

**NEO FOR
NAMIBIA**
HELPING BABIES
SURVIVE



AUTHORS

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Lucerne, 2015

**NEONATOLOGY IN THE
NORTHERN PART OF
NAMIBIA**

Mission 2015

October 24 to November 13, 2015

NEO FOR NAMIBIA
HELPING BABIES SURVIVE

www.neo-for-namibia.org

INTRODUCTION

Following our three visits to Hospitals in the Ivory Coast in 2012, 2013 and 2015, we were offered the opportunity for a three-week trip to Namibia from October 24 to November 13, 2015. Barbara Müller, a Namibia expert and project leader of Mudio (www.mudio.com), organised our tour. We were accompanied by Christoph König (obstetrician & gynaecologist from Berne) and his partner Nellie (a nurse with International Committee of the Red Cross missions experience), Paul and Charlotte Jenni (Isotherm, Uetenberg) Ueli Schafroth (general practitioner from Münsingen) and his wife Brigitte (nurse) and their assistant Svetlana Avdimetaj-Ueltschi, and – last but not least – the Namibian all-rounder Tertius.

PEARL75 and GLORIA8,
Barbara's two Landrovers



MISSION OVERVIEW

On October 24, 2015, an over-night flight with Air Namibia brought us from Frankfurt to Windhoek, where Laston (“the last one”) picked us up. After two nights at Hammer’s Farm (near Otjiwarongo), we drove up north in two Landrovers (PEARL75 and GLORIA8) to the Etosha National Park for an impressive Safari experience (Etosha Safari Lodge, Camp Halali, Camp Namutoni).

From October 31 to November 4, 2015, we had the opportunity to visit the paediatric and neonatology wards, as well as the emergency department at Rundu State Hospital. Our educational sessions were well organised by Sibylle Wyss, an ICU nurse from Switzerland who has spent almost three years at the Rundu State Hospital. The nearby Kaisosi River Lodge at the border of the Kavango River was a very convenient place to stay.

Following a short break in Botswana (Drotsky Cabins, Sedia Hotel in Maun), we went back to Rundu for further training sessions. Before returning to Windhoek, we were able to repeat our neonatal resuscitation training and case discussions at the Andara Hospital on two occasions (with overnight stays at Mobola Lodge).

After a two-day-trip from Andara to Windhoek with an overnight stay at Roy’s Camp, we spent an interesting day with Paul and Charlotte in Windhoek (including a memorable visit of the meat market in the Katutura Township) and a perfect lunch at Gathemann’s (run by Urs Gamma, the Swiss Honorary Consul General). On November 13, 2015, we left Windhoek on another over-night flight with Air Namibia and safely returned home the next day.

Thank You.

We would like to thank Barbara Müller for her relentless efforts to guarantee a smooth trip.

Our educational sessions were well organised by Sibylle Wyss and her three-year-experience at the Rundu State Hospital was very helpful.

Finally, we are also very grateful for the hospitality of our Namibian hosts.

