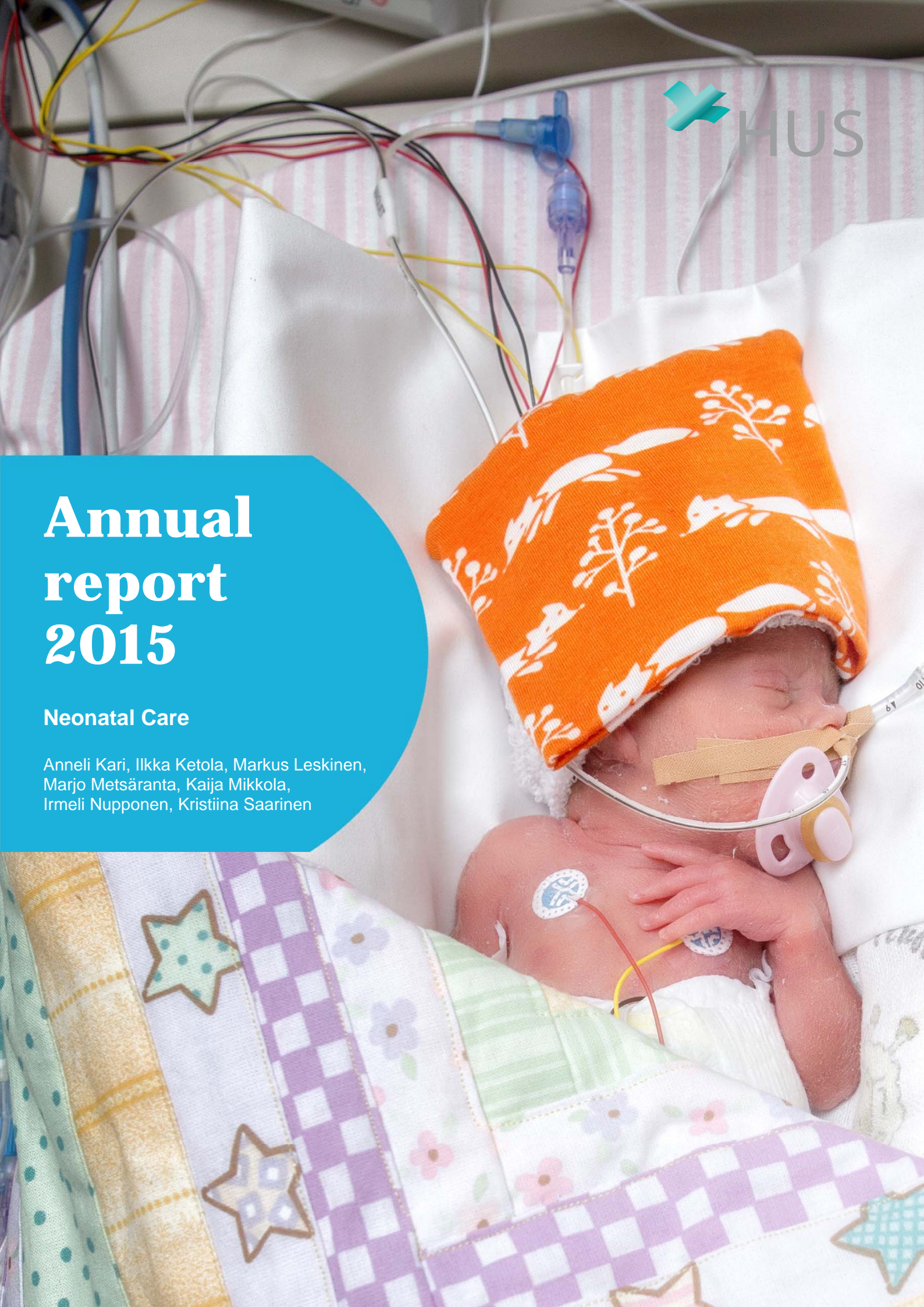


Annual report 2015

Neonatal Care

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Abbreviations:

BPD	Bronchopulmonary dysplasia - a chronic lung disease of preterm infants
NEC	Necrotising enterocolitis
IVH	Cerebral intraventricular hemorrhage
ROP	Retinopathy of prematurity
RDS	Respiratory distress syndrome
VLBW	Very low birth weight infant (under 1500 g)
ELBW	Extremely low birth weight infant (under 1000 g)

Cover image: HUS photography

Unit presentation

The neonatal units handle the care of sick neonates and preterm infants born at Helsinki and Uusimaa Hospital District (HUS). The unit also provides care for neonates in the HUS catchment area who require university hospital care due their prematurity or disease. Full-term neonates requiring surgical care are primarily treated at pediatric surgery wards.

At Helsinki University Hospital (HUH), neonatal care is provided at the Children's Hospital K7 Neonatal Intensive Care Unit, Women's Hospital N7 Neonatal Observation Ward, Jorvi Hospital L2 Neonatal Ward and Kätilöopisto Maternity Hospital LV37 Neonatal Ward. In addition, care for healthy neonates is provided in the Women's Hospital, Jorvi Hospital and Kätilöopisto Maternity Hospital maternity wards. Neonatal Care Unit physicians also assess all children born in these hospitals before their discharge. Outpatient care is provided at the Women's Hospital K7AVO, Kätilöopisto Maternity Hospital LV37AVO and Jorvi Hospital pediatric outpatient clinic. In 2015, there were 13,973 births at HUH and 17,687 at HUS. There were 17,921 children born at HUS, which accounts for a third of all children born in Finland in 2015.

