The nursing care of these infants requires a unique skill set. The neonatal surgical nurse has specific skills in fluid assessment and management, care of central venous access devices, administration of parenteral nutrition, and the use of highly modified milk preparations. They play a key role in a large multidisciplinary team, interacting with surgeons, anaesthetists, neonatologists, radiologists, nephrologists, neurologists, infectious diseases/microbiology, gastroenterologists, cardiologists, dietitians, physiotherapists, medical social workers, occupational therapists, pharmacists, speech and language therapists and clinical psychologists as required.

Surgical Nursing
1. Infants pre- and post-abdominal surgery
2. Specific highly complex management of infants with gastroschisis, Hirschsprungs, and ileostomy
3. Infants pre- and post-neurosurgery for spina bifida and/or hydrocephalus
4. Infants pre- and post-cardiac surgery

Table 10: Case Criteria for Neonatal Surgical Nursing

Neonatal Nurse Staffing

The approximate number of neonatal nurses working in all neonatal units was determined by the NCPPN, and is detailed in Appendix 1. There were 539.7WTE neonatal nurses nationally. In total, 4 units had 65-75WTEs, 4 units had 25-35WTEs, 1 unit had 15-25WTEs and the remaining 10 units had 5-15WTEs. These numbers provide a useful surrogate marker of each unit's clinical activity. There are four units with median 70WTE neonatal nurses (tertiary neonatal units), while on the other hand 10 units have a median of 10WTEs (local neonatal units). It is a complex exercise to determine the required numbers of neonatal nurses in each unit, based on categories of cot (special care, high dependency and intensive care), which is often not available for all units. The Programme have approximated the current deficit to be approximately 10% nationally, or 54WTE neonatal nurses.

The key staffing challenges faced by neonatal nursing are funding, recruitment and retention:

- The funding required to staff all neonatal units adequately and safely is not insurmountable. An additional 54WTE neonatal nurses nationally would alleviate much of the staffing deficit. Regional and local units require a 10% increase in neonatal staffing, while the tertiary units need an additional 7WTE.
- Recruitment has become a greater challenge in recent years, despite the quality of graduate nurses. Due to a widespread shortage of neonatal nurses, Irish neonatal nurses may be offered attractive packages to relocate to other countries including the UK, Australia and the Middle East. Non-replacement of staff on maternity and sick leave has created short-term staffing issues in individual units.
- The issues relating to recruitment also apply to retention of neonatal nurses. Career progression and continuous professional development must also be ensured. All neonatal nurses should be encouraged to obtain a nationally recognised qualification in neonatal nursing. Staff should be protected from excessive stress within their work environment.

Neonatal Nurse Education

Neonatology is constantly evolving, requiring skilled professionals who are educated to a high level. Up to the late 1980s, education options for neonatal nurses were generally limited to certification programmes. Significant changes in practice over the last 15 years, founded on both basic science and clinical research, have strengthened the career pathway for neonatal nursing. This has had a positive impact on recruitment and retention in neonatal nursing. The increasing acuity and complexity of infants admitted to neonatal units demands an increasingly higher level of education for neonatal nurses.

In recent years, neonatal services have been subject to a number of official reviews, with reports highlighting how the service should be organised and delivered. KPMG recommended, within their 2008 review of maternity and gynaecological services in the greater Dublin area, *“a continued focus on nurse education and professional development in neonatal care to help improve the overall effectiveness of the workforce is pivotal”*. Evidence is emerging that a reduction in morbidity and mortality of the smallest and most pre-term infants relates not only to nurse staffing ratios but also to the specialist education and experience of nurses delivering care.

It is recommended that all neonatal nurses have a qualification relevant to their role. A number of neonatal nursing programmes are available to support safe, effective and competent neonatal care, including:

- Postgraduate diploma in neonatal intensive care nursing
- Foundation programme in neonatal nursing
- Advanced practice (neonatology)
- MSc in neonatal nursing

Further details on these courses is provided in Appendix 2. The BAPM standards recommend that workforce planning for neonatal intensive care services should include additional funding of 25%, in addition to that required for direct clinical care, to contribute to education, training and continuous professional development.

Advanced Neonatal Nurse Practitioners

The role of advanced neonatal nurse practitioner (ANNP) was initially proposed in the UK in 1990. While the role has been embraced there, Ireland has been more deliberate in introducing ANNP posts. The availability of an education programme here will facilitate more neonatal nurses being employed in this role. ANNPs have a valuable contribution to make in addressing issues in recruiting NCHDs and achieving EWTD compliance, as well as being cost-effective. The ANNP can improve standards of care by ensuring continuity and effective caseload management in neonatal intensive care units where turnover of clinical staff is high.

Further expansion of ANNP numbers is recommended, as well as consideration of new areas of practice including neonatal transport and ANNP-led clinics. The governance and clinical indemnity underpinning this role also needs to be reviewed to reflect its development. While accreditation is currently on an individual post basis, this should change to the individual ANNP being accredited to facilitate staff mobility as more posts become available.

Clinical Nurse Specialists

Clinical nurse specialists (CNSs) in the NICU provide services in areas such as discharge planning, resuscitation and lactation. As there are currently limited numbers, there has not been capacity to further expand their roles. Discharge planning CNSs should be extended into the community, with home visits pre- and post-discharge, providing parents with greater confidence and potentially reducing readmissions. It is recommended that each NICU has a dedicated lactation consultant to assist mothers with the provision of expressed breast milk initially, and to promote exclusive breastfeeding at discharge. Although this is

not the sole responsibility of a lactation CNS, the provision of such a service would improve long-term outcomes for NICU infants and national breastfeeding rates.

It is a goal in NICUs to provide family-centred care, aided by programmes such as the Newborn Individualised Developmental Care and Assessment Programme (NIDCAP) which aims to provide individual holistic care to infants in an environment that can be potentially toxic to the developing brain. Currently, limited numbers of nurses have undertaken the NIDCAP education programme. A CNS role specialising in family-centred care and NIDCAP, initially in the tertiary units with future expansion to other units.

Clinical Midwife Specialist in Bereavement

End of life decisions in neonatology fall into two categories. Firstly, it may be decided not to initiate resuscitative care at birth as the infant's outcome is too poor. Secondly, care may be withdrawn from infants after a period of intensive care where it is deemed not appropriate to continue. The main reasons for withholding or withdrawing care are: extreme prematurity (35%); lethal congenital malformation (45%); and severe birth asphyxia or other causes (20%). Currently in the NICU setting, 62% of infant deaths are due to withdrawal of care, 20% are due to withholding treatment, and 18% die while still undergoing full neonatal intensive care.