Waterhole in the Etosha National Park



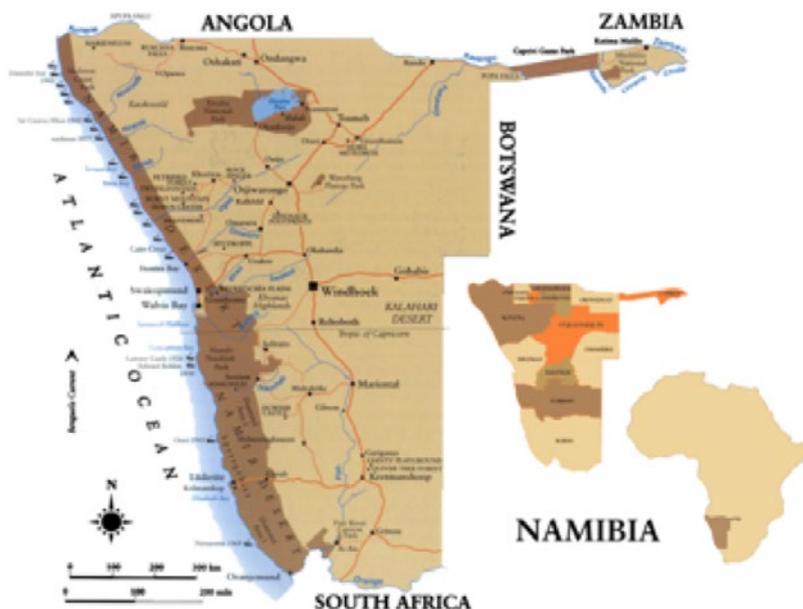
NAMIBIAN FACTS

- Population density of 2.5/km² (2.2 Mio people, 825'615 km²)
- Capital city: Windhoek
- Independence day: March 21, 10990
- Multi-party parliamentary democracy
- Current president: Hage Geingob
- Currency: Namibian dollars (1 CHF = 14 ND); South African dollars are also used
- Main industries: agriculture and herding, tourism, mining

At 825'615 km² and a population of 2.2 million people, Namibia is the second least densely populated country in the world after Mongolia (population density Namibia 2.5/m², Switzerland 190/km²). Being situated between the Namib and the Kalahari deserts, Namibia is the country with the least rainfall in sub-Saharan Africa. With an average rainfall of about 350 mm per annum, the highest rainfall occurs in the Caprivi Strip in the northeast (about 600 mm per annum) and decreases in a westerly and south-westerly direction to as little as 50 mm and less per annum at the coast. The only perennial rivers are found on the national borders with South Africa, Angola, Zambia, and the short border with Botswana in the Caprivi. In the interior of the country surface water is available only in the summer months when rivers are in flood after exceptional rainfalls.

The dry lands of Namibia were inhabited since early times by San, Damara, and Namaqua, and since about the 14th century AD by immigrating Bantu who came with the Bantu expansion. Most of the territory became a German Imperial protectorate in 1884 and remained a German colony until the end of World War I. In 1920, the League of Nations mandated the country to South Africa, which imposed its laws and, from 1948, its apartheid policy. The port of Walvis Bay and the offshore Penguin Islands had been annexed by the Cape Colony under the British crown by 1878 and had become an integral part of the new Union of South Africa at its creation in 1910.

Uprisings and demands by African leaders led the United Nations to assume direct responsibility over the territory. It recognised the South West Africa People's Organisation (SWAPO) as the official representative of the Namibian people in 1973. Namibia, however, remained under South African administration during this time as South-West Africa. Following internal violence, South Africa installed an interim administration in Namibia in 1985. Namibia obtained full independence from South Africa in 1990, with the exception of Walvis Bay and the Penguin Islands, which remained under South African control until 1994.



Map of Namibia

Nowadays, the Republic of Namibia is a stable multi-party parliamentary democracy. Agriculture, herding, tourism and the mining industry – including mining for gem diamonds, uranium, gold, silver, and base metals – form the basis of Namibia’s economy. Namibia enjoys high political, economic and social stability. According to the World Bank, Namibia is classified as an upper middle-income country (gross domestic product (GDP) divided by the country’s population). Interestingly, Namibia’s president, Hage Geingob, has argued that such a classification was misguided. There are still severe social imbalances with the wealth concentrating in the hands of 5% of the people. Almost 30% of the population live in poverty, with even higher rates in the northern part of the country.

