NEO FOR NAMIBIA
HELPING BABIES SURVIVE

MISSION REPORT

Mission 2018 – 1

April 10, 2018 to May 2, 2018

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NEO FOR NAMIBIA
HELPING BABIES SURVIVE

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1. INTRODUCTION

As planned after our visit in November 2017, we returned to the Rundu State Hospital to analyze how our suggestions from previous visits have been implemented, to identify obstacles that remain and to analyze what impact our interventions might have had. This time the team consisted of Prof. Thomas M. Berger, MD, his wife Sabine Berger, RN and Marcel Bösch, Assistant.

Thanks to many people who have made donations to our non-governmental organization NEO FOR NAMIBIA – Helping Babies Survive, we were able to support ongoing improvements by bringing additional equipment (3 Masimo® Rad-5 pulse oximeters with 40 sensors, 1 JM-105, a device to measure transcutaneous bilirubin concentrations donated by Dräger) and consumables (100 umbilical venous catheters (UVC) with distance markings, 250 infusion connectors, replacement parts for the Pumani® bCPAP machines, 20 anatomically shaped inflatable cushion rim face masks, dressing material) to the Rundu State Hospital (estimated total value of approximately NAD 65'000.00 or CHF 5'100.00).

Once again, we enjoyed meeting familiar doctors and nurses who welcomed us with big smiles on their faces. We were pleased to receive ongoing support from the Health Minister, Dr. Bernard Haufiku, and his staff.

2. MAIN MISSION GOALS

Our main mission goals were a) to refresh knowledge on neonatal resuscitation trying to reach as many obstetricians and midwives as possible, b) to once again review diagnoses and management of common neonatal disorders, c) to supervise and reinforce the use of the Pumani® bCPAP device, d) to support writing of comprehensive and sound fluid and nutrition orders, and e) to work side by side with the local health care professionals in the Prem Unit. In addition, we wanted to analyze data from the newly established CPAP registry, as well as basic statistical data from the Prem Unit and the Maternity Ward.

While this was the 5th mission for Sabine and Thomas Berger, their friend and colleague visited Namibia for the first time. Marcel Bösch is a banker by trade, and he is interested in supporting fundraising efforts for NEO FOR NAMIBIA. Despite the fact that he does not have a medical background, he proved to be very helpful in various circumstances; he was immediately well liked by both the medical staff and the mothers in the Prem Unit.

3. EDUCATIONAL SESSIONS

A total of 6 morning lectures (from 08:00 to 08:45 am) were organized for the pediatricians (Dr. Isha Kamara, Dr. Kundai Mapanga, Dr. Odalys Alfonso, Dr. Amarilys Castro, Dr. Chantal Nyembo). Another 6 lectures for nurses were given as lunch sessions (from

12:00 to 01:30 pm) with an average attendance of 15 people. In addition, 2 Grand Round presentations were organized for Friday, April 13, 2018 and Friday, April 20, 2018.

Two neonatal resuscitation training sessions were organized in the Maternity Ward to facilitate participation of midwives who were on duty; again, both the theoretical background and manual skills were taught.

The program was complemented by brief interprofessional teaching sessions during regular ward rounds in direct context with current patient issues.

3.1 Lectures

The formal lectures (Fig. 1) covered neonatal resuscitation, neonatal respiratory distress and neonatal respiratory support (oxygen therapy, bCPAP, oxygen saturation monitoring), perinatal asphyxia, fluid and nutrition therapy, hyperbilirubinemia, apnea of prematurity, and risks and benefits of various forms of IV access.

The two Grand Round presentations covered the physiology and pathophysiology of neonatal adaptation and pediatric fluid therapy.

Fig. 1. A total of 12 lectures on common neonatal problems were given to provide a basic theoretical background for neonatal care.

3.2 Practical sessions

Small group sessions were used to train the practical aspects of neonatal resuscitation and the calculation and writing of detailed and individualized fluid and nutrition orders for sick neonates. We reemphasized that it is important that all physicians comply with the new system and nurses provide the necessary information (incl. daily weight, actual oral and parenteral intake) during rounds.

4. WORK ON THE WARDS

4.1 Prem Unit

4.1.1 Working side-by-side with the local health care professionals

During our 18-day-stay in Rundu, we worked every day (including the weekends) side-by-side with the physicians and nurses of the Prem Unit. We are convinced that this type of educational experience is most valuable.