The K7 Neonatal Intensive Care Unit provides care for the most acute and severe cases of neonatal disease and prematurity, such as all neonates born earlier than the 30th week of gestation, children requiring mechanical ventilation, therapeutic hypothermia and infants suffering from difficult infections. The N7 Neonatal Observation Ward and LV37 and L2 Neonatal Wards provide care for less acute cases of prematurity and other neonates requiring hospital care as well as convalescent care for patients coming from intensive care.

The Neonatal Unit has a staff consisting of 14 neonatologists, a specialist in pediatrics, 1-2 residents in neonatology, physicians specializing in pediatrics, over 200 nurses and other specialists, such as rehabilitation counselors, hospital pharmacists, ward secretaries, social workers, physiotherapists, hospital chaplains, supply technicians and ward domestics. All unit specialists are Medical Doctors and three are docents in neonatology. In 2015, there were 4,233 in-patient days in the Neonatal Intensive Care Unit, 11,339 in the neonatal wards and 4,576 visits in outpatient clinics.

Neonatal intensive care

The Neonatal Intensive Care Unit K7 provides intensive care for preterm and full-term neonates born in the Hospital District of Helsinki and Uusimaa and its catchment area. The most common reasons for admittance to the unit are preterm birth, infections, delivery complications, birth defects, neonatal neurological disorders and problems caused by a disease in the mother. The unit has a neonatology staff on call 24 hours a day and is prepared to receive neonates requiring intensive care.

There are 15 intensive care beds in the unit. In 2015, the unit treated 451 neonates, 128 of which were under 1500 g (very low birth weight) and 41 under 1000 g (extremely low birth weight) at birth. Approximately two-thirds of the neonates treated in the unit are nearly full-term. The average length of stay in 2015 was 9.3 days, but the smallest preterm babies may need to stay in the unit for several months. The number of in-patient days totaled 4,233 and the ward's bed occupancy rate was 79%. The number of in-patient days increased by 4.5% compared to the year 2014.

Neonatal intensive care is being developed continuously, with excellent treatment results in international comparisons. In addition to skilled personnel, neonatal intensive care requires advanced machinery, including ventilators, incubators, monitoring equipment and infusion (IV) machines. A large percentage of the examinations and surgical procedures required by neonates can be performed at the unit.

Encouraging early bonding with the baby and supporting parenting are essential parts of neonatal intensive care. Unit personnel provide parents with support and guidance in participating in the care of their baby right from the start. The unit organizes parent and father groups, in which parents are given information on special-needs babies as well as peer support.

Neonatal wards

N7 Neonatal Observation Ward

Because HUS has only one Neonatal Intensive Care Unit, centralizing high-risk pregnancies and deliveries into the Women's Hospital is essential for best results. Thus children born in the Women's Hospital have a greater, more acute need for monitoring than children born in other HUS hospitals.

The N7 Neonatal Observation Ward is located directly adjacent to the delivery rooms and OR's in Women's Hospital. The ward provides care for neonates requiring postnatal treatment and observation, due to preterm birth, respiratory difficulty, infections or hypoglycemia. The ward provides acute care and short-term intensive observation for neonates. Resuscitation and ventilator support for neonates requiring intensive care is also administered in the N7 emergency room. After initial assessment and acute treatment, these children are transferred to the Children's Hospital K7 Neonatal Intensive Care Unit for follow-up care. If it is already known or discovered at birth that the child has, for example, a disease that requires surgical treatment, he or she can also be transferred to the Children's Hospital K9 Intensive Care Unit, K6 Neonatal and Infant Surgery Ward or the K4 Pediatric Cardiac Ward.

The unit physicians work in close cooperation with obstetricians. The acute treatment of neonates with severe diseases is planned in cooperation with pediatric surgeons, pediatric cardiologists, anesthesiologists, radiologists and clinical geneticists. The ward nurses are trained in neonatal resuscitation and the treatment of problems arising during the early neonatal phase. If necessary, the nurses will assist labor ward midwives in caring for infants.

The N7 Ward has five patient beds and provided treatment for 997 children in 2015. There were 1,110 net in-patient days and an average length of stay was 1.1 days. Children were transferred from N7 to the Women's Hospital Postpartum ward 52 or one of the local hospitals' neonatal wards for convalescent care. N7 handles the antibiotic treatment of children in Postpartum 52. There were approximately 150 such cases handled.