Neonatologists are guided by the Royal College of Paediatrics and Child Health framework *Withholding or Withdrawing Life Sustaining Treatment in Children*, which describes five situations where redirection can be considered:

1. The 'no chance' situation
2. The 'no purpose' situation
3. A brain dead child
4. Permanent vegetative state
5. The unbearable situation

The 'no chance' and 'no purpose' situations are applied to newborns whose status deteriorates irretrievably despite intensive care. There is agreement on the importance of proceeding slowly, and allowing parents and families plenty of time. Staff will explain about examinations and results of investigations that demonstrate poor outcome. When intensive care is withdrawn, parents must be given time and privacy with their child. In protracted cases, the palliative care team should be consulted. A bereavement counsellor should be available in all units.

Clinical midwife specialists have an important role to play in the coordination of bereavement services in maternity hospitals. Posts have been appointed in Holles Street, the Coombe, the Rotunda, Cork and Limerick for some time, and more recently in Galway and Drogheda. Their role is extensive. It is recognised that parents need skilled advice and counselling after a pregnancy loss or perinatal death. The service at Holles Street looks after approximately 700 ERCP cases, 80 mid-trimester losses, 30 stillbirths and 32 neonatal deaths annually. This workload would be replicated across the other tertiary units, and at a lower level in other units.

8.2 Neonatal Dietitian

Neonates are a unique population with special nutritional requirements, often complicated by complex medical conditions. The dietitian can have a significant impact on the care of sick and premature infants providing, as part of the neonatal team, consistent nutritional care to each infant. Neonatal dietitians have expertise in nutritional assessment of the neonate; provision and monitoring of enteral and parenteral nutrition; support and monitoring adequacy of nutritional intake in infants transitioning to breastfeeding or infant feeding; assessment and monitoring of growth; provision of therapeutic diets; outpatient follow-up; and research, audit, training and education on nutrition-related topics. They are central to the development of nutrition policies and guidelines within the unit.

Each tertiary unit should have full-time neonatal dietitians, who should also provide support to other referring hospitals within the network or group. The recommended staffing ratios are: 0.05-0.1WTE senior dietitian for each intensive care cot; 0.025-0.05WTE for each high dependency cot; and 0.017-0.033WTE for each special care cot. A staffing survey undertaken in 2013 (some data updated in 2015) highlighted the deficits in dietetic staffing nationally (see Appendix 3). Many units do not have access to dietetic services, and where resources exist they are far below that recommended with an average of 0.01WTE per cot.

8.3 Neonatal Pharmacist

A full-time pharmacist with appropriate experience (i.e. Chief II or clinical specialist grade) is essential for tertiary neonatal services. The role of the pharmacist encompasses:

- Development and implementation of medication strategies within neonatology
- Development and assurance of cost-effective clinical pathways
- Ensuring the safe use of medicines in neonatal units through dedicated, innovative and population-specific medication safety initiatives
- Prescription monitoring, incorporating prevention of prescribing errors, administration of complex intravenous medications, and documentation of adverse drug reactions
- Ordering and monitoring of parenteral nutrition
- Provision of information about existing and new pharmaceutical therapies
- Education of other healthcare professionals and parents

In the future, with the introduction of the Maternal-Newborn Clinical Management System, pharmacy resources will be essential for the appropriate execution of medication safety strategies such as e-prescribing, smartpump technology, barcoding and standardisation of medication use in newborns nationally.

8.4 Neonatal Physiotherapist

While respiratory and neurodevelopmental physiotherapy assessments and interventions have always been part of NICU care, improved survival rates in pre-term infants, the advent of new therapies, and the need to measure and improve longer-term outcomes have led to further specialisation and a focus on quality of care provided in the NICU. These highly vulnerable infants are at high risk of developmental sequelae. Neonatal physiotherapists are involved in assessing and identifying infants at risk of developmental morbidity, with early intervention in the NICU and follow-up both during and after the infant's discharge to home.

With increased survival of premature infants, morbidity has increased. An extremely premature infant's brain is not sufficiently developed to withstand the environment in which they find themselves, and complications can occur. As many developmental difficulties do not manifest in initial months, it is imperative that a physiotherapist in the appropriate setting is involved in the neurodevelopmental follow-up of this 'at risk' cohort. They can assess, advise, provide intervention, or refer onwards in a timely manner. National integrated care pathways can ensure that infants receive the most appropriate follow-up, by staff with the appropriate expertise, in a setting as close to home as possible. Many children will require ongoing physiotherapy input following discharge from the neonatal unit.

Paediatric physiotherapists working in a tertiary neonatal unit should be at minimum senior grade, with a special interest in neonatology and relevant clinical experience. A physiotherapist leading the physiotherapy service in a level 3 NICU should be at clinical specialist grade, and in a level 2 NICU should be at senior grade. Paediatric physiotherapists providing a service to a level 1 neonatal unit should also be at senior grade. Post-graduate training for neonatal physiotherapists is recommended in the following areas:

- Family-centred developmental care (NIDCAP or other)
- Behavioural sciences and neurobehavioural assessment (NBAS, NBO)
- Neurodevelopmental or Bobath training
- Physiotherapy-specific assessment tools and interventions
 - Lacy assessment of pre-term infants (LAPI); a validated outcome measure, demonstrated to have better predictive abilities than cranial ultrasound imaging for predicting cerebral palsy rates in this population, and identifying neonates requiring monitoring or early intervention
 - Test of infant motor performance (TIMP); a validated and reliable infant assessment and intervention tool
 - Alberta infant motor scale (AIMS); developmental assessment of motor performance
- Pretchl's method of qualitative assessment of general movement
- Bayley's developmental assessment profile
- Peabody developmental motor scales

8.5 Neonatal Medical Social Worker

The role of the medical social worker in neonatology is to provide emotional and practical support to parents who have found themselves in unfamiliar surroundings, faced with a myriad of issues and decisions relating to their child. The medical social worker will support them through the hospital admission and help to organise the practical supports needed post-discharge. They will also work with families whose situation is compounded by other social difficulties such as addiction, or child protection issues. Follow-up bereavement support and counselling is provided. Social work in neonatology also extends to the families of the well infants in neonatal and maternity units, including perinatal mental health, child protection, and adjustment to parenthood.

8.6 Neonatal Occupational Therapist

Occupational therapy is an underdeveloped area of practice in Irish neonatal units. The main goal of occupational therapy intervention in the NICU is to assess and treat any disability or developmental variability which may be present. The occupational therapist will treat the infant, and also support the family, in terms of positioning, equipment, sensory stimulation, feeding, education, and discharge planning.

