Karlstad Central Hospital, Sweden
Creating an infection-controlled NICU

After extensive research, planning, and visits to other hospitals and the Dräger Design Center, Karlstad Central Hospital replaced its 27-year-old neonatal intensive care unit with a brand-new ergonomic unit of single-family rooms with external corridors for parent access. The new space minimizes the spread of infectious diseases, while enabling caregivers to deliver developmentally supportive care.

BACKGROUND
In 2011, the neonatal intensive care unit (NICU) staff of Karlstad Central Hospital, Sweden, received permission to renovate its unit. The project team immediately began to plan the ideal neonatal care unit: a state-of-the-art unit where all babies can be with their parents 24/7 and where the primary focus is on avoiding infections due to antibiotic-resistant bacteria.

Dr. Karl-Gustav Ellström, head doctor of the NICU and leader of the project team, explains the key reason for the redesign. "Globally there is a growing problem of antibiotic resistance, and the biggest problem is in the neonatal unit."

The hospital takes care of approximately 410 newborn babies per year, 25 of them are very low birth weight babies. The hospital is designed to care for babies from the 26th week of gestation on, referring younger neonates to the hospital in Uppsala. Once the infants are stabilized, they return to Karlstad.

A SIGNIFICANT TRANSFORMATION
The existing unit was 27 years old and needed to be renovated and enlarged, yet the location of the NICU and structural framework of the building could not be changed.

The planning team set out to create a modern neonatal unit, built according to the latest neonatal care knowledge and designed to meet the following goals, including the UNICEF Rights of the Child (see page 2):

- Provide a single family room for every infant: Babies can be together with their parents throughout their entire stay, so space for one parent bed inside each NICU room was mandatory. The room must provide privacy for each family and support 24-hour kangaroo care.
- Avoid the spread of infectious diseases: The layout must be designed to prevent the spread of antibiotic-resistant bacteria.
- Create an ergonomic and flexible workplace: The room design should be very flexible, so that the twin room could convert to a double room, for example, and care for sick mothers could be provided within the unit.
The planning group also included members of the department responsible for handling infectious diseases in the county. The hospital team examined the infectious disease department’s solution for preventing the spreading of antibiotic-resistant bacteria, which is a ground floor building with one entrance to the outside where patients can enter the room. The staff could move around inside the building, but there was no contact between the patients.

Dr. Ellström explains, “We said, ‘Why not do the same here?’ But the problem was that we are on the second floor. After much discussion regarding the cost and construction challenges, we built exterior corridors or ‘skywalks’. As far as we know, there is no other neonatal unit in the world that has that. But it enables us to prevent the spread of infectious diseases within the unit.”

The final design doubled the area of the unit from 600 square meters to 1150 square meters for 13 baby rooms. The entire project took two years from the beginning to the end – approximately half of this time was spent on planning and half on building.

The planning team also tried successfully to minimize the amount of harmful substances in the building and equipment material and thus contributed to creating a healthy environment (see page 4).

**AN IDEAL SOLUTION**

The NICU is very close to the delivery unit – just 50 meters away – and adjacent to the operating room. Each baby has an intensive care room where the parents can take care of their babies at all times. There are also two intensive care isolation rooms – both equipped for twins.

There is a kitchen for the parents, which they access via the external corridors. The parents in the isolation rooms have a kitchen of their own. The hospital also commissioned an artist to paint murals throughout the NICU to create a pleasant atmosphere for the families.

When the architect’s plans were finalized, Dräger received the floorplan and worked with the hospital team on suitable positions for the medical supply units. The result was one supply column at the head end and one at the foot end. Having two separate pendants provided maximum flexibility and enabled the unit to care for both babies and their sick mothers in the same room.
After the floor plan was finalized, the planning team visited the Dräger Design Centre in Lübeck, Germany. The Dräger 3D modeling tool enabled the team to explore different approaches and visualize ideas. Dräger’s architectural systems are the room’s foundation for improving workflow – providing optimum flexibility for integration of various medical devices.

Once the team decided on their optimal workspace design, Dräger put the equipment in place – so the team could physically experience the new design and equipment.

Kristina Nilsson, Equipment coordinator and member of the Project team explains: “We wanted optimal flexibility for the placement of equipment within each room, because sometimes the big bed for the mother comes in at the right side and sometimes at the left. But with the Dräger pendants, the side doesn’t matter because we can easily move the equipment. Working with the Dräger Design Centre was essential because it allowed us to test out different options before we finalized our solution.”

