

# Neonatal intensive-care unit

A **neonatal intensive care unit**, usually shortened **NICU** (sometimes pronounced "Nickyou") and also called a newborn intensive care unit, intensive care nursery (ICN), and special care baby unit (SCBU [pronounced "Skiboo"], especially in Great Britain), or a humidicrib, is a unit of a hospital specializing in the care of ill or premature newborn infants. The NICU is distinct from a special care nursery (SCN) in providing a high level of intensive care to premature infants while the SCN provides specialized care for infants with less severe medical problems.



A newborn infant sleeping in an incubator.

NICUs were developed in the 1950s and 1960s by pediatricians to provide better temperature support, isolation from infection risk, specialized feeding, and greater access to specialized equipment and resources. Infants are cared for in **incubators** or "open warmers." Some low birth weight infants need respiratory support ranging from extra oxygen (by head hood or nasal cannula) to continuous positive airway pressure (CPAP) or mechanical ventilation. Public access is limited, and staff and visitors are required to take precautions to reduce transmission of infection. Nearly all children's hospitals have NICUs, but they can often be found in large general hospitals as well.

A NICU is typically directed by one or more neonatologists and staffed by nurses, nurse practitioners, Nursery Nurses, physician assistants, resident physicians, and respiratory therapists. Many other ancillary services are necessary for a top-level NICU. Other physicians, especially those with "organ-defined" specialties often assist in the care of these infants.

## Equipment

### Incubator

An *incubator* (or *open warmer* or *isolette*<sup>[1]</sup>) is an apparatus used to maintain environmental conditions suitable for a neonate, (newborn baby). It is used in preterm births.

Possible functions of a neonatal incubator are:

- **Oxygenation**, through oxygen supplementation by head hood or nasal cannula, or even continuous positive airway pressure (CPAP) or mechanical ventilation. Infant respiratory distress syndrome is the leading cause of death in preterm infants,<sup>[2]</sup> and the main treatments are CPAP, in addition to administering surfactant and stabilizing the blood sugar, blood salts, and blood pressure.
- **Observation**: Modern neonatal intensive care involves sophisticated measurement of temperature, respiration, cardiac function, oxygenation, and brain activity.
- **Protection** from cold temperature, infection, noise, drafts and excess handling:<sup>[3]</sup> Incubators may be described as bassinets enclosed in plastic, with climate control equipment designed to keep them warm and limit their exposure to germs.
- Provision of **nutrition**, through intravenous catheters
- Administration of **medications**.
- **Maintaining fluid balance** by providing fluid and keeping a high air humidity to prevent a too great loss from skin and respiratory evaporation<sup>[4]</sup>.

A *transport incubator* is an incubator and the most necessary neonatal instruments in a transportable format, and is used when a sick or premature baby is moved, e.g. from one hospital to another, as from a community hospital to a larger medical center with a proper neonatal intensive care unit. It usually has a miniature ventilator,

cardio-respiratory monitor, IV pump, pulse oximeter, and oxygen supply built into its frame. [3]

## Early years

Doctors took an increasing role in childbirth from the eighteenth century onwards. However, the care of newborn babies, sick or well, remained largely in the hands of mothers and midwives. Some baby incubators, similar to those used for hatching chicks, were devised in the late nineteenth century. In the United States these were shown at commercial exhibitions, complete with babies inside, until 1943. It wasn't until after the Second World War that special care baby units (SCBUs) were established in many hospitals. In Britain, early SCBUs opened in Birmingham and Bristol. At Southmead Hospital, Bristol, initial opposition from obstetricians lessened after quadruplets born there in 1948 were successfully cared for in the new unit. More resources became available - the first unit had been set up with £100. Most early units had little equipment and relied on careful nursing and observation.

Incubators were expensive so the whole room often was kept warm instead. Cross-infection between babies was greatly feared. Strict nursing routines involved staff wearing gowns and masks, constant hand washing and minimal handling of babies. Parents were sometimes allowed to watch through the windows of the unit. Much was learned about feeding - frequent, tiny feeds seemed best - and breathing. Oxygen was given freely until the end of the 1950s, when it was shown that the high concentrations reached inside incubators caused some babies to go blind. Monitoring conditions in the incubator, and the baby itself, was to become a major area of research. Although incubators provided oxygen and warmth, science in the 1950s was limited and it was not until later that technology played a larger role in the decline of infant mortality. Even though the elimination of infectious disease was mostly responsible for decline in infant mortality, low birth weight infant mortality remained high. Yet, because of medical advances in neonatology, low birth weight infants today are surviving on average 15 years more than low weight infants born in the 1950s.