Sibylle Wyss with paediatric patients



RUNDU STATE HOSPITAL

Overview

Rundu State Hospital

- More than 300 beds
- Staff shortage: 25 physicians and 200 nurses
- More than 5000 deliveries per year
- Approximately 10–15 maternal deaths per year
- Approximately 100 neonatal deaths per year
- 180–200 paediatric deaths per year

The Rundu State Hospital is the second largest government hospital of Namibia. It has approximately 300 beds and serves the population of the Kavango region and the Caprivi Strip in the northern part of Namibia. Every day, up to 200 patients are seen in the emergency department. The hospital's departments include a paediatric and a neonatology ward (the so-called Prem Unit). With 200 nurses and 25 physicians, the hospital is severely understaffed. Dr. Jury Yangazov, a surgeon and the Senior Medical Superintendent, originates from the Ukraine; other doctors we met came from Cuba, the Republic of Zambia, the Democratic Republic of Congo (DRC) and Zimbabwe. The nurses, on the other hand, are mostly Namibian.

Obstetrics and Neonatology – Statistics

Based on statistical data from quarterly reports of 2015, there are more than 5000 deliveries/year in this hospital. Sadly, there may be as many as 10–15 maternal deaths per year, if this information is correct, this would correspond to a maternal mortality ratio of 200–300 deaths per 100'000 live births – possibly exceeding the 130 deaths per 1000'000 live births reported for the entire country in 2015 (www.mdgs.un.org).

In addition, there are approximately 100 neonatal deaths at Rundu State Hospital annually, representing a neonatal mortality rate of 20 deaths per 1000 live births (exceeding the rate of 16 deaths per 1000 live births reported for the entire country). These figures are only rough estimates for hospitalised mothers and neonates; nevertheless, when compared with the respective numbers for Switzerland (6/100'000 live births and 3/1000 live births for maternal and neonatal mortality rates, respectively), the extraordinary discrepancy becomes obvious.

Paediatrics – statistics

In addition to the substantial neonatal mortality, mortality rates for infants and children beyond one month of age are also high: over a three-month-period (October to December 2014), there were 25 deaths between 1 and 12 months of age, and 20 deaths between 1 and 5 years of age. Obviously, malnutrition and HIV/AIDS significantly contribute to this staggering toll.



Lecture on the physiological basis of neonatal resuscitation

EDUCATION

Neonatal Resuscitation Training

During our stay at the Rundu State Hospital, we taught both theory and practical aspects of neonatal resuscitation. The lecture and training sessions were repeated four times to facilitate participation of as many health care professionals as possible. We estimate that close to 100 people were trained.

Educational Sessions

- Neonatal resuscitation training (theory and practice): overall close to 100 people trained
- Case discussions on perinatal asphyxia, early-onset sepsis, hyperbilirubinaemia, hypoglycaemia, fluid management and nutrition: overall close to 50 participants

Neonatal case Discussions

The neonatal case discussions focused on neonatal asphyxia, early-onset sepsis, neonatal hypoglycaemia, hyperbilirubinaemia, and fluid management and nutrition of preterm infants. Thanks to the organisational skills and enthusiasm of Sibylle Wyss, a Swiss ICU nurse, who now has spent almost three years in Namibia on an INTERTEAM mission with her husband Christian (a teacher), the sessions were well attended by health care professionals despite their heavy work load: close to 50 were able to participate in the case discussions. Written feedback forms suggested that our efforts were highly appreciated.

Labour and Delivery Ward

- Unclear whether CTG is used
- High-tech resuscitation table (Dräger Resuscitaire®) cannot be used to its full capacity due to lack of compressed air
- No SpO₂ monitors are used during/ following resuscitation or support of transition
- Resuscitation material is incomplete (e.g. umbilical venous catheter set, adrenaline are missing)

Mother and her baby lying on mattress in hospital corridor shortly after delivery

Ward Rounds – Labour and Delivery Ward

Women in labour are kept in eight-bed rooms until shortly before the babies are born; often, additional mattresses are placed in the corridor to accommodate more women. Monitoring of mothers and foetuses seems very limited; it remained unclear to us if and when cardiotocography (CTG) is used. There is a resuscitation table in the delivery room but because of lack of compressed air it cannot be used to its full capacity (see below). Vacuum and suction catheters, pure oxygen and self-inflating bags and masks are available and largely in working order. However, oxygen cannot be blended and SpO₂ monitors are not used. The material necessary to place an umbilical venous catheter is not readily available.