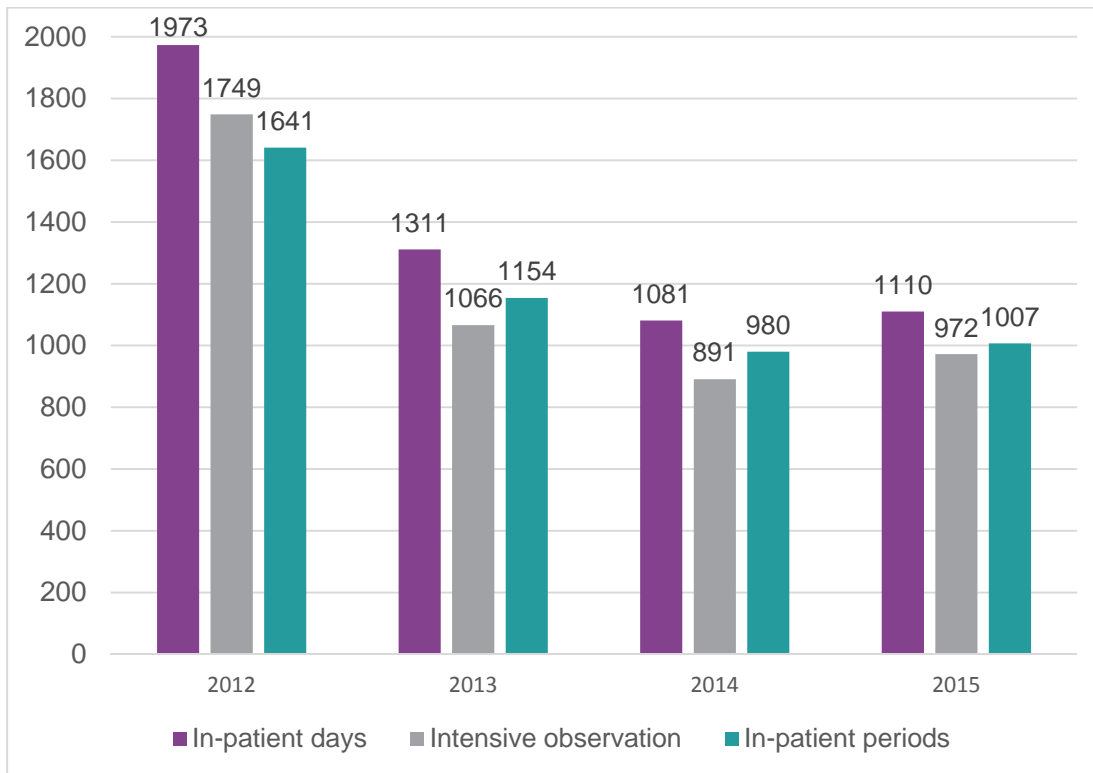


Figure 1. Women's Hospital N7 Neonatal Observation Ward in-patient days, intensive observation and in-patient periods in 2012-15. It should be noted that, on May 6th 2013, the number of ward beds dropped from 8 to 5.

L2 Neonatal Ward

Operational focus areas in the L2 ward:

- Convalescent care for preterm infants after intensive care.
- Diagnostics and in-patient care for neonates not requiring intensive care
- Treatment of neonates suffering from withdrawal symptoms passed on from mothers with substance abuse

In 2014, a total of 487 infants were treated in the 15 beds of the L2 ward. The average ward length of stay was 9.0 days, with a total of 4,096 in-patient days logged. Although the ward case load per hospital bed was 75 %, the utilization rate of intensive observation beds was 188 %. The ward also had 665 outpatient clinic visits.

Ward L2	Number of patients	Time in treatment (days)	Net in-patient days	Total ward bed occupancy rate (%)	Occupancy rate of beds in intensive monitoring (%)	Outpatient visits at the ward
2014	554	8.67	4096	75	188	665
2015	598	8.35	4231	77	207	786

Distribution of L2 treatment periods

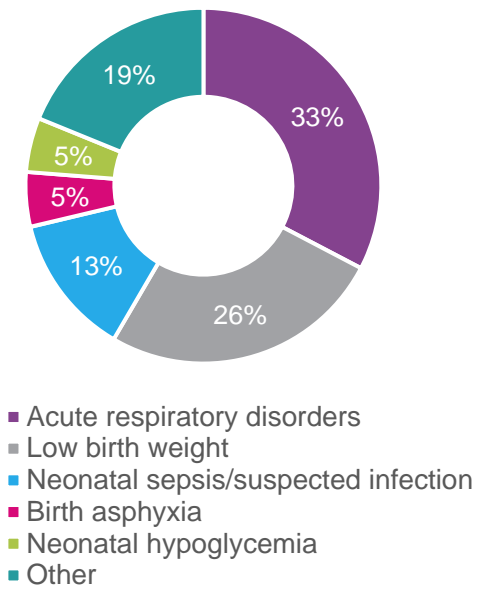
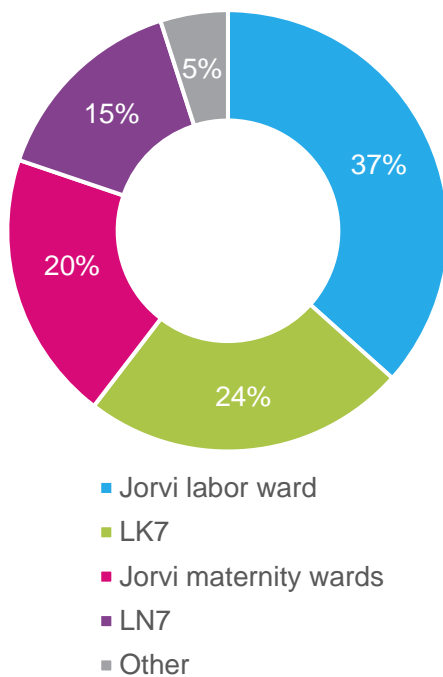
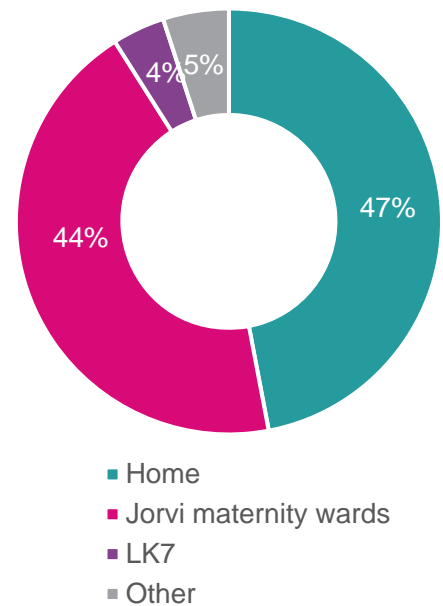