Occupational therapy staff working in neonatology should be at senior grade (for level 1 or 2 NICU) or clinical specialist grade (for level 3 NICU), and gain additional postgraduate training and expertise in neonatology. Competencies for occupational therapists working in Irish neonatal units need to be developed in accordance with best practice. Staff should adhere to these competence standards and maintain continuous professional development.

8.7 Neonatal Speech & Language Therapist

Optimal feeding is of fundamental importance in the care of high risk infants. The role of the neonatal speech and language therapist includes the assessment and management of infant feeding issues. Problems encountered in large neonatal units include oral motor dysfunction, risk of choking, inhalation of milk feeds, and inability to take adequate volumes. All tertiary neonatal units should have a speech and language therapist competent in the assessment and management of infant feeding difficulties, including impaired swallowing. Speech and language therapists collaborate with both parents and multidisciplinary team members to provide appropriate education.

8.8 Neonatal Clinical Psychologist

The neonatal clinical psychologist has a number of roles, including the provision of support to families and assessment/intervention in perinatal mental health. They can also foster a good attachment between parents and infants. Preterm infants are more likely to develop long-term neurodevelopmental difficulties, and clinical psychologists are trained in cognitive assessment throughout childhood. A variety of scales may be used, including the Bayley's developmental assessment profile in infancy, and progressing to standardised measures of cognitive and academic ability throughout childhood. Clinical psychologists have a role in supporting parents during a child's palliation and following bereavement. They also provide support, education and training to other neonatal multidisciplinary team members.

8.9 Clinical Engineers

Clinical engineers maintain the vast amount of equipment required in neonatal intensive care units. Equipment requiring constant maintenance includes: ventilators, incubators, cardio-respiratory and oxygen monitors, syringe drivers, ultrasound machines, therapeutic cooling, and EEG monitors. The workload is substantial as equipment malfunction rates are approximately 10% per month. Transport incubators and ventilators are increasingly contributing to the workload of clinical engineers as the service develops.

9. Model of Care

The primary aim of this model of care is to describe the services that should be provided at each level of neonatal unit nationally to inform future service planning and developments, and to eliminate duplication and fragmentation of services.

9.1 Neonatal Services in a Level 1 (Local) Unit

A local level 1 hospital should provide routine neonatal care to term infants, as follows:

- The unit should be staffed by consultant general paediatricians who undertake routine newborn care as part of their duties and on-call roster
- The unit should provide 24/7 cover to the labour ward and operative deliveries
- There must be established arrangements for prompt, safe and effective resuscitation of babies after birth
- The unit should provide routine and special care to infants ≥ 32 weeks gestation onwards. *Infants of 30-31 weeks gestation can be cared for in Level 1 units if the appropriate staffing complement is available, i.e. 1:2 high dependency nursing ratios, middle grade and consultant staff.*
- Infants ≤ 32 weeks gestation should usually be transferred to a regional or tertiary unit, preferably in-utero – if this is not possible the infant will be transferred after birth by the NNTP if possible
- Routine care comprises the newborn examination and management of common conditions such as neonatal jaundice
- Special care should care for infants who are borderline pre-term and require tube feeding, and manage term infants with transient tachypnoea of the newborn
- Incubator care, monitoring of vital signs, blood pressure and blood gases, venous access, portable x-ray service, and short term ventilation for stabilisation prior to the arrival of the NNTP should all be available
- The unit should accept retro-transfers from tertiary units when the baby is off CPAP, tolerating feeds and off parenteral nutrition, and usually greater than 1500g in weight
- There should be access to health and social care professional (HSCP) services – dietetics, pharmacy, physiotherapy, social work, speech and language therapy and occupational therapy

9.2 Neonatal Services in a Level 2 (Regional) Unit

Regional neonatal units provide high dependency and short-term ventilation care services. There are four regional units undertaking initial neonatal intensive care – Limerick, Galway Waterford and Drogheda. At present there is little uniformity or national planning on the role and function regional units. In the UK, level 2 units would provide limited intensive care with infants < 28 weeks transferred to a tertiary centre. In the case of level 2 units in Ireland, it has been proposed by some groups that the cut-off could be reduced to infants < 27 weeks gestation. If this is a unit's practice it is important that it can provide the necessary 1:1 neonatal cover, middle grade medical staff, and consultants with appropriate experience and training in neonatology. The roles of a level 2 unit should be as follows:

- The unit should be staffed by a combination of neonatologists and paediatricians with a special interest in neonatology, and have both senior house officer and middle grade registrar NCHDs
- There should be a separate on call neonatology roster
- The unit should provide short-term ventilation support and CPAP
- Infants ≤ 27 weeks and infants requiring therapeutic cooling should be transferred to a tertiary unit
- The unit will typically have < 50 BW < 1500 g infants per year
- There should be organised retro-transfer services with the tertiary units
- The unit should provide parenteral nutrition
- There should be a neonatal nurse complement of 30-35WTE, and neonatal nurses should have appropriate qualifications
- There should be dedicated HSCP services – dietetics, pharmacy, physiotherapy, social work, speech and language therapy and occupational therapy
- Radiology services should be provided by radiologists with an interest in paediatric radiology
- Infants of birth weight (BW) < 1500 g should be enrolled in the Vermont-Oxford collaborative
- There should be a neurodevelopmental follow up programme for infants BW < 1500 g, including a Bayley's developmental assessment profile and early intervention HSCP assessment following discharge to ensure timely intervention received
- Regional units should produce an annual clinical report

9.3 Neonatal Services in a Level 3 (Tertiary) Unit

The primary function of tertiary neonatal units is to provide specialised care to infants who are critically unwell. Most of the workload is concentrated on very preterm infants, unwell term infants, and infants with major congenital malformation. Tertiary care is about the activity, not the place. It is a facility where healthcare professionals have the necessary knowledge, training and experience to deliver intensive care to small infants. Neonatal intensive care requires a high level of attention to detail and the accurate recording of a large bank of physiological data about each infant.

Good teamwork is essential, emergencies will occur frequently and doctors and nurses must be able to respond quickly and decisively. There must be a culture of teaching and training, situation awareness and valuing staff. The turnover in tertiary NICUs is high, ranging from 100% for NCHDs to approximately 10% for nursing and HSCPs, and units must be proactive in recognising and addressing this as succession planning, and upskilling new staff will be a constant challenge.