Ward Rounds – Prem Unit

Prem Ward

- Only mode of respiratory support is administration of 100% oxygen by facemask
- CPAP devices cannot be used because no compressed air is available
- SpO₂ monitors are used intermittently and available sensors are not ideal for preterm infants
- No caffeine is available for the prevention and treatment of A&B spells

Prematurity, birth asphyxia, early-onset sepsis, respiratory distress and hyperbilirubinaemia are the major admission diagnoses in this unit. Due to infectious disease concerns, only inborn babies are admitted here; outborn neonates are cared for in the paediatric ward.

This neonatology unit is equipped with a variety of incubators that are solely used for temperature control in a non-servo mode; additional humidification is not used. Infants with respiratory distress are monitored intermittently (respiratory rate, transcutaneous oxygen saturation, SpO₂) and the only mode of respiratory support is pure oxygen from wall outlets administered by facemask at various flow rates; there are no low flow meters and no nasal cannulas. Only some of the SpO₂ sensors are appropriate for neonates. Caffeine is not available for the treatment of apnoea and bradycardia syndrome in preterm infants. Two nCPAP (nasal continuous positive airway pressure) devices cannot be used because compressed air (either from a wall outlet or from a cylinder) is not available. For the same reason, two sophisticated resuscitation tables (Resuscitaire®) are not used to their full capacity (i.e., vacuum, oxygen blender and CPAP are not used).

Maintenance of technical equipment is an important challenge. The person in charge explained to us that they are understaffed and no formal training is available.

Fluids and medications are only administered through peripheral venous catheters; some physicians reported that umbilical venous catheters are sometimes used in the smaller babies, but we did not see any such patients. Only glucose 10% and NEOLYTE® solutions are used, i.e. parenteral nutrition is not available. For neonates unable to feed on his or her own, enteral nutrition is provided by gavage or cup feeding (expressed mother's milk or formula milk). At the time of our visit milk fortifiers (i.e., Nestlé FM 85®) were out of stock and it was unclear when they would again become available.

Nurses and physicians were unfamiliar with most of the technical equipment; however, they were eager to learn and rapidly adopted some of our recommendations.



Cup feeding of near term infant

Intensive Care Unit

- There is no continuous monitoring (SpO₂, ECG)
- No central venous access, no parenteral nutrition
- No uniform approach in fluid management (hypotonic versus isotonic solutions)
- Children older than 6 years can be visited only twice per day

Ward Rounds – Intensive Care Unit

Both sick children and adults are admitted to the intensive care unit. Mechanical ventilators are used in adults (although we never saw a ventilated patient during our visit). They have built-in air compressors and can thus provide various fractions of inspired oxygen (FiO₂).

During our visit, a number of paediatric patients were hospitalised: a 6-year-old boy following cholecystectomy because of gall bladder perforation and chylascites thought to be due to Salmonella typhi infection, infants with severe dehydration, toddlers with upper and lower respiratory tract infections, as well as patients with severe malaria. It does not appear customary to continuously monitor the patients.

We saw no patients with central venous access. Surgical patients cannot benefit from parenteral nutrition and glucose is the only source of energy for those unable to digest any food.

Mothers and fathers can stay with their child (and provide a lot of their care) if the child is less than six years old; older children must stay alone and relatives can visit only from 3 to 4 o'clock and in the afternoon again from 6 to 7 o'clock in the evening.