Figure 2. Distribution of in-patient periods by major diagnostic category. The respiratory disorder category includes both transient tachypnea of the newborn (TTN) and respiratory distress syndrome (RDS), air leak and meconium aspiration syndrome (MAS). The infection category includes both confirmed and suspected infections.

Patients admitted to L2



Patients discharged from L2



Peer support

A group for parents and group for fathers meet weekly at the ward. The group for fathers was formed in 2014 and, in 2015, 63 fathers participated in the group. The group received positive feedback from the participating fathers. The group for parents is active, with group meetings addressing prescribed topics organized by specialists from different fields. Under the direction of a music therapist, the ward hosts a 'music playschool', where parents are taught how to sing to their newborn babies. Hospital musicians who perform at Jorvi Hospital also regularly visit the ward. The ward holds a November market each year. Preterm infants who were treated at the ward and their families are invited to the market. In 2015, the event was attended by 57 adults and 46 children.

LV37 Neonatal Ward

The Kätilöopisto Maternity Hospital is the largest maternity hospital in Finland. In 2015, 7,524 children were born, 2.8% of which were born before 37 weeks of gestation. At the Kätilöopisto Maternity Hospital, children are born on 32 weeks of gestation or later.

In 2015, all women in labour were screened for Group B Streptococcus by using rapid testing. If the rapid test proved positive, an antibiotic treatment was administered. In 2015, not a single case of blood culture verified, early-onset sepsis caused by Group B Streptococcus was observed in neonates whose mothers were screened for Group B Streptococcus and administered antibiotics when needed.

Neonatal Ward LV37 has 21 beds, 4 of which are intensive observation beds. 5 of the beds are in family rooms on the 9th floor. Full-term and moderate preterm neonates born in the Kätilöopisto Maternity Hospital are treated in LV37. In addition, small preterms and other neonates who received intensive care are transferred from the Children's Hospital K7 unit for convalescent care. Neonates treated in other Children's Hospital wards are also transferred to LV37 for convalescent care. In 2015, there were 994 in-patient periods. The corresponding figure for LV37B (family rooms) was 355. The average length of stay was 7 days. The hospitalization time for small preterm neonates transferred from K7 for convalescent care is several weeks. The in-patient periods for neonates suffering from withdrawal symptoms are also several weeks in duration. Although the total ward bed occupancy rate was 79%, the utilization rate of intensive observation beds was 166%. There were 5,998 in-patient days. Approximately half of the patients from LV37 are sent directly for care from the delivery room or C-section OR and one-fourth from the maternity wards. Respiratory distress and prematurity were the key reasons for in-patient stay.

A multidisciplinary team convenes weekly at LV37. The team consists of ward physicians and nurses as well as a social worker, rehabilitation counsellor, child psychiatric nurse and, if necessary, a hospital chaplain. A parents' group meets at the ward on a weekly basis.

Patients admitted to LV37

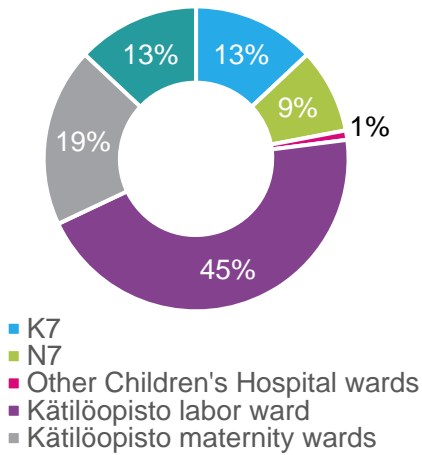


Figure 4. Approximately half of the patients admitted to ward LV37 in 2015 came directly from the delivery room or dedicated obstetric OR.

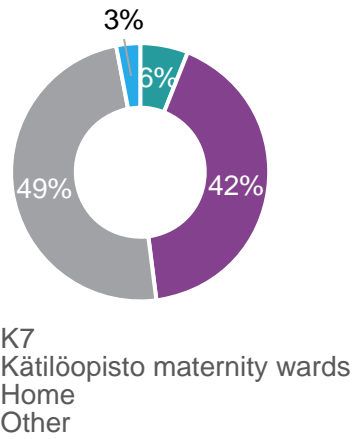


Figure 5. A majority of the patients were discharged straight away or through the maternity wards.