Level 3 units should meet the following criteria:

- The unit should be able to provide the full spectrum of specialised care to critically ill pre-term and term newborn infants
- There should be sufficient clinical throughput to maintain clinical skills and expertise, with a minimum of 100 infants BW < 1500 g and/or 100 infants requiring assisted ventilation / CPAP
- There should be availability of all modes of ventilation including nitric oxide

- The unit should be able to provide therapeutic cooling
- The unit should provide parenteral nutrition
- The unit should be staffed by professionals with the necessary neonatal knowledge, training and experience to undertake complex newborn care, with all professionals clear about their role
- There must be consultant neonatologist daily presence and on-call cover 24/7, and a separate neonatal on-call roster
- There should be two grades of trainee neonatal staff at registrar and SHO level in either SpR or BST training schemes
- The unit should be staffed by skilled neonatal nurses, and it is recommended that at least 70% of nurses should have a neonatal qualification
- There should be daily paediatric radiology services, with out of hours cover for emergencies
- There should be consultant microbiologist support with ward round attendance
- The unit should be staffed by HSCPs with an interest in neonatology, including clinical psychology, dietetics, pharmacy, physiotherapy, social work, speech and language therapy, occupational therapy, and radiographers trained in paediatric diagnostic imaging
- Clinical engineers should be available daily and out of hours
- There should be high quality data collection on short- and long-term neonatal outcomes, and units should be members of the Vermont-Oxford collaborative with high quality neurodevelopmental follow-up including a Bayley's developmental assessment profile and early intervention HSCP assessment following discharge to ensure timely intervention received
- There should be a standardised approach to care and treatment with algorithms and guidelines available for common neonatal conditions

Tertiary centres must coordinate the retinopathy of prematurity (ROP) screening service. Most infants requiring ROP screening will be cared for in tertiary centres. If an infant is transferred to a local or regional unit, or to a paediatric intensive care unit, it is imperative that arrangements for screening are in place. ROP screening can be difficult to coordinate operationally; a recent UK study found that 37.7% of infants were not screened within the optimal time frame.

9.4 Neonatology Services in the New Children's Hospital

When the new children's hospital opens, the existing surgical and medical neonatal services at Crumlin and Temple Street will be moved and combined under a new single structure. The new clinical entity will be an 18-bed NICU, which will provide intensive care and high dependency care to newborn infants. The NICU will be staffed by consultant neonatologists, neonatal nurses, and paediatric NCHDs. The casemix that will be cared for in this NICU will comprise infants requiring surgery or complex medical care. This new neonatal service will provide both the pre-operative intensive care, and the post-operative management, of the surgical newborn. It will deliver intensive care and high dependency care support to newborns transferred to the new children's hospital for subspecialist care such as those infants with neurological and renal problems.

This new neonatal service differs from the existing structures at Crumlin and Temple Street. At present, newborns undergoing intensive care are managed by PICU consultants with neonatologists providing consultative input and support. In the new governance structure, the neonatologists will provide the intensive care. The complexity of service being provided will necessitate that it is mainly undertaken by senior decision makers. It has been calculated that a complement of 12WTE consultant neonatologists will be required. The second core group will be advanced neonatal nurse practitioners. The NCHD complement will need to be advanced trainees such as neonatal fellows and SpRs. The staffing structures cannot be rapidly put in place. It is imperative that consultant appointments and ANNPs are implemented in the 'run up' 4-year period before the new children's hospital opens. In the first phase, it is proposed that an additional 4WTE consultant neonatologists are appointed, two at Crumlin and two at Temple Street. The majority of sessions (7 sessions) of these posts will be at the tertiary paediatric hospitals, with some sessions (4 sessions per post) linked to the maternity hospitals.

9.5 Integrated Neonatology Service Pathways

Neonatal services are currently based around individual hospitals, and mostly practice independently of each other. This is understandable given that governance, funding and staffing levels have to date been determined by the respective hospital. The NCPPN advocates for the needs of neonatal services to be considered nationally, however there has been some concern expressed that collective approaches to neonatal care will affect individual hospitals' funding. However, the opposite is more likely with greater impact and improved results in terms of funding and manpower.

The National Neonatal Transport Programme (NNTP) has been the primary integration activity up until now. This single national service transfers babies from all units and operates across three sites:

- National Maternity Hospital Holles Street
- Rotunda Hospital
- Coombe Women and Infants University Hospital

Staff in each hospital provide the service on a weekly rotation. The appointment of a consultant neonatologist has further strengthened integration as he works across the three units in Dublin, and with all units outside of Dublin.

The recently developed hospital groups provide a new opportunity for integration between units, with units working together cohesively within their group managed by a senior management team and group chief executive officer. It is envisaged that this will maximise the amount of care delivered locally, while ensuring complex care is safely provided in larger units. Clinical services, education, teaching and training should be more closely integrated. Patients should flow through the system based on complexity and the needs of the mother or baby. The new networks should focus on patient services, rather than buildings or individual institutions, avoid fragmentation and duplication, and improve access to expert care. It should enable the development of enduring relationships with all stakeholders, and should focus on clinical needs and be responsive to new or emerging issues.

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Hospital groups are not, however, equal in terms of size and activity. The number of births ranges from approximately 17,000 annually in Ireland East to approximately 5,000 in University of Limerick Hospitals. The six groups will not be able to operate as independent perinatal centres. There are four groups currently operating as perinatal and neonatal centres: Ireland East, RCSI Hospitals, Dublin Midlands, and South-South West. The Saolta Group is next closest to recognition as a perinatal centre; however there is no tertiary neonatal unit within this configuration and activity is spread over a wide geographic area. In Limerick, there is a single regional unit with approximately 5,000 births.

Hospital Group	Local Unit	Regional Unit	Tertiary Unit
RCSI Hospitals (Dublin North East) <i>14,892 births</i>	Cavan	Drogheda	Rotunda
Dublin Midlands <i>11,099 births</i>	Portlaoise	<i>None</i>	Coombe
Ireland East <i>17,067 births</i>	Mullingar Kilkenny Wexford	<i>None</i>	Holles Street
South – South West <i>14,401 births</i>	Clonmel Tralee	Waterford	Cork
UL Hospitals <i>5,167 births</i>	<i>None</i>	Limerick	<i>None</i>
Saolta <i>9,230 births</i>	Ballinasloe Castlebar Sligo Letterkenny	Galway	<i>None</i>

Table 11: Neonatal Service Configuration in Hospital Groups and Annual Births

The new hospital groups will require sustainable funding, good governance structures and a new partnership between management and healthcare professionals. Networks are more cost-effective and easier to administrate when the hospitals are in close proximity and the volume is high. As it will not be feasible to physically amalgamate hospitals, it is essential that services such as neonatology are integrated across the group, such as the network in the North East between the Rotunda, Drogheda and Cavan neonatal units. Each unit must be clear about the services they are expected to provide, and be appropriately equipped and staffed to undertake their work. As obstetrics and neonatology are closely linked, there will need to be common solutions.