Boy recovering after cholecystectomy
following gall bladder perforation



Compressed air must be available to allow full use of the resuscitation table



OBSERVATIONS AND SUGGESTIONS FOR IMPROVEMENT

Labour and Delivery Ward Equipment for Neonatal Resuscitation

Labour and Delivery Ward List of main suggestions

- Self-inflating bags equipped with PEEP valves (appendix, Fig. 1)
- Masks with a cushion rim inflatable with air (appendix, Fig. 2)
- Air-oxygen blenders (appendix, Fig. 3)
- Make compressed air available to allow the use of the Resuscitaire® resuscitation table (thorough instruction of its use is mandatory) (appendix, Fig. 4)
- Umbilical venous catheter and adrenaline sets
- Table with dosing instructions
- Designate personnel responsible for availability of properly functioning material

Observation: Some of the equipment needed during neonatal resuscitation is not readily available (e.g., umbilical venous catheter set, adrenaline). The self-inflating bags are not equipped with PEEP valves and only round silicone masks are in use. Although the hospital has acquired two sophisticated resuscitation tables (Dräger Resuscitaire®), lack of compressed air severely limits their use.

Suggestions for improvement: It is important that all the material required for neonatal resuscitation is readily available in the delivery rooms and in functioning order. The self-inflating bags should be equipped with PEEP valves. Masks with a cushion rim that is inflatable with air make achieving a good seal easier and should be given preference. Once compressed air becomes available (preferably from a wall outlet), the use of air-oxygen blenders would allow proper dosing of oxygen; currently the FiO_2 can only be regulated by the flow rate and removal/attachment of an oxygen reservoir. Compressed air is also a prerequisite for the use of the high-tech resuscitation tables: the oxygen blender, the suction device, and the built-in continuous positive airway pressure (CPAP) system, which can be used in a manual and an AutoBreath® mode, all require a compressed air source. Prior to its use, thorough training of all staff involved in the care of neonates would be required.

Oxygen therapy should be standardized and unstable patients should be monitored continuously



NEONATAL INTENSIVE CARE UNIT (PREM UNIT)

Respiratory Support – Oxygen

Prem Unit

List of main suggestions

- Protocol for oxygen therapy (incl. SpO₂ targets)
- Supplemental oxygen should be administered through soft nasal cannulas rather than the rigid facemasks
- Flow meters that allow administration of low flows (facilitating dosing of oxygen)
- Availability of compressed air would allow the use of air-oxygen blenders
- Enhanced use of SpO₂ monitors (continuous versus intermittent monitoring)

Observation: The only way to support neonates with respiratory distress is free-flow pure oxygen (wall outlets). Oxygen is administered by facemasks. Dosing is only possible by varying the flow rate, as no air-oxygen blenders are available. Transcutaneous oxygen saturation (SpO₂) is only measured intermittently. The nurses are not intimately familiar with the various SpO₂ monitors. Finally, the sensors are not well adapted to smaller neonates.

Suggestions for improvement: There are several possibilities for improvement. First, there should be a protocol for oxygen therapy (indications, way of administration, dosing instructions). Second, as long as compressed air wall outlets and air-oxygen blenders are not available, it would be important to have flow meters that can be regulated down to very low flows (e.g., 0.1 l/Min); this not only allows for more precise dosing but also reduces the consumption of oxygen and therefore costs. Third, neonates with significant respiratory distress and with a significant oxygen requirement should be monitored continuously with pulse oximetry. Fourth, oxygen should be administered through soft nasal cannulas instead of the large facemasks in use.

Respiratory Support – Infant Positioning

Observation: In general, neonates are kept in a supine position, frequently with elevation of the upper body; this is done because of the still widespread belief that such a position avoids gastro-oesophageal (GE) reflux, which in turn is thought to lead to aspiration and apnoea and bradycardia (A&B) spells.

Suggestions for improvement: Frequently, gas exchange can be improved when infants are put in a prone position. The reason for this is not entirely clear, but many NICUs

routinely use prone positioning in unstable neonates. The concerns that GE reflux and aspiration are responsible for A&B spells have largely been disproven.