Sabine Berger supported the nursing staff in direct patient care and made numerous suggestions to improve work flows. Her pragmatic approach and calm in difficult situations were highly appreciated by all of the nurses (Fig. 2). Prof. Thomas M. Berger was delighted to get the opportunity to work with Dr. Kundai Mapanga, a talented and dedicated second year resident, who was eager to learn and rapidly picking up new ideas (Fig. 3).

Fig. 2. Sabine Berger, a pediatric nurse, taking care of a 1140 g preterm infant on bCPAP.

Fig. 3. Prof. Thomas M. Berger assisting Dr. Kundai Mapanga on ward rounds in the Prem Unit.

4.1.2 Experience with bCPAP

During our stay, 31 patients were admitted to the PremUnit. Of these, 6 were put on CPAP for respiratory distress; all but one of them were successfully weaned and are likely to survive (3 were discharged and 3 were stable off supplemental oxygen, but still hospitalized when we left).

One death occurred in a very low birth weight infant who was put on CPAP when he deteriorated on nasal cannula oxygen eight hours after admission. This case was discussed with both physician and nursing staff to emphasize the importance of an appropriate CPAP strategy (1, 2): particularly in preterm babies (i.e. very low birth weight infants), early use of CPAP is of paramount importance to prevent lung collapse (Fig. 4). Even when oxygen saturations are in the normal range on low flow supplemental oxygen (e.g., 0.5 l/min), CPAP should be started without delay if other signs of respiratory distress, such as retractions, flaring, grunting and/or are present. Chest X-rays should be obtained in all patients with moderate to severe respiratory distress to determine the underling cause.

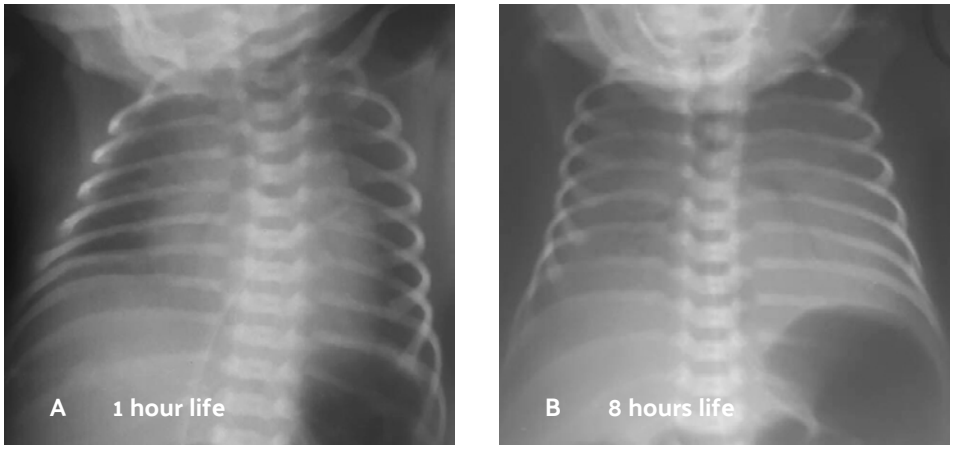

Fig. 4. Preterm infant with only mild respiratory distress and low lung volumes on CXR on admission (A) progressed to severe hyaline membrane disease (B) within eight hours and died (this infant was admitted after we had left Rundu).

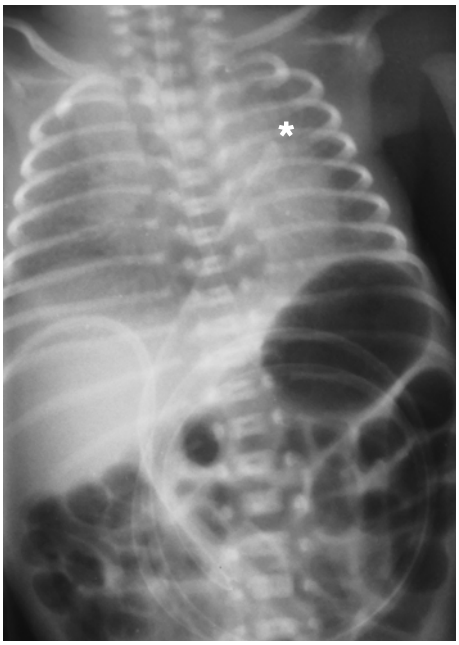

Fig. 5. We emphasized that a babygram must be obtained whenever an umbilical venous catheter (UVC) is inserted: malposition of this UVC (asterisk: tip in left upper pulmonary vein) was only recognized with considerable delay.