The expansion of the neonatal unit in Galway should be considered. This would involve the immediate appointment of two paediatricians with a special interest in neonatology to increase the consultant staffing complement to 4WTE. A separate neonatal on-call roster will also be required if Galway is to be recognised as a level 2 regional unit. If Galway is to become a designated tertiary neonatal centre, a workload of >100 infants BW of <1500g each year would be required. If all very low birth weight infants in the region were managed in Galway, this would equate to approximately 90 cases per year. While Limerick has already established a separate neonatal consultant roster, the next challenge is to address the geographically isolated position. There are no other neonatal units within this

group, therefore alliances will be required with Galway, Cork or Dublin based on what services and support structures need to be developed.

9.6 Baby and Family Experience

All neonatal units should be responsive to concerns raised by parents about the care of their infants. Patient satisfaction surveys should be regularly undertaken. The Bliss Baby Charter Audit Tool may be useful to provide a framework for units to examine key aspects of service provision and embed family-centred care. Good communication is essential. Information should be provided on the unit and the services provided. Individual discharge plans should be place for all infants, detailing diagnosis, current medication, positioning and sensory requirements, results of investigations, planned tests, outpatient follow-up, and emergency contact details.

10. Special Considerations in Neonatology

10.1 Neonatal Resuscitation

Resuscitation is an essential function of units providing acute neonatal services, and must be available at very short notice 24/7. The quality of procedures in neonatal resuscitation is being subjected to greater scrutiny, therefore a need exists for a coordinated and standardised approach nationally. All units should undertake frequent drills using mannequins. The key points are:

- Situation awareness
- Concise documentation

Situation awareness refers to *knowing what is going on so as that the best decisions can be made*, and ensures everybody at the resuscitation has a clearly defined role. Documentation should be the specific task of one individual. The accurate timing of every intervention and medication administered is essential. At the end of the resuscitation, the team must complete and sign one agreed record of the event. The NCPPN intend to explore how neonatal resuscitation can be simplified, standardised and improved across all units.

10.2 Therapeutic Hypothermia

Therapeutic hypothermia is now accepted as the treatment of choice in the management of infants suffering from neonatal encephalopathy. Neonatal encephalopathy is a condition encountered in term infants who suffer from oxygen deprivation during labour or delivery. The incidence of the disorder is 1-2 per 1000 births, both in Ireland and internationally. The usual presentation is poor respiratory condition at birth, acidosis, abnormal neurological behavior, and seizures. The condition is associated with an increased risk of death or disability. Studies have shown improved neurological outcomes with therapeutic hypothermia, including reduced risk of cerebral palsy or disability.

The commencement of therapeutic hypothermia is time critical and must be initiated within six hours of birth. The treatment consists of total body cooling at 33.5°C for 72 hours, followed by gradual rewarming. The therapy is complex and should only be undertaken in tertiary neonatal units. When an infant is born in a local or regional unit with neonatal encephalopathy, passive cooling should be commenced. The NNTP should be contacted and the infant transferred to a tertiary neonatal unit for active cooling. The NNTP has a *Candidacy Checklist for Therapeutic Neonatal Hypothermia (Cooling)* on its website www.nntp.ie, which provides guidance on which babies meet the criteria for this treatment.

10.3 Neurodevelopmental Assessment and Follow-up

With increasing survival of preterm infants, developmental assessment at 2 years should be an integral part of follow-up care in neonatology as the risk of neurodevelopmental impairment is high. Infants with neonatal encephalopathy should also be assessed. Age two is the critical transition period in cognitive development, during which skills in symbolic function, language development and early concept formation change. Extremely low body weight children have a high prevalence of impairment in visuospatial, perceptuomotor, attention-executive and gross motor function at early school age. These children are 3-10 times more likely to require assistance at school. Identifying and managing these issues at an early age is therefore important to help facilitate optimum long-term outcomes.

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The Bayley III is accepted as a good assessment tool for this purpose, providing clinically useful information. It can identify children with specific developmental delay or global delay, as well as children with normal outcome demonstrating early signs of poor attention skills, poor auditory processing or sensory integration skills, and poor motor planning / coordination skills. All of these factors are relevant in terms of poor classroom performance. The process of administering the scale alone generates very valuable information about a child’s learning potential. A survey undertaken by the Programme highlighted that only 4 units perform assessments on infants BW <1500g at 2 years corrected age (see table 12). It is recommended that each hospital group undertake this assessment in all infants BW <1500g, and that resources are pooled to provide a service between local, regional and tertiary units where appropriate.

Hospital Group	Hospital	Bayley III Assessment at 2 years	Assessor
RCSI Hospitals	Rotunda	Yes	Paediatrician
	Drogheda	No	-
	Cavan	Yes, but Griffiths	Paediatrician
Ireland East	Holles Street	Yes	Psychologist
	Mullingar	No	-
	Kilkenny	No	-
	Wexford	No	-
Dublin Midlands	Coombe	Yes, at 18 months, CGA	Paediatrician
	Portlaoise	No	
South-South West	Cork	Yes	Occupational Therapist
	Waterford	No	-
	Clonmel	No	-
	Tralee	No	-
UL Hospitals	Limerick*	No	-
Saolta	Galway	No	-
	Ballinasloe	No	-
	Castlebar**	No	-
	Sligo	Yes	Psychologist
	Letterkenny	No	-

Table 12: Units Undertaking Bayley III Assessment at 2 years

* The *Bright Horizons* clinic is a joint initiative between the neonatal service at Limerick University Maternity Hospital and HSE Disability Services in the region for infants BW <1500g and term infants with hypoxic encephalopathy. The programme optimises involvement of the multidisciplinary early intervention team approach up to corrected age 24 months. A Bayley III assessment is performed, along with other developmental tools as appropriate including the ‘Ages and Stages’ questionnaire and the Alberta Infant Motor Scale.