Patients treated in LV37

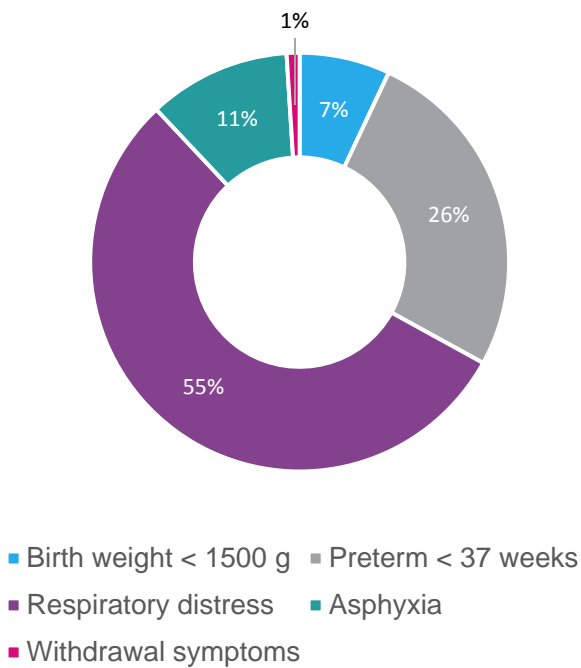


Figure 6. Respiratory distress and prematurity were the key reasons for an in-patient stay in 2015.

Neonatal outpatient care

K7AVO

K7AVO is a follow-up clinic for monitoring growth and development for infants being cared for in the Children's Hospital Neonatal Intensive Care Unit K7 and Women's Hospital Neonatal Observation Ward N7.

The patients being followed-up include preterm infants born before 32 weeks of gestation or very low birth weight (VLBW) infants (birth weight < 1500 g) and infants which have been in intensive care and/or have developmental risk factors, such as cerebral hemorrhage or periventricular leukomalacia, birth asphyxia, severe bronchopulmonary dysplasia (BPD), severe necrotising enterocolitis (post-NEC), severe nutritional problems (poor growth, severe vomiting, major eating problems), significant fetal growth restriction, severe/prolonged hypoglycemia during the neonatal period, severe infections and congenital defects.

K7AVO care is multidisciplinary - the team consists of a neonatologist, child neurologist, nurse, physiotherapist, rehabilitation counsellor, social worker, child psychiatric nurse and, if necessary, other experts. In addition, a pediatrician working as a resident in neonatology also works at the follow-up clinic weekly. Among others, Palivizumab injections are given at the nurse reception for at-risk infants in order to prevent serious RSV infections.

At the K7AVO most doctors' visits are carried out by a neonatologist. A child neurologist is present in 25% of the patient visits. A physiotherapist participates in 88% of the physician consultations. Infants with developmental risks are checked every 3-6 months at K7AVO follow-up clinic for the first year of life. Preterm infants are followed until the developmental age of 12 months. If there is any evidence of a major delay or abnormality in development, the child will begin a physical therapy program, which is carried out at home. In 2015, 40 children (13%) underwent physical therapy.