## Increasing technology

By the 1970s SCBUs were an established part of hospitals in the developed world. In Britain, some early units ran community programmes, sending experienced nurses to help care for premature babies at home. But increasingly technological monitoring and therapy meant special care for babies became hospital-based. By the 1980s, over 90% of births took place in hospital anyway. The emergency dash from home to SCBU with baby in a transport incubator had become a thing of the past, though transport incubators were still needed. Specialist equipment and expertise were not available at every hospital, and strong arguments were made for large, centralised SCBUs. On the downside was the long travelling time for frail babies and for parents. A 1979 study showed that 20% of babies in SCBUs for up to a week were never visited by either parent. Centralised or not, by the 1980s few questioned the role of SCBUs in saving babies. Around 80% of babies born weighing under 1.5 kg now survived, compared to around 40% in the 1960s. From 1982 in Britain pediatricians could train and qualify in the sub-specialty of neonatal medicine.



Neonatal intensive care unit from 1980

Not only careful nursing, but also new techniques and instruments now played a major role. As in adult intensive care units, the use of monitoring and life support systems became routine. These needed special modification for small babies, whose bodies were tiny and often immature. Adult ventilators, for example, could damage babies lungs and gentler techniques with smaller pressure changes were devised. The many tubes and sensors used for monitoring the baby's condition, blood sampling and artificial feeding made some babies scarcely visible beneath the technology. Furthermore, by 1975, over 18% of newborn babies in Britain were being admitted to SCBUs. Some hospitals admitted all babies delivered by Caesarian section, or under 2500g in weight. The fact

that these babies missed early close contact with their mothers was a growing concern. As in other area of medicine, the 1980s saw questions being raised about the human, and the economic costs of too much technology. Admission policies gradually changed. In addition, treating low birth weight infants is expensive, especially when there are much cheaper ways of ensuring healthy babies. The key is prevention. Money can be spent on programs educating mothers on staying healthy during their pregnancy. One program (one that encourages women to stop smoking) is one third the price of neonatal intensive care and has been proven to work. During this program, a significant number of women often quit.



Neonatal intensive care unit in 2009.

### Changing priorities

SCBUs now concentrate on treating very small, premature, or otherwise sick babies. Some of these babies are from higher-order multiple births, but most are still single babies born too early. Premature labour, and how to prevent it, remains a perplexing problem for doctors. Even though medical advancements allow doctors to save low birth weight babies, it is almost invariably better to delay such births.



A new mother holds her premature baby at Kapiolani Medical Center NICU in Honolulu, Hawaii

Over the last 10 years or so, SCBUs have become much more 'parent friendly', encouraging maximum involvement with the babies. Routine gowns and masks have gone and parents are encouraged to help with care as much as possible. Cuddling, and skin-to-skin contact, also known as Kangaroo care, are seen as beneficial for all but the frailest (very tiny babies are exhausted by the stimulus of being handled, or larger critically ill infants). Less stressful ways of delivering high-technology medicine to tiny patients have been devised - stick-on sensors to measure blood oxygen levels through the skin, for example, and ways of reducing the amount of blood taken for tests.

Some major problems of the SCBU have almost disappeared. Exchange transfusions, in which all the blood is removed and replaced, little by little, are rare now. Rhesus incompatibility (a difference in blood groups) between mother and baby is largely preventable. Breathing difficulties and brain hemorrhage still claim many infant lives and are the focus of many current research projects.

The long term outlook for premature babies saved by SCBUs has always been a concern. From the early years, it was reported that a higher proportion than normal grew up with disabilities, including cerebral palsy and learning difficulties. Now that treatments are available for many of the problems faced by tiny or immature babies in the first weeks of life, long-term follow-up, and minimising long-term disability, are major research areas.

Besides prematurity and extreme low birth weight, common diseases cared for in a NICU include perinatal asphyxia, extreme cases of preeclampsia/eclampsia, major birth defects, sepsis, neonatal jaundice, and respiratory distress syndrome due to immaturity of the lungs. The leading cause of death in NICUs is generally necrotizing enterocolitis. Complications of extreme prematurity may include intracranial hemorrhage, chronic bronchopulmonary dysplasia (see Infant respiratory distress syndrome), or retinopathy of prematurity. An infant may spend a day of observation in a NICU or may spend many months there. Overall survival rates, for all gestational ages lumped together, are roughly 70%.

Neonatology and NICUs have greatly increased the survival of very low birth weight and extremely premature infants. In the era before NICUs, infants of birth weight less than 1400 grams (3 lb, usually about 30 weeks gestation) rarely survived. Today, infants of 500 grams at 26 weeks have a fair chance of survival.

The NICU environment provides challenges as well as benefits. Stressors for the infants can include continual light, a high level of noise, separation from their mothers, reduced physical contact, painful procedures, and interference with the opportunity to breastfeed. A NICU can be stressful for the staff as well. A special aspect of NICU stress for both parents and staff is that infants may survive, but with damage to the brain or eyes.

NICU rotations are essential aspects of pediatric and obstetric residency programs, but NICU experience is encouraged by other specialty residencies, such as family practice, surgery, Pharmacy, and emergency medicine.