** Mayo Early Intervention Services run a comprehensive multidisciplinary *Premature Baby Pathway* for infants born ≤30 weeks gestation or <1000g:

- A physiotherapist completes the fine and gross motor sections of the Bayley III assessment
- An occupational therapist completes the relevant sections of the Carolina Curriculum
- A speech and language therapist completes the Reynell Developmental Language Scales or other communication assessment where relevant
- A psychologist performs the cognitive section of the Bayley III at around 3.5 years of age before discharge from the programme

These assessments are an important service for children and their families. The outcome reports are sent to the consultant paediatrician and, where necessary, to the relevant Early Intervention Services. Unfortunately, the required HSCP services can be limited in the community or have lengthy waiting lists, and this is inconsistent around the country. It is important that preterm infants and children can access these services if required. Parental education should be addressed nationally through these programmes. Early play and developmental activities can influence a child's development. When infants are discharged from the NICU, it should be emphasised to parents the importance of this intervention and stimulation in their child's development. The assessment experience also serves to educate parents, providing insight into the range of developmental activities that may benefit their child thus strengthening potential.

10.4 Parenteral Nutrition

The availability of parenteral nutrition (PN) to sustain growth in neonates who are unable to feed, or have severe functional intestinal immaturity, represents one of the most important therapeutic advances in paediatrics over the last four decades. In order to safely provide PN, structures and processes need to be in place that ensure assessment of the infant's nutritional requirements, appropriate constitution and compounding of the PN, safe intravenous access (with meticulous aseptic insertion technique and subsequent catheter care) and rigorous monitoring of the infant's electrolytes and response to treatment. Units caring for pre-term infants must be capable of safely and effectively providing PN until enteral feeding can be established. The NCPPN have commenced work, via a multidisciplinary PN committee, on a standardised national guideline for PN in neonates and paediatrics.

10.5 Extracorporeal Membrane Oxygenation (ECMO)

Extracorporeal membrane oxygenation (ECMO) is a life support in which venous blood is oxygenated outside the body and returned to the patient. The oxygen and carbon dioxide gas exchange is performed using an oxygenator. It is a highly technical procedure requiring a team of skilled doctors, nurses, and technicians. In 1996, a UK collaborative randomised controlled trial of neonatal ECMO showed a clear benefit of ECMO compared with conventional management of respiratory failure in infants $OI > 40$. The study reported one additional survivor for every 3 or 4 infants allocated to ECMO treatment. The Extracorporeal Life Support Organisation (ELSO) has documented 55,668 ECMO cases (July 2013), with over half in newborns.

The clinical indications for ECMO treatment in newborn infants are intractable respiratory failure due meconium aspiration syndrome (MAS), persistent pulmonary hypertension of

the newborn (PPHN), sepsis, and congenital diaphragmatic hernia. The overall survival rate for infants receiving ECMO therapy is in the range 65 – 75%.

The number of newborn infants receiving ECMO in Ireland is approximately 5 cases annually. A previous study reported 11 neonatal ECMO cases over a 30 months period. When Irish infants require ECMO, they are transferred to the Astrid Lindgren Children's Hospital, Karolinska University, Stockholm, Sweden. The transport of these infants from Ireland to Sweden is undertaken by the Swedish ECMO team. The mean time between the ECMO team being called and their arrival in Ireland is 8 hours. ECMO is commenced within 2 hours in the local NICU and the infant is then transferred to Stockholm for continued ECMO treatment. The mean duration of ECMO therapy is 5 days. The average cost of ECMO treatment per individual infant is €133,000, consisting of €25,000 for transport and €108,000 for the ECMO services at the Karolinska centre.

There have been a number of suggestions and proposals that a respiratory ECMO service should be established in Ireland. In order to establish an ECMO service, considerations include the recruitment of a team with the required skills, the necessary technology, and a sufficient throughput of cases for maintenance of skills, and the costs. The cardiac surgery unit at Crumlin hospital currently provides cardiac ECMO but not respiratory ECMO. It is suggested that this unit could expand its services and include respiratory ECMO. It has also been proposed that if respiratory ECMO was established, its services could be extended to infants and children from the north of Ireland.

The development of the model of care for Neonatology, and the plans for the new children's hospital both provide a new opportunity to consider the establishment of ECMO services in Ireland for newborns and older children. It would be helpful if a record of all the infants and children sent for ECMO was maintained. We suggest that a working group be established to explore the feasibility of a paediatric ECMO service in Ireland.

11. Staffing Resources

The international trend is towards delivery of obstetric and neonatal services in larger centres. This provides higher quality care and increases patient satisfaction. There are currently nineteen units in Ireland providing neonatal services. The establishment of hospital groups will facilitate units working more closely together. Staffing requirements should be standardised nationally. Some local units will need to consider how best to function in providing obstetric and neonatal services to their local population, as it may not be possible to adequately staff all 19 units to a high, internationally comparable standard.

Challenges in recruitment of NCHDs in smaller units are not sustainable into the future, and in addition compliance with EWTD can add to these staffing pressures. ANNP roles, and increases in consultant-delivered services can help to address these issues and reduce dependency on NCHDs. Senior staff will be available to provide leadership, make decisions and deliver more direct patient care.

11.1 Tertiary Neonatal Units

The number of consultant neonatologists in all four tertiary units is insufficient to meet current service demands. Each unit should have at least 7 neonatologists. Table 6 detailed the current and proposed staffing levels for the four tertiary neonatal intensive care units. Expansion of consultant neonatologist numbers requires a change in approach by the HSE and Department of Health. In the last four years, there have been only three additional new consultant neonatologists appointed, with one through the National Neonatal Transport Programme not Acute Hospitals. At the current rate, it would take twelve years to obtain the additional ten new consultants that are needed.

Consultant Appointments	Number
Replacement neonatologist post	3
New neonatologist post	4
Replacement paediatrician post	20
New paediatrician post	11

Table 13: Consultant Appointments Approved Dec 2009-Dec 2014




NCHD numbers have increased to achieve European Working Time Directive compliance. Funding is required for 4 neonatal fellows who will undertake training to complete the new Certificate of Completion of Specialist Training (CCST) in Neonatology. These experienced trainees will add considerably to clinical care standards. An increase in nursing complement is required in line with the recommended ratios for intensive and high dependency care. The extended role of the neonatal nurse should be actively promoted in areas such as venepuncture, cannulae insertion and nurse prescribing. The number of advanced neonatal nurse practitioners should be increased. HSCPs have been under-resourced in Irish neonatal units, and are essential when caring for critically ill newborn infants.

Tertiary neonatal care, similar to other intensive care services, experiences peaks and troughs in workload. The delivery of multiple pre-term births such as twins or triplets can cause a rapid increase in activity. Neonatal units should be staffed for 80% occupancy. Connectivity and good communication are important when faced with a peak in neonatal

intensive care activity, as cases may need to be transferred from an overburdened unit to one of the other tertiary units.