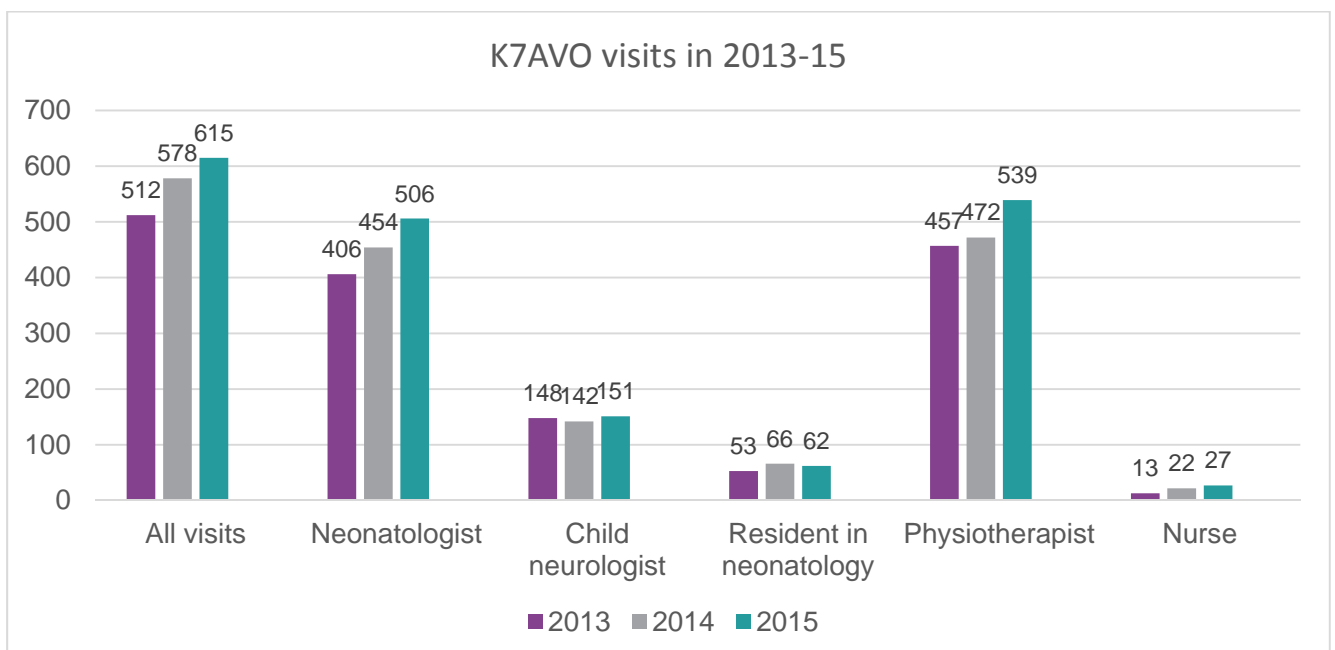


Figure 7. Number of visits to the K7AVO follow-up clinic in 2013-15.

Jorvi Hospital Neonatal outpatient clinic

The Jorvi Hospital Neonatal outpatient clinic focuses on the following:

- Developmental follow-up and ophthalmologist control of preterm neonates (birth weight over 1500 g)
- Developmental follow-up of at-risk children (major neonatal growth restriction, hypoglycemia, sepsis, post-intensive care monitoring, asphyxia or neurological abnormalities)
- Follow-up of children from at-risk families (parental substance abuse, mental disorders or interactivity problems)
- Nursing neonates referred from a public health service for specialist medical treatment, with the exception of allergy diagnostics on its own.

In 2015, the pediatric outpatient clinic logged 751 physician consultations. The nurse outpatient clinic also works in close cooperation with the physician reception, which logged 257 visits.

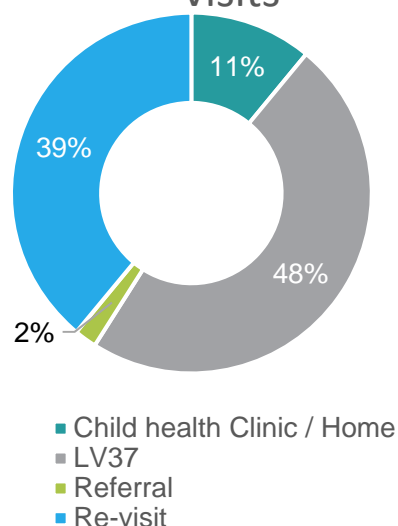
LV37AVO, neonatal follow-up clinic in Kätilöopisto Maternity Hospital, had 2,424 visits in 2015. Of these, 1,155 infants visited a neonatal nurse and 1,269 neonatologist or pediatrician. Of all physician's visits, 30% were patients discharged early (382/1,269). The team of LV37AVO consists of 2 nurses, 1 neonatologist, 1 social worker and 1 physiotherapist. In addition a child neurologist and a resident in child neurology make weekly consultation visits.

LV37AVO

LV37AVO, neonatal follow-up clinic in Kätilöopisto Maternity Hospital, had 2,424 visits in 2015. Of these, 1,155 infants visited a neonatal nurse and 1,269 neonatologist or pediatrician. Of all physician's visits, 30% were patients discharged early (382/1,269). The team of LV37AVO consists of 2 nurses, 1 neonatologist, 1 social worker and 1 physiotherapist. In addition a child neurologist and a resident in child neurology make weekly consultation visits.

Figure 8. Visits are divided into two types: short consultations for patients being discharged from the children's ward and consultations following treatment in the children's ward. Additionally, infants with low or moderate developmental risks, are monitored according to the follow-up program

LV37AVO outpatient clinic visits



Treatment outcomes

Vermont - Oxford Network

The treatment of small neonates is monitored using the Vermont Oxford Network. The network is an international comparative database, which includes nearly 1,000 hospitals all over the world that provide care for small neonates. A majority of the hospitals are located in the United States. All five of Finland's university central hospitals are part of the network. Data on all preterm neonates with a birth weight of less than 1500 g or born before the 32nd week of gestation is collected for the database. In

2014, data on over 56,000 preterm neonates was entered into the database. The comparative database makes it possible to monitor diseases and complications affecting the mortality and morbidity among small neonates, and it allows organizations to compare their own results with those of the network.

The results for K7 are of a high international standard. In comparison for 2008-2010, K7 placed in the top 6 % in terms of the survival of small neonates and discharging without any disease presenting in the patient. Comparative data for 2014 is not yet available; K7 data in the table below covers until November 2014.

Perinatal mortality

In 2015, there were 14,187 children born in the HUH area, 44 of which were stillborn and 21 expiring during the first week. The perinatal mortality rate is thus 4.5 deaths per 1,000 births. In 2014, the perinatal mortality rate at HUH was 4.5 deaths per 1,000 births. The perinatal mortality rate for all of Finland was 3.5 deaths. When considering perinatal mortality, it should be noted that known congenital heart defects and some severe congenital anomalies, such as diaphragmatic hernia, are concentrated within the HUS area out of Finland as a whole.