## See also

- Intensive Care Unit
- Neonatology
- Pediatric intensive care unit
- Embrace (organization)
- Neonatal Nurse Practitioner

## External links

- Life in the NICU: what parents can expect <sup>[5]</sup>
- NeonatalICU.com - Expecting a Preterm Infant in the NICU <sup>[6]</sup>
- Equipment used in the NICU -- interactive parent friendly information <sup>[7]</sup>
- 99nicu - forum for NICU staff and pediatric specialists <sup>[8]</sup>

## References

- [1] meriam-webster dictionary --> isolette (<http://mw1.meriam-webster.com/medical/isolette>) retrieved on September 2, 2009
- [2] Rodriguez RJ, Martin RJ, and Fanaroff, AA. *Respiratory distress syndrome and its management*. Fanaroff and Martin (eds.) Neonatal-perinatal medicine: Diseases of the fetus and infant; 7th ed. (2002):1001-1011. St. Louis: Mosby.
- [3] neonatology.org --> Equipment in the NICU (<http://www.neonatology.org/tour/equipment.html>) Created 1/25/2002 / Last modified 6/9/2002. Retrieved on September 2, 2009
- [4] Humidity control tool for neonatal incubator ([http://www.biomedexperts.com/Abstract.bme/9684469/Humidity\\_control\\_tool\\_for\\_neonatal\\_incubator](http://www.biomedexperts.com/Abstract.bme/9684469/Humidity_control_tool_for_neonatal_incubator)) 1998; Abdiche M; Farges G; Delanaud S; Bach V; Villon P; Libert J P, Medical & biological engineering & computing 1998;36(2):241-5.
- [5] <http://www.aboutkidshealth.ca/PrematureBabies/Life-in-the-NICU.aspx?articleID=7524&categoryID=PI-nh1-11>
- [6] <http://neonatalicu.com/expecting-preterm-infant-in-the-nicu/>
- [7] <http://www.aboutkidshealth.ca/PrematureBabies/NICU-Equipment.aspx?articleID=9429&categoryID=PI-nh1-11a>
- [8] <http://99nicu.org/pageone/index.php>

# Article Sources and Contributors

**Neonatal intensive-care unit** *Source:* <http://en.wikipedia.org/w/index.php?oldid=356731397> *Contributors:* AgentPeppermint, Alansohn, Alteripse, Americaisgray, Aranel, Basie, Bcatt, Bobblewik, Bobjgalindo, CanisRufus, ChrisCork, Clee15, Darklilac, Davidruben, DeadEyeArrow, DuncanHill, ESPNIC, Edison, Effeetsanders, Esemono, Falcon8765, Fatoomch, Fattyjwoods, Graham87, Hallbrianh, Hede2000, I sams, J04n, Jacoplane, Jeepday, Jmjanzen, Josh Parris, Keilana, Llevity, Maltomma, Mathematicsprof, Medicellis, Meejanski, Merlion444, Mikael Häggström, NICUDad, NNPRecruiter, Nancy, Neomed, Oxymoron83, Pediatric, Pedro, Polihale, Poorlyearlybabies, Radiojon, Reinhardheydt, Reinyday, Retpallykhor, RogueNinja, SJK, Salanth, Sbfw, Shadowjams, Sharkface217, Shlomke, Shoefly, SiobhanHansa, Sohelpme, Steven Zhang, Stevenfruitsmaak, Themfromspace, Thingg, Tide rolls, Tombomp, Unforgiven24, Useight, Vincej, Wackjum, Wizard191, Wyldman, Yasutoshi, Zerbey, 88 anonymous edits

# Image Sources, Licenses and Contributors

**Image:Human Infant in Incubator.jpg** *Source:* [http://en.wikipedia.org/w/index.php?title=File:Human\\_Infant\\_in\\_Incubator.jpg](http://en.wikipedia.org/w/index.php?title=File:Human_Infant_in_Incubator.jpg) *License:* unknown *Contributors:* Original uploader was Zerbey at en.wikipedia

**Image:Neonatal Jacoplane.jpg** *Source:* [http://en.wikipedia.org/w/index.php?title=File:Neonatal\\_Jacoplane.jpg](http://en.wikipedia.org/w/index.php?title=File:Neonatal_Jacoplane.jpg) *License:* GNU Free Documentation License *Contributors:* w:User:JacoplaneJacoplane (well, his parents anyway)

**File:UCIN HCM.JPG** *Source:* [http://en.wikipedia.org/w/index.php?title=File:UCIN\\_HCM.JPG](http://en.wikipedia.org/w/index.php?title=File:UCIN_HCM.JPG) *License:* GNU Free Documentation License *Contributors:* User:Bobjgalindo

**Image:Mom and Premature Baby at Kapiolani.jpg** *Source:* [http://en.wikipedia.org/w/index.php?title=File:Mom\\_and\\_Premature\\_Baby\\_at\\_Kapiolani.jpg](http://en.wikipedia.org/w/index.php?title=File:Mom_and_Premature_Baby_at_Kapiolani.jpg) *License:* Creative Commons Attribution-Sharealike 3.0 *Contributors:* User:Polihale

# License

---

Creative Commons Attribution-Share Alike 3.0 Unported  
<http://creativecommons.org/licenses/by-sa/3.0/>