11.2 Tertiary Paediatric Hospitals

There are currently 113 consultant neonatologist sessions in the three Dublin maternity hospitals, and 28 in the paediatric hospitals (2.7WTE). The three paediatric hospitals have been brought together in a new single governance structure within the Children’s Hospital Group, which presents an opportunity to review neonatal services. A new integrated neonatal service across the three tertiary neonatal units in Dublin and the service in Crumlin and Temple Street.

Maternity Hospital Sessions		Paediatric Hospital Sessions
Holles Street: 6 neonatologists (54 sessions)		3 neonatologists attached to Temple Street (6 sessions) 3 neonatologists attached to Crumlin (6 sessions)
Rotunda: 5 neonatologists (43 sessions)		4 neonatologists attached to Temple Street (8 sessions) 1 neonatologist attached to Crumlin (2 sessions)
Coombe: 4 neonatologists (34 sessions)		4 neonatologists attached to Crumlin (10 sessions)

In an initial attempt to improve neonatal services in Crumlin and Temple Street, an additional 2WTE consultant neonatologists should be appointed to both hospitals. There should be full time daily consultant neonatologist presence in both Crumlin and Temple Street. It may be an option for consultants to rotate from the maternity hospitals for one month at a time. This would substantially improve the care provided to infants in these hospitals, improve governance through greater medical supervision and audit of clinical outcomes, improve communication with families and other multidisciplinary team members, and greater collaboration with local hospitals regarding complex discharge plans.

There will be a knock on effect of increasing neonatal activity in the children’s hospitals on nursing and health and social care professional workload which will need to be addressed. There are no dedicated neonatal health and social care professionals in the paediatric hospitals.

11.3 Paediatric Radiology

Outside the four tertiary neonatal units, paediatric radiology services are under-resourced. The paediatric radiologist is a priority support service requirement for any unit looking after newborn infants. Expansion and development of national paediatric radiology services must be addressed urgently, otherwise infants will have to continue to travel to Dublin for investigations that should be provided locally.

12. Education, Training and Research

12.1 Education and Training

All units should have a culture of teaching and training, allowing staff to ask questions and contribute to the learning of all multidisciplinary team members. Training may be within their daily work, via group teaching sessions, case presentations, guideline reviews or journal clubs, or through personal development activities.

12.2 Neonatology as a Separate Specialty

The recognition of Neonatology as a separate specialty on the Medical Council register is at an advanced stage. Extensive negotiation has taken place between the Faculty of Paediatrics, RCPI and the Medical Council. In principle this has been accepted by the Medical Council. The remaining issue is to obtain sign-off from the RCPI for the curriculum of training required for the certificate of completion of specialist training (CCST) in neonatology. The sequence of specialist registrar training will be as follows:

- 1st year - Neonatology
- 2nd year - General Paediatrics
- 3rd, 4th, 5th years – Neonatology, rotating through the four tertiary neonatal units (Hollis Street, Coombe, Rotunda, Cork) and the two PICUs (Crumlin, Temple Street).

After five years, the trainee will receive the CCST in Neonatology. If the trainee also wishes to be on the General Paediatrics register, a further one year's training in general paediatrics will be required. It is hoped to commence the neonatal fellowship programme in July 2016, with the recruitment of 3-4 neonatal fellows.

12.3 Research

Clinical research has played an important role in the advancement of neonatology, with Irish units contributing significantly to the international literature over the last decade. The concentration of births in the large centres has been an enabler for local and international studies. There have been encouraging developments with Irish randomised controlled trials, and the establishment of laboratory-based neonatal research at the Conway Institute in University College Dublin. Outside Dublin, a strong neonatal research programme has been developed in Cork with areas of special interest in neonatal EEG studies, randomised controlled trials and perinatal data analysis. There have also been a number of important obstetric-neonatal collaborations. The challenge is to make neonatal research sustainable into the future, which is dependent on adequate funding and development of a culture of participating in research activities within all units.

13. Governance

Governance has emerged as an essential component in the delivery of high quality tertiary neonatal care. Clinical governance structures for neonatal services are 'nested' in the clinical governance structure of each hospital, and the relevant hospital group. Good governance is based on constant assessment of the unit's infrastructure, manpower and staff morale, knowledge of short- and long-term neonatal outcomes through good metrics, analysis of all neonatal deaths through monthly perinatal mortality meetings, benchmarking nationally and internationally, and standardised algorithms, protocols and guidelines. While much of this is already occurring in tertiary units, there should be agreed national standards implemented in all units. Neonatology is a specialty with a high procedural component, which necessitates frequent revision of technical skills. All units should have a '*skills and drills*' programme with a medical director and a nursing director. Units should have regular, minuted departmental meetings and publish annual reports. Issues raised at departmental level should include manpower and staffing issues, unit activity statistics, infection rates, equipment, training and development, and audit and research. Deficiencies or concerns should be channelled to the appropriate hospital executive for further action. Additional funding and support should be made available to any unit experiencing difficulties in meeting the set criteria for the level of care provided.

14. Programme Metrics and Evaluation

There are four categories of performance indicators in neonatology:

- Unit infrastructure
 - Does the unit have the required facilities to operate effectively, e.g. adequate space between cots, handwashing facilities, private area for parents receiving information on their child's condition?
- Staffing
 - Does the unit meet the recommended nurse to baby ratios for special care, high dependency care and intensive care?
 - Does the unit have the required multidisciplinary team resources to undertake its activities?
- Processes
 - How is the unit performing in terms of operations against agreed standards, clinical guidelines, care pathways/algorithms and benchmarks?
 - Clinical activity statistics should also be measured, including admissions, transfers in/out, interventions (parenteral nutrition, CPAP, ventilation etc.), and length of stay.
- Outcomes
 - These relate broadly to mortality and morbidity.
 - Useful measures of morbidity in neonatology include:

Preterm Infants	Term Infants
Late onset sepsis	Breastfeeding rates on discharge
Pneumothorax	Readmission with dehydration and weight loss
Extreme length of stay	Proportion of newborn metabolic screens that need to be repeated due to inadequate sample size
Intraventricular haemorrhage	
Periventricular leucomalacia	
Necrotising enterocolitis	

- Infection rates should also be measured.
- All units should contribute to the Vermont Oxford Network (VON) collaboration in order to record outcomes in infants BW <1500g and benchmark performance. Parameters include mortality, infection, necrotising enterocolitis, retinopathy of prematurity, and chronic lung disease of infancy. Currently, all 19 neonatal units are reporting to VON with the fees paid centrally for all hospitals by the National Paediatric Epidemiology Unit.