Table 1. K7 Unit and Vermont-Oxford Network comparative data for 2012-15.

	2012		2013		2014		2015	
	K7	Network	K7	Network	K7	Network	K7	Network
Preterm neonates with a low birth weight	127	55956	114	56421	114	56121	128	
Deaths	8		12		9		10	
Deaths	6.3	12	10.5	12	7.6	11.8	7.8	
Death or serious disease (%)	37.8	42.2	38.6	41.9	39.8	41.6	28.8	
In-hospital sepsis (%)	24.6	12.8	23.4	12	20.7	12.2	12.3	
NEC (%)	4.7	5.4	7.1	5	6.9	5.4	3.2	
BPD < 33 weeks (%)	16.9	25.4	19.7	25.7	15	26.3	9.1	
Pneumothorax	6.2	4	3.6	3.6	12.1	4.3	10.4	
Severe IVH (%)	7.8	7.8	7.1	7.1	7.0	7.9	8.2	
Cystic PVL (%)	2.3	2.8	0.9	2.9	0	2.8	4.1	
Severe ROP (%)	6.1	6.1	16.1	5.8	6.1	5.9	0	

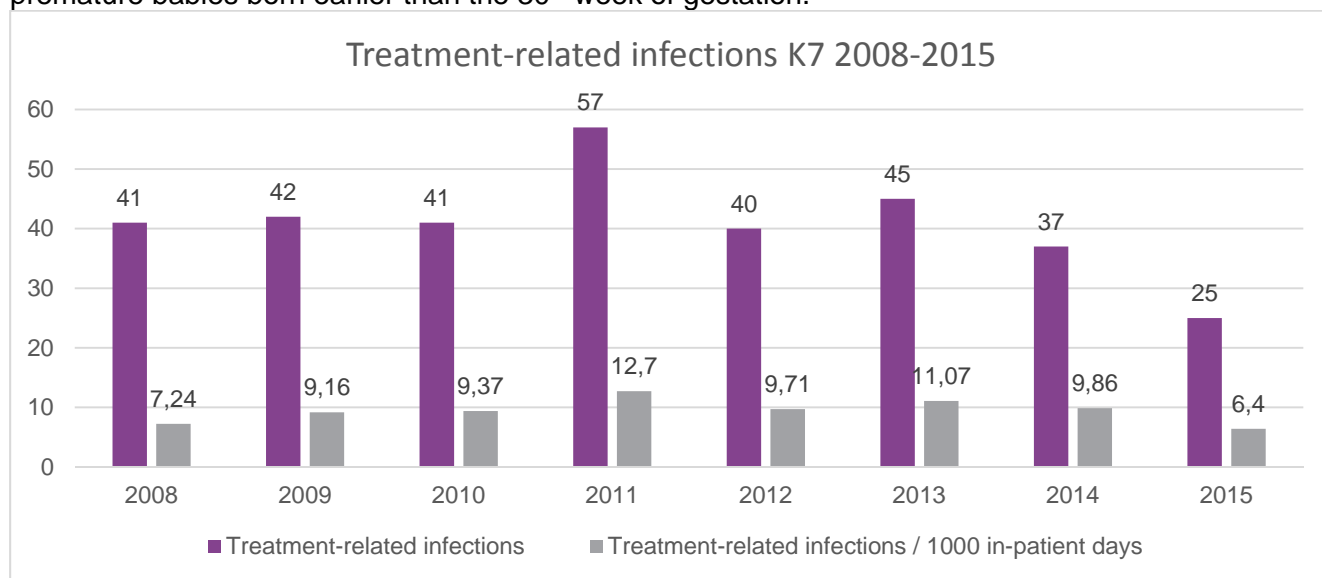
Taulukko 1. Osaston K7 ja Vermont-Oxford Network -verkoston vertailutietoja vuosilta 2012–2015.

Treatment-related infections

In 2015, 25 blood culture positive, treatment-related infections were observed in K7, 0 in N7, 4 in LV37 and 2 in L2. In 2015, two MRSA carrier states were encountered at the L2 ward. The other units did not observe any multiresistant MRSA, VRE or CPE carrier states. At the LV37 outpatient clinic, one case of MRSA-caused pemphigus was diagnosed on a previously discharged infant. No spread of infection to the wards.

The prevalence of sepsis at Ward K7 has been on a concerning level throughout the years. Small premature babies are especially susceptible to hospital-acquired sepsis which influences their later development and lengthens their hospital stay. To reduce the prevalence of sepsis, the ward founded a team to identify what actions could be taken to improve the situation. The team consisted of two

neonatology specialists, a hygiene nurse, a clinical expert, two hygiene contact persons, and two deputy nurse managers. Since the risk factors for sepsis are known, the team concentrated on the treatment actions and aseptic factors which are known to increase the risk of sepsis. The team compiled instructions which concern the seven aseptic factors: hand disinfection, use of protective gloves, emptying phlegm from the airways, intravenous cannulation, administering intravenous drugs, changing the intravenous liquids and taking blood cultures and laboratory samples. After the results were compiled, the staff was informed of the new instructions and the instructions were processed several times during the ward's training days and at the ward meetings. Possibly due to the new instructions and practices, the number of hospital-acquired sepsis cases decreased almost to a half of what they were during the two previous years in babies weighing under 1,500 grams at birth and in premature babies born earlier than the 30th week of gestation.