Preterm infant with severe respiratory distress improves on intermittent mask CPAP (the patient died two days later)



Respiratory Support – Nasal Continuous Positive Airway Pressure (nCPAP)

Observation: As mentioned above, the only therapy available for neonates with respiratory distress is free-flow pure oxygen. It is well known that the use of nasal continuous positive airway pressure (nCPAP) can be highly effective in the treatment of a variety of neonatal lung disorders. There are two devices in the Prem Unit (Fabian from Accutronic, Infant Flow from Viasys) capable of delivering nCPAP; unfortunately, they cannot be used because compressed air is not available.

Suggestion for improvement: The introduction of nCPAP would be an important step towards improved care for neonates with respiratory distress. It is much easier to learn than invasive mechanical ventilation. It does, however, require considerable nursing skills. There are numerous CPAP devices; the cheapest among these are bubble CPAP machines (i.e., the continuous positive airway pressure is generated by flow and placing the expiratory tube under 5–8 cmH₂O). Researchers at Rice University in Houston have developed a low-cost device that has now become available commercially (Hadleigh Health Technologies).

Apnoea and Bradycardia (A&B) Spells in Preterm Infants

Observation: At present, preterm infants do not receive Caffeine and are not monitored for A&B spells.

Suggestion for improvement: Caffeine should be introduced for preterm infants with an estimated gestational age of less than 32–34 weeks. Dosing is as follows: a loading dose (LD) 20 mg/kg and a maintenance dose (MD) of 5–10 mg/kg q24 hours (source: NeoFax 22nd Edition (2009), pages 256–257). If appropriate preparations are available, caffeine can be administered intravenously or orally. Some infants have less A&B spells

Prem Unit

List of main suggestions (continued)

- Use intermittent prone positioning in neonates with respiratory distress
- Once oxygen therapy has been refined, the introduction of low-cost bubble CPAP should be considered
- A commercial product (Pumani® bCPAP) has recently become available at a cost of 800 USD (appendix, Fig. 5, 6)
- Use caffeine citrate at appropriate dosing (LD 20 mg/kg, MD 5–10 mg/kg q 24 hours)
- Once CPAP devices become available, they can be used to treat obstructive and mixed A&B spells
- Consider use of breast pumps
- Breast milk fortification (e.g., Nestlé FM 85) for infants with a birth weight less than 1500 g

when put in a prone position. If CPAP devices would become available (see above), they can be very effective for the treatment of obstructive and mixed A&B spells.



Gavage feeding by gravity of a preterm infant

Prem Unit

List of main suggestions (continued)

- Heel prick devices that cut the skin rather than puncture it should be introduced
- Guidelines for pain control should be developed and implemented
- Obtain lightweight reclining chairs to facilitate Kangaroo care
- Assess urine output by weighing diapers
- Weigh infants daily
- Assess milk intake by weighing infants before and after breastfeeding if weight gain is not satisfactory
- Use warming beds instead of incubators in near term and term infants

Breast-feeding and Enteral Nutrition

Observation: Apart from provision of 10% dextrose and NEOLYTE® solutions, there is no parenteral nutrition available. For infants who are too weak to breast feed, fresh expressed breast milk (EBM) is used. EBM is not fortified because Nestlé FM 85® is not available.

Suggestion for improvement: Given the fact that no parenteral nutrition is available, optimization of enteral nutrition is very important. Preference should be given to breast milk; to support lactation, mothers may have to be encouraged to express their breast milk at the bedside of their infants. They should also express their breast milk regularly (i.e., also at home) even if this milk cannot be appropriately stored and must be discarded. The advantages of breast pumps should be discussed with lactation consultants familiar with low- and middle-income countries. For infants with birth weights of less than 1500 g, the use of a human milk fortifier should be re-introduced (potential contacts: Prof. Riccardo Pfister, Geneva; Nestlé, Lausanne).