In addition, a babygram must be obtained in all patients in whom umbilical venous catheters are inserted to check for proper position (Fig. 5). To facilitate viewing of X-rays, a view box was purchased and mounted in the Prem Unit. A structured approach to the interpretation of CXR was suggested using the RIPE & ABCDE approach (**R**otation-**I**nspiration-**P**icture-**E**xposure & **A**irway-**B**reathing-**C**irculation-**D**iaphragms-**E**xternal) (Fig. 6).

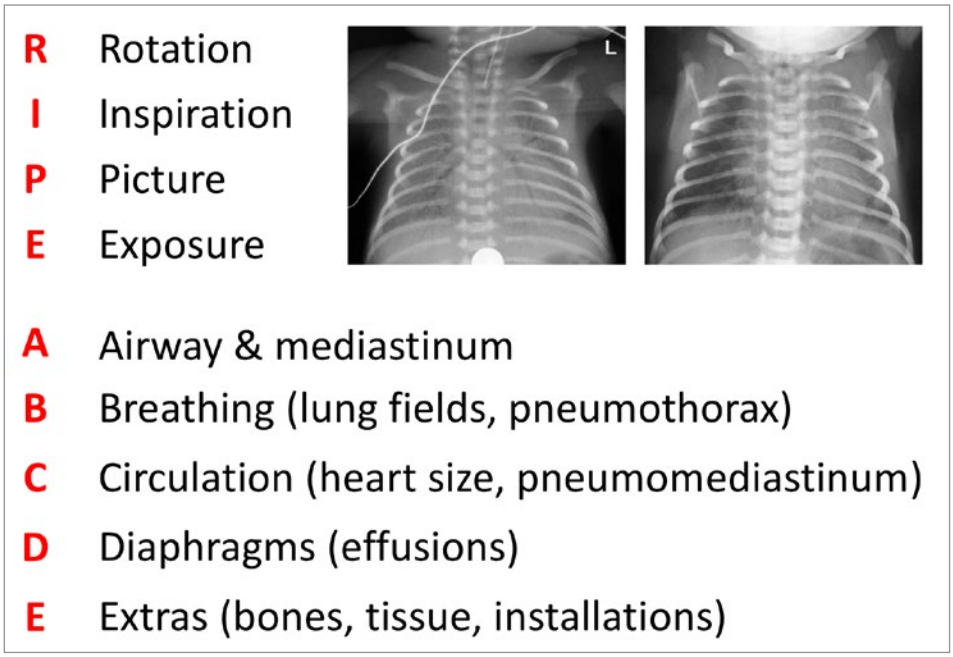

Fig. 6. RIPE-ABCDE: structured approach to the interpretation of CXR (posted next to the view box in the Prem Unit).

4.1.3 Progress is visible but some deficiencies remain

Overall, we were very pleased to see that the nurses had become comfortable and proficient using both the CPAP devices and the pulse oximeters (Fig. 7–9). Babies get weighed daily and weights are available for rounds. Phototherapy is used appropriately and normothermia is established and maintained in most infants following admission.

Fig. 7. Nurses have become comfortable with the technical aspects of the use of Continuous Positive Airway Pressure (CPAP) and pulse oximetry: Eila Naurenge, RN, is adjusting the CPAP pressure by filing water into the bottle.

Fig. 8. CPAP strategies need to be improved; to avoid significant delays, nurses must be given the authority to start CPAP early in infants with respiratory distress even before a doctor has evaluated the patient.

Fig. 9. Meticulous care is of paramount importance when caring for the smallest and most vulnerable patients.