Quality of treatment and patient safety

The neonatal wards use an anonymous online reporting system called the Haipro system for reporting adverse events and close-call situations. The aim of the system is to improve patient safety and quality of treatment.

Ward	All reports	Close calls	Related to drug or fluid therapy	Number of reports/treated patients	Number of reports/in-patient days (gross number)	Changes to practices
K7 + N7	190	42 (22%)	98 (52 %)	190/1,448 (0.13)	190/6,803 (0.03)	2
L2	87	28 (32%)	41 (47%)	87/595 (0.14)	87/5,062 (0.02)	
LV37	131	46 (35%)	60 (48%)	131/995 (0.13)	131/7,006 (0.02)	1

Research projects

Clinical research plays a major role in neonatal care unit operations. In 2015, there were 8 research projects underway.

ELVA

This study examines medication and injury related changes to the EEG

Anxiety in children and their guardians

This research project expands upon the "Lifequality measurements in the evaluation of the cost effectiveness of specialized medical care" research project and attempts to determine the impact that treatment factors have on the effectiveness and cost-effectiveness of treatment. The research examines the incidence of anxiety in children and their guardians when a child falls ill with a chronic or serious disease.

CMV

Randomized study of congenital cytomegalovirus infection. Even though CMV infection is the most common congenital infection encountered in developing countries, very little is known about its natural progression. This study examines the burden of disease caused by the virus in Finland.

GENBPD

This study examines genetic predisposition to bronchopulmonary dysplasia (BPD).

Big data – small preterm neonates

This study seeks to find factors predicting prognoses and complications of small neonates by data mining the data in K7's Clinisoft information system.

Kangaroo families- the impact of sound environment on the development of preterm neonates

This study examines the impact of music on the development of preterm neonates provided with 'kangaroo care'.

Caffeine study

This study examines the impact that caffeine and supplemental oxygen have on the sleep and breathing of preterm neonates.

NEO-Opioid

This study examines the use of opiates in managing chronic pain and procedural pain.

NEUROSIS

An international multicenter trial which examines whether early inhaled budesonide reduces the incidence of BPD in extremely preterm neonates born before week 28 of gestation.

PiMiKo – microbial colonization of the small preterm neonates

This study examines changes in microbial colonization on the skin and in the gut during the first weeks of intensive care as well as the impact that microbes have on the risk of infection for preterm neonates.

PLUS

This study examines the protein intake and growth of preterm neonates with an extremely low birth weight.

REDEXAM

This study examines the use of urinary NTproBNP concentration in identifying mild cases of retinopathy of prematurity (ROP).

TOIBILAS

This study examines how early examination of sight or early cognitive assessment based on eye movement examination are suitable to be used in clinical work.

Vauras study

This study examines how cerebral hemorrhages affect the networking of brain functions, and attempts to prove the effect of synchrony to the development of the brains.

In 2015, physicians published a total of 25 papers.

New in 2015

The screening of neonates for congenital metabolic disorders was begun at the end of 2014 in HUH and screening was expanded in March of 2015 to cover 22 different congenital metabolic disorders. This is now an established process and 99% of newborns are screened. One case of congenital adrenal hyperplasia, one case of medium-chain acyl-CoA dehydrogenase (MCAD) deficiency, one case of phenylketonuria and two cases of congenital B12 vitamin deficiency were discovered through screening in 2015.

Group B Streptococcus is the most common cause for early-onset neonatal sepsis. In 2014, Kätilöopisto Maternity Hospital piloted a screening program for all women in labour using the GBS rapid test (Xpert GBS). In 2015, all women in labour at Kätilöopisto Maternity Hospital were screened for GBS and, if they tested positive, antibiotics were administered. At Kätilöopisto Maternity Hospital in 2015, not a single case of blood culture-verified, early-onset sepsis caused by Group B Streptococcus was observed in neonates whose mothers were screened for Group B Streptococcus and administered antibiotics when needed. Jorvi Hospital and Women's hospital began screening in late 2015.

Summary

With regard to the incidence of disease, disability and death, the neonatal phase is the most high-risk stage of life. Expert, focused neonatal care makes it possible to diagnose children in need of treatment as early as possible and is cost-effective. The HUH Neonatal Care Unit cares for one out of every four neonates born in Finland and is the largest unit of its kind in the country. The size of the unit allows for continuous neonatal care and the development of specialized expertise by dividing areas of responsibility.

The unit is divided among four hospitals, which have a total of 15 intensive care beds and 41 beds in neonatal wards. The unit logged more than 15,000 in-patient days and nearly 4,500 outpatient visits. The outcome of small neonates was of a high international standard and the perinatal mortality rate is low. Neonatal care is being developed by both conducting extensive research and actively adopting new forms of treatment.



Neonatology

K7 Neonatal Intensive Care Unit,
Children's Hospital
N7 Neonatal Observation Ward,
Women's Hospital
L2 Neonatal Ward,
Jorvi Hospital
LV37 Neonatal Ward,
Kätilöopisto Maternity Hospital

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