

Creatively saving the tiniest of tots

Hundreds of severely underweight babies are now being saved across the Western Cape every year because of the creativity and resourcefulness of one neonatology team and its support network at Tygerberg Hospital.

The budgetary funding switch away from tertiary healthcare towards primary healthcare has forced several innovations that have doubled Tygerberg Hospital's extremely low birth weight survival rate from the alarming national average of 40% – to almost 80%. The neonatal team has developed a multipronged approach, with at least two pivotal inventions that have put the resource-constrained facility on a par with the underweight infant survival rates of most First-World institutions where absence of major budget constraints and state of the art equipment are virtually taken for granted.

The most innovative of these approaches is a relatively cheap home-built nasal continuous positive airway pressure (nCPAP) machine, complemented by the so-called INSURE (intubation surfactant administration extubation) administration of surfactant (a surface-active lipoprotein substance secreted naturally in the lungs, a lack of which causes respiratory problems especially in premature babies) to the non-intubated baby. A cheaper synthetic version of surfactant is also being developed. The new approach has taken major pressure off the 8-bed (down from 20 beds) neonatal ICU where expensive ventilators are in continual demand.

Package tailored and shared

The team, with the support of the obstetric unit, also lessens the risk of respiratory disease by using antenatal steroid treatment, applies the latest prevention of mother-to-child HIV transmission (PMTCT) protocols and uses Doppler testing to identify abnormal fetal growth, a condition that places the fetus at high risk of intra-uterine demise. The treatment package is being tailored to rural and secondary hospitals to reduce the steady stream of babies to Tygerberg where treating a single child in the neonatal ICU can cost up to R10 000 per day. Secondary hospitals such as Karl Bremer,

Worcester and Paarl were among the first to use the nCPAP prototype a few years ago – developed when the ever-alert Tygerberg team leader, Professor Gert Kirsten, established that the patent rights of the popular, but very expensive, commercial nCPAP machine had lapsed. He urged the hospital's technical workshop to develop and build a more affordable in-house prototype, which, with Round Table and Rotary funding, now number 30 on site, with a commercial production stream available to supply other hospitals.

nCPAP is currently practised at Hermanus, Swartland, Helderberg and Ceres hospitals, as well as the newly built



Professor Gert Kirsten, neonatology chief at Tygerberg Hospital. Picture: Courtesy of Professor Gert Kirsten.

Khayelitsha Hospital on the Cape Flats, saving many lives, millions of rands and preventing the transfer of rural mothers and babies to Tygerberg Hospital.

Women with preterm labour before 32 weeks are automatically referred to Tygerberg Hospital, which has a catchment area in which 50 000 babies are born annually. Kirsten said extremely low birth weight infants were medically classified as such at 1 000 g or less, very low birth weight at less than 1 500 g and low birth weight at less than 2 500 g. Of the babies born at Tygerberg Hospital annually, some 22% are low birth weight and 4 - 5% very low birth weight.

'We may not have the same resources as the world's top children's hospitals but the challenge to make do with less and still ensure that kids in our care get the best possible treatment and chance of survival is a gratifying experience that makes our work at the coalface something special every day.'

Mums reunited with infants

Professor Kirsten explained that with the switch in funding emphasis to primary healthcare, mothers could no longer stay in hospital with their premature infants and the hospital was only allowed to admit infants with a minimum birth weight of >1 000 g to the ICU. This led to a heart-breaking scenario in which underweight infants were denied their mothers' vital immune-boosting breastmilk and led to soaring infection and death rates in the neonatal unit – a problem still all too tragically common in many state hospitals in South Africa where infections spread like wildfire through overcrowded neonatal wards. A shocking 8 001 babies died in state hospitals during the first five months

of 2010 (National Department of Health figures) and the following year again saw headlines declaring infections to have claimed six premature babies at the Charlotte Maxeke Hospital in Gauteng and another 11 – all on the same day – at the Natalspruit Hospital in Ekurhuleni. According to the United Nations the newborn (up to one month old) death rate in South Africa stands at 18 per 1 000 live births while 58 000 children under five died in 2010. A highly publicised series of fatal infection outbreaks at Tygerberg Hospital in the 1990s sapped the morale of hard-pressed staff and was the catalyst for introducing a Kangaroo Care ward. The new ward freed up overcrowded incubator space, allowed the mothers of these tiny babies to be admitted alongside their babies, and breastmilk replaced formula milk feeding. Additionally, mothers were now empowered to nurse their own infants, thereby reducing the load on neonatal nursing staff. However, Kirsten and his team still had to deal with extremely low birth weight infants faced with respiratory distress syndrome but unable to be admitted to the ICU owing to the lack of ventilation equipment, neonatal ICU beds, and nursing staff. The answer was non-invasive ventilation in the neonatal high-care ward – something never attempted in First-World hospitals. This coincided with the lapsing of the patent rights on the Swedish-developed Infant Flow Driver nCPAP system – and the rest is history. nCPAP and Kangaroo Mother Care at Tygerberg Hospital have significantly reduced hospital stays and infant mortality rates.

Some five years ago the neonatal unit fell victim to a rotavirus that caused diarrhoea and several deaths. The hospital's infection control expert, Professor Shaheen Mehtar, quickly developed protocols that two years later proved themselves when a second rotavirus outbreak occurred – with not a single death.

Going where few others dare ...

The Tygerberg team are also at the forefront of developing protocols for diagnosing TB

in premature babies and establishing safe levels of TB and antiretroviral drugs for babies below 1 500 g. They work closely with the Safe-Passage Study of Professor Hein Odendaal from Tygerberg Hospital. This international study aims to investigate the link between early consumption of alcohol during pregnancy and stillbirths, sudden infant death syndrome (SIDS), and other poor outcomes of pregnancy. Almost 50% of pregnant mothers in the province drink alcohol, compared with 34% of pregnant mothers in other metropolitan areas of the country. One in 10 children referred to the genetic clinic at Red Cross War Memorial Children's Hospital in Rondebosch have fetal alcohol spectrum disorder (FASD) and an audit of children attending schools for the mentally disabled revealed that one in four had FASD.¹ Mothers of FASD children in the region come from families with a history of generations of alcohol abuse and heavy drinking, mostly via the outlawed *dop* system on wine farms.

Another epidemic confronting Kirsten's team is Tik, which affects unborn children as profoundly as alcohol. 'It's only through collective efforts of different people and institutions that we can make a real impact. We may not have the same resources as the world's top children's hospitals but the challenge to make do with less and still ensure that kids in our care get the best possible treatment and chance of survival is a gratifying experience that makes our work at the coalface something special every day,' he said.

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1. Bateman C. FASD – De Aar mums get beyond the 'tipping point'. *S Afr Med J* 2010;100(11):706-708. [<http://dx.doi.org/10.7196/SAMJ.6083>]