On the other hand, a number of aspects of routine care remain unsatisfactory and render daily work more difficult than necessary:

- Laboratory investigations are very limited (blood glucose (the only POCT available), FBC: full blood count, CRP: C-reactive protein, total and direct bilirubin, blood type and direct antibody test) (3)
- The results of laboratory tests are frequently only available after many hours or on the next day; in addition, samples clot on the way to the laboratory or get lost
- The delay for emergency X-rays is often considerable (there is only one portable X-ray machine for the entire hospital)

- Intermittent lack of basic, essential material is not uncommon; during our stay, the following items were at times «out of stock»: diapers, non-sterile gloves and preterm formula

- The value of Kangaroo Care must be reemphasized: many stable preterm infants spend too much time in incubators and too little time with their mothers (4)!

- Communication between Obstetrics and Pediatrics must be improved: often, information on infants who get admitted from the delivery room is incomplete, rendering an appropriate assessment of the patient's condition difficult

Fig. 10. Kangaroo Mother Care is good for both mom and baby.

Fig. 11. Skin-to-skin contact promotes bonding, helps to maintain a normal body temperature and increases the chances of successful breastfeeding.

4.1.4 High incidence of hypothermia on admission to the Prem Unit

Many sick babies who are admitted to the Prem Unit are severely hypothermic because they spend too much time in labor and delivery without adequate supervision and care. This issue needs to be addressed urgently: as soon as it is clear that a baby needs to be admitted, the patient should be brought to the Prem Unit without delay. The practice of keeping babies in labor and delivery until intravenous access has been gained and a pediatrician has seen the baby must be abandoned as soon as possible!

On admission to the Prem Unit, the baby should be placed on the warming table and oxygen saturation monitoring and provision of supplemental oxygen (if needed) must be started immediately. Then peripheral venous lines or umbilical venous catheters can be inserted, and admission labs can be obtained. As mentioned above, babies with significant respiratory distress benefit most from early CPAP. Once the babies have been stabilized, X-rays should be obtained in babies with significant respiratory distress and those in whom a UVC has been inserted.

4.1.5 Laminated reminders – Unité de Doctrine

We decided to create simple laminated reminders (Fig. 12–15) to reinforce our suggestions. Together with the nursing staff, we put them up in the Prem Unit (Fig. 16). We hope that they will lead to a more uniform approach to the care of sick neonates (unité de doctrine). We encouraged everybody to use them as reminders for health care professionals who do not act accordingly.

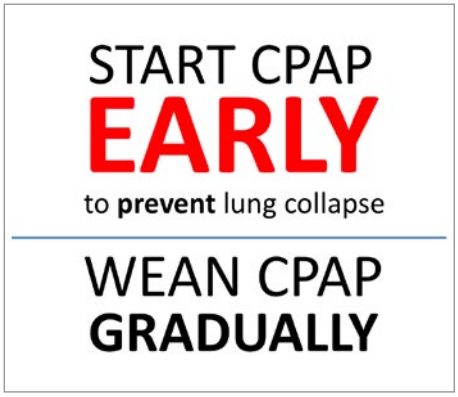

Fig. 12. Apart from the technical aspects of CPAP use, appropriate strategies must be followed to maximize the benefit of this form of respiratory support: in preterm babies with hyaline membrane disease, CPAP must be started early.

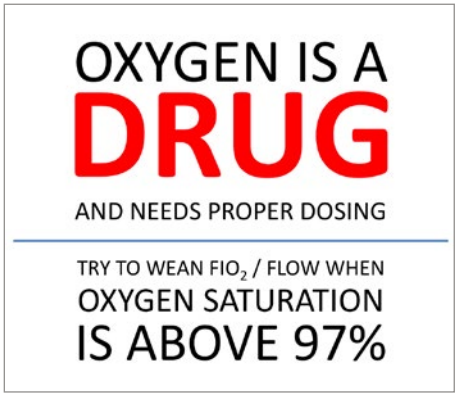

Fig. 13. Monitoring of oxygen saturations is important for all infants who receive supplemental oxygen (either by nasal cannula or by CPAP) to minimize oxygen toxicity; this is particularly important in preterm infants.

Fig. 14. The practice of automatically putting sick babies NPO (nil per os) should be abandoned because it is harmful: at least minimal enteral nutrition (also called gut priming) should be started in most of these infants.

Fig. 15. Kangaroo Mother Care (i.e., skin-to-skin contact) provides multiple benefits; it should be reinforced by encouraging mothers to spend as much time as possible with their infants.