Care of Preterm Infants – General Aspects

Observation: Blood samples are obtained by heel pricks with the use of needles; often, babies need to be pricked repetitively. Non-pharmacological or pharmacological pain control is not used. Comfortable chairs for Kangaroo care are lacking. Infants are not weighed regularly and urine output (e.g., by measuring the diapers) is not recorded. Relatively large and mature neonates are put in incubators; they could easily be nursed in cheaper warming beds. Nurses are not fully familiar with the operation of the incubators, SpO₂ monitors and other technical equipment.

Suggestion for improvement: A protocol for neonatal pain control should be developed; it should include non-pharmacological interventions (i.e., oral glucose solutions,

facilitated tucking) as well as the use of drugs (paracetamol, opioids). Lightweight, inexpensive reclining chairs should be provided to facilitate Kangaroo care. Sick neonates should be weighed on a daily basis to help calculate their fluid requirements; similarly, urine output should be assessed by weighing diapers. Warming beds are cheaper than incubators and often sufficient to care for near term and term infants. Education of the nurses must be a top priority.

Encourage mothers to express breast milk
and provide Kangaroo Care



Prof. Thomas M. Berger, MD
NEO FOR NAMIBIA
Helping Babies Survive

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Figure 1

Resuscitation
Self-inflating bag with PEEP valve

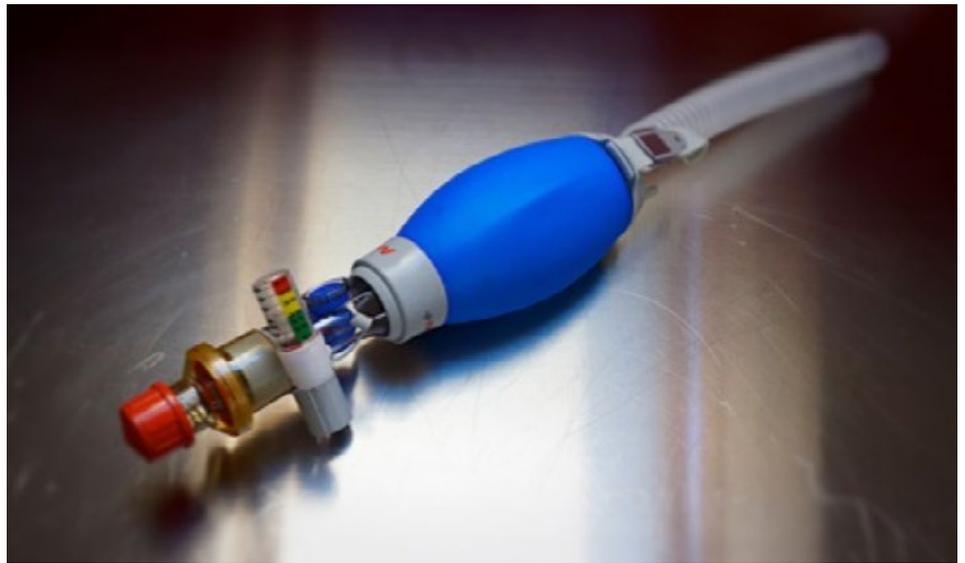


Figure 2

Resuscitation
Mask with cushion rim inflatable with air



Figure 3

Oxygen Therapy
Air-oxygen blender to allow dosing of O₂



Figure 4

Resuscitaire®
Built-in continuous flow CPAP system



Figure 5

ResPumani® bCPAP
Low-cost bubble CPAP system



Figure 6

Pumani® bCPAP
Uses internal pumps to generate air flow



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Etosha National Park
Elephants on their way to a water hole