Dr. Ellström continues: “With the old unit, a lot of parents complained about not being able to be at their baby’s side because there wasn’t enough room for them. But now they can be. So they are much happier now. Actually, we were surprised at how many of the parents lived here from the beginning – even the fathers. In Sweden, parents are paid for the time they spend with their babies.”

Another benefit of single-family rooms is that it enables kangaroo care – where the infant receives skin-to-skin contact with a parent while still being connected to all necessary medical equipment, like the ventilator. “This new neonatal unit makes it possible for families to do kangaroo care. That is one of the reasons why we chose Dräger pendants,” says Dr. Ellström.

“The goal is to have 24-hour contact between parent and child,” added Head of Department Assistant Ann Bredberg Johansson, “so you need both parents here.”

The new NICU workflow necessitated a staff increase of approximately 20 percent. The team had realized this from the start of the planning process and was given the budget for more staff. Approximately 60 persons work in the new unit: four doctors, 31 nurses and 24 assistants.

The new design has met the planning team’s number one goal: eliminating infectious diseases in the unit. “With our new NICU, we have had no spreading of antibiotic-resistant bacteria between the patients,” states Dr. Ellström.

Not only has the new design been successful in eliminating infectious diseases in the NICU, it has also reduced the time babies have to be in the hospital. According to Ann Bredberg Johansson, “Because of the parents’ involvement, babies are now here fewer days than before; they need less time until they are safe to go home.”

* Lester, B.M., Hawes, K. et al (2014), Single-Family Room Care and Neurobehavioral and Medical Outcomes in Preterm Infants, American Academy of Pediatrics, Vol. 134 No. 4 October, pp. 754 -760
IMPROVED CLINICAL WORKFLOW AND BETTER ERGONOMICS

“We now have everything we need to care for the baby right in the baby’s room,” explains Johansson. “Before, we had to take the baby to another preparing room right after it was born to take an x-ray and put all of these tubes on. Now we do everything in the baby’s room. It’s much better for the baby not to be moved – so I think it’s a very good workflow.”

Johansson talks about how the staff likes the new Dräger architectural supply units. “For the staff, it is very nice with the pendants, because it is good for your body. Before, the outlets were up too high for the short people. In other units we visited, they had to use a step stool and extra cables. I think it is very good that we easily move the pendants and have the outlets and the accessories positioned at a convenient height to each care giver – high, low or in the middle.”

The flexibility of the architectural system enables the staff to place the pendants so that they can reach the mother’s bed – which was one of the goals of the solution. The pendants also support hygiene by keeping almost all of the equipment off the floor.

COMING FULL CIRCLE

While the physical structure of the neonatal unit and workflow have changed, one thing has remained the same: the hospital’s commitment to its youngest and most fragile patients.

So it’s not surprising that when the hospital opened its new NICU in March 2013, the two young men chosen to cut the ribbon at the opening ceremony were former patients in the unit. One had been 850 grams at birth and the other 1380 grams.

Today, these young men are strong and healthy university students. These former patients are a living testimony to the quality of care provided at the Karlstad Central Hospital’s neonatal care unit.

Dräger solution
- 4 Babylog® VN500 ventilators
- 6 Caleo® incubators
- 3 Babytherm® 8010 baby warmers
- 8 areas equipped with Agila® supply units at head and foot end (IVA & isolation rooms)
- 8 Polaris® 50 lights
Dr. Karl-Gustav Ellström, Head of the NICU department
“With our new NICU, we have had no spreading of antibiotic-resistant bacteria among or between the patients.”

Kristina Nilsson, Equipment coordinator and member of the Project team
“We wanted optimal flexibility for the placement of equipment within each room.”

Ann Bredberg Johansson, Head of Department Assistant
“Because of the parents’ involvement, babies are now here fewer days than before; they need less time until they are safe to go home.”

Guenther Feufel, Dräger
“Early Dräger involvement and the regular exchange between the team and an experienced group of people were both major factors contributing to the success of this project.”
Hospital at a glance
Karlstad Central Hospital is a 421-bed general hospital that provides medical, surgical, orthopaedic and other specialty services to the county of Värmland, Sweden – of which Karlstad is the capital city.

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