15. Appendices

15.1 Appendix 1 Neonatal Nurse Staffing and Qualifications

Hospital	Total WTE	No. of RGN	No. of RM	No. of RCN	No. of ANNP	No. with Diploma
Ballinasloe	11.5	14	8	5	0	11
Castlebar	16	19	16	4	0	11
Cavan	12.5	2	3.51	5.76	0	6
Clonmel	8.6	-	0	4	0	6
Coombe	78.8	76	36	8	1	60
Cork	69.49	81	61	20	0	32
Drogheda	33	28	19	6	1	12
Galway	24	3	24	4	1	24
Kilkenny	8.49	9	3	5	0	6
Letterkenny	14.5	17	9	6	0	7
Limerick	33.73	42	40	6	0	23
Mullingar	9.67	9	1	6	0	4
NMH Holles Street	67	68	15	6	1	28
Portlaoise	16.16	14	2	9	0	4
Rotunda	67.3	47	12.46	11.83	2	34.5
Sligo	13.5	9	0	6	0	8
Tralee	13.54	3	2	7	0	4
Waterford	32	13	7	6	0	11
Wexford	9	13	3	5	0	5.1
Totals:	539.7					296.6 (55%)

15.2 Appendix 2 Neonatal Nursing Postgraduate Courses

Postgraduate Diploma in Neonatal Intensive Care Nursing

In 2001, a higher diploma course replaced the certificate in neonatal nursing, which was renamed in 2006 as a postgraduate diploma course. This programme is regulated under the statutory requirements of the Nursing and Midwifery Board of Ireland (NMBI) and the National University of Ireland. The course is delivered in partnership with the RCSI, Coombe Women and Infants University Hospital, Rotunda Hospital and the National Maternity Hospital Holles Street. Staff from units in Limerick, Galway, Drogheda and Waterford have accessed the programme. It provides intensive theoretical and competency-based training for neonatal nurses and, as a national programme, it provides an important benchmark for standards of care and the development of expanded and specialist nursing roles. To date, 106 nurses have completed, and 21 are currently undertaking, the diploma course.

MSc in Neonatal Nursing

Students that have completed the postgraduate diploma, and who wish to undertake further study, can apply to continue their studies for a second year. On completion of this, they are awarded a masters qualification in this specialised area of practice. To date, 11 neonatal nurses have graduated with MSc in Neonatal Nursing.

Foundation Programme in Neonatal Nursing

Two foundation programmes have been devised to support competency development in nurses recently recruited to both special care and high dependency care. Both programmes have category one accreditation from NMBI with 40 continuing educational units, and are based on a similar format to that provided in the UK. Staff from neonatal units in Dublin, Drogheda, Letterkenny, Sligo, Wexford and Portlaoise have completed this course. In view of the large theoretical content and clinical competence requirements, NMBI have recommended that this course be accredited by a higher education authority and serve as an access point to the postgraduate diploma in neonatal intensive care nursing. However, without funding this cannot be considered. The expansion of the foundation programme to include blended learning is proposed, combining the benefits of elearning (ease of access and time saving) with face-to-face discussion, training and skills validation. There is also a requirement for competency assessment, however clinical learning opportunities are not available in smaller units and as a result are facilitated by the tertiary neonatal units.

Advanced Nurse Practitioner (Neonatology)

The role of advanced neonatal nurse practitioner (ANNP) is increasingly recognised as integral within the multidisciplinary neonatal team. This programme, affiliated to the RCSI, commenced in January 2012 with four neonatal nurses participating from Holles Street, Cork, Galway and Drogheda. Prior to the introduction of this programme, ANNPs completed the educational requirements for this role in Southampton University. The training of ANNPs exists within a masters framework with in-depth knowledge and skills acquisition. Training and assessment should be made available if new roles are deemed appropriate within the ANNP role, e.g. cerebral ultrasound.

15.3 Appendix 3 Dietetic Staffing in Neonatal Units

Hospital Neonatal Unit	Cots	Dietitian Staffing (WTE)	Dietitian Staffing per Cot (WTE)
NMH Holles Street	40	1	0.025
Rotunda	39	1	0.026
Coombe	40	0	0
Cork	37	1	0.027
Galway	20	0.5	0.025
Limerick	19	0	0
Drogheda	16	0	0
Waterford	31	0	0
Ballinasloe	8	0	0
Castlebar	10	0.1	0.01
Cavan	14	0	0
Clonmel	5	0	0
Kilkenny	6	0	0
Letterkenny	8	0	0
Mullingar	5	0	0
Portlaoise	8	0	0
Sligo	10	0.08	0.008
Tralee	10	0	0
Wexford	5	0	0
Total:	331	3.68WTE	1.1WTE per 100 cots

Abbreviations and Acronyms

AIMS	Alberta Infant Motor Scale	LAPI	Lacy Assessment of Preterm Infants
ANNP	Advanced Neonatal Nurse Practitioner	MAS	Meconium Aspiration Syndrome
BAPM	British Association of Perinatal Medicine	NBAS	Neuro-developmental Assessment Scale
BCG	Bacillus Calmette-Guerin	NCHD	Non-consultant Hospital Doctor
BIPAP	Bilevel Positive Airway Pressure	NCPPN	National Clinical Programme for Paediatrics & Neonatology
BW	Birth Weight	NICU	Neonatal Intensive Care Unit
CCST	Certificate of Completion of Specialist Training	NIDCAP	Newborn Individual Development Care and Assessment Programme
CGA	Corrected Gestational Age	NMBI	Nursing and Midwifery Board of Ireland
CNS	Clinical Nurse Specialist	NMH	National Maternity Hospital
CPAP	Continuous Positive Airway Pressure	NNTP	National Neonatal Transport Programme
DDH	Developmental Dysplasia of the Hip	PICC	Peripherally Inserted Central Catheter
ECMO	Extracorporeal Membrane Oxygenation	PN	Parenteral Nutrition
EEG	Electroencephalogram	PPHN	Persistent Pulmonary Hypertension of the Newborn
ELSO	Extracorporeal Life Support Organisation	RCPCH	Royal College of Paediatrics and Child Health
EU	European Union	RCPI	Royal College of Physicians of Ireland
EWTD	European Working Time Directive	ROP	Retinopathy of Prematurity
HHFNC	Humidified High Flow Nasal Cannula	SIPAP	Positive Airway Pressure
HSCP	Health and Social Care Professional	TIMP	Test of Infant Motor Performance
HSE	Health Service Executive	UK	United Kingdom
INMO	Irish Nurses and Midwives Association	VON	Vermont Oxford Network
IPA	Irish Paediatric Association	WTE	Wholetime Equivalent
IPS	Irish Paediatric Society		

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