Etosha National Park
Elephant at the border of the Kavango River



Etosha National Park
Lion King



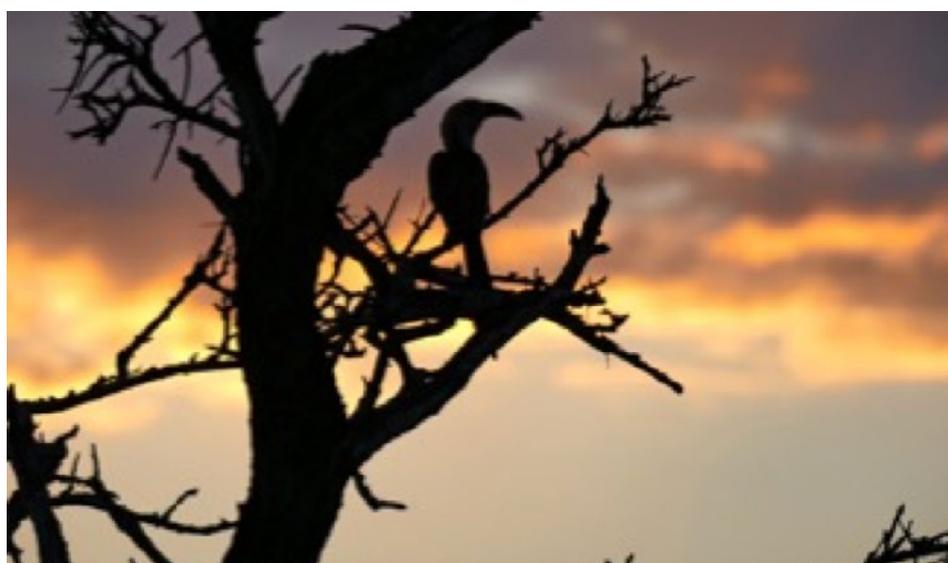
Etosha National Park
A herd of sprinbok



Etosha National Park
A mixed group of warthog, zebra and water-buck



Etosha National Park
Evening at the Kavango River



Pediatric Ward

Patient severe CHD (cor triatriatum)



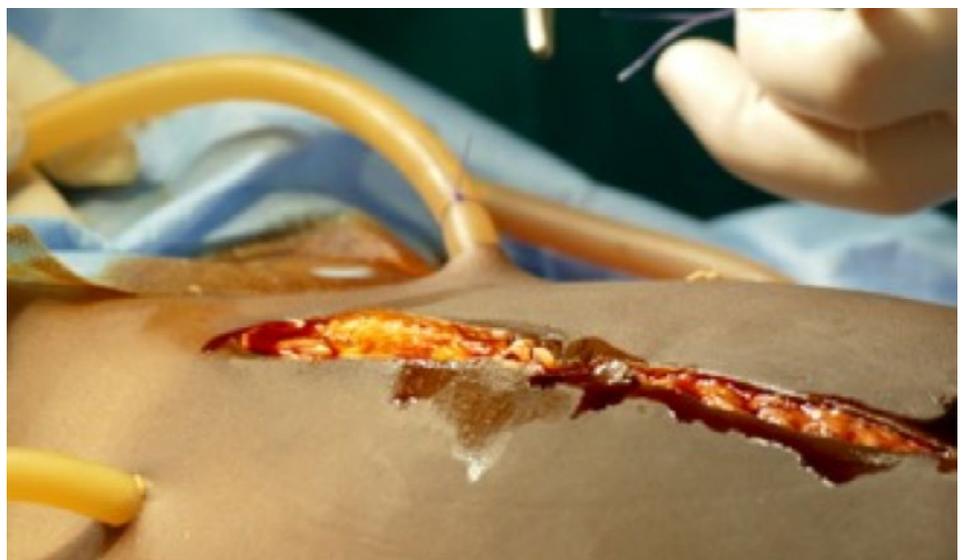
Etosha National Park

Toddler with croup syndrome



Operating Theatre

Abdominal drains following cholecystectomy



Prem Unit

Term infant undergoing phototherapy



Prem Unit

Preterm infant with new fixation of NG tube



Prem Unit

Ward rounds with colleague from Cuba



Education

Training with manikin



Education

Training of UVC placement



Neonatology

Explanation of monitoring equipment





The future

The children deserve that we care. Their mothers will do everything to help us succeed.

Thomas & Sabine Berger