Fig. 16. Laminated reminders were placed in the Prem Unit to promote a uniform approach to sick infants.

4.1.6 JM-105 – transcutaneous bilirubin measurements

We were able to bring a Dräger JM-105, a device that allows transcutaneous (tc) measurement of bilirubin levels. This screening tool was donated by Dräger, Switzerland. During our stay, we noted some significant discrepancies between tc and lab values. Therefore, we asked the nurses from the Prem Unit to document both the transcutaneous and the blood bilirubin levels in a booklet to allow us to assess the usefulness of the new device.

4.2 High Care Unit

One of the Pumani® bCPAP device is occasionally used in the High Care Unit (the hospital's intensive care unit for adults and children); unfortunately, we have not been able to track them retrospectively, and the CPAP registry forms are not used.

During our stay, a 5-month-old infant with severe anemia (hemoglobin 19 g/l) and severe respiratory compromise arrived in casualty. Peripheral access was difficult but ultimately successful after shaving the head; at our suggestion, the patient was immediately transferred to High Care and started on CPAP (Fig. 17–18). After blood transfusion, the infant's condition rapidly improved and he was taken off CPAP. According to the local physicians, herbal poisoning was thought to have caused the anemia.

Fig. 17. A five-month-old infant wit severe anemia, hypothermia and respiratory distress after admission to the High Care Unit.

Fig. 18. Infant with severe anemia and respiratory distress who failed to maintain normal oxygen saturations on nasal cannula oxygen could rapidly be stabilized on bCPAP.

5. STATISTICS

During our fifth visit to the Rundu State Hospital, we were interested to get some statistical information on the number of admissions and mortality rates over time, both for the Prem Unit and the Maternity Ward. In addition, we reviewed the CPAP registry to analyze the experience of the first few months of CPAP use.

5.1 Maternity Ward statistics

Based on the review of two delivery room (DR) log books, we were able to evaluate the deliveries over a period of 100 days:

- 1330 deliveries (extrapolated: 4855/year)
- Macerated stillbirths 12 (extrapolated: 44 / year) and fresh stillbirths 16 (extrapolated: 58/year), resulting in a total number of stillbirths of 28 (extrapolated: 102/year); therefore, an estimated 2.1 % of all deliveries result in stillbirths
- Only 3 deliveries were reported as abortions (extrapolated: 11 / year)
- In addition, only 1 DR room death following live birth was recorded (extrapolated: 4 / year)
- A total of 98 newborns were admitted to the Prem Unit (extrapolated: 358 / year); therefore, approximately 7.4 % of all liveborn infants are reportedly admitted to the neonatology ward

It was difficult to assess data quality. At least with regards to the number of infants admitted to the Prem Unit, we found a significant discrepancy between the DR log book and the Prem Unit admission book: annually, there are approximately 630 admissions to the Prem Unit (see below), a number that largely exceeds the one recorded in the DR log book (n = 358).

Some other findings are also remarkable: given the circumstances, the rate of DR deaths following live births seems very low (4/year or 0.08 %). It is conceivable that some DR deaths after livebirth were classified as fresh stillbirths. It will be important to review the data once again over a longer period of time, and to discuss the findings with the local doctors and midwives.

5.2 Prem Unit statistics

5.2.1 Historical data

In 2015, Sibylle Wyss, a Swiss nurse, provided us with some hospital statistics. According to this data, there were about 5000 deliveries and 100 neonatal deaths annually at Rundu State Hospital. Assuming a similar number of Prem Unit admissions as in 2017 (the precise number is not available), this corresponds to a mortality rate of 15.9 %

(however, it is not clear whether all of these deaths occurred in the Prem Unit, some babies may have dies in the High Care Unit) (Fig. 19).

In 2016, we analyzed the Prem Unit admission book for the first time. Based on data recorded from January 1, 2016 to September 26, 2016, we estimated that there would be 85 deaths among 745 admissions to the neonatology ward (mortality rate 11.4 %) (Source: Mission Report – Mission 2016, September 21–25, 2016) (Fig. 19).

5.2.2 Most recent data

Sabine Berger and Marcel Bösch collected data on all admissions to the Prem Unit over a 6-month-period from October 1, 2017 to March 31, 2018 (Fig. 19):

- 315 admissions (extrapolated: 630/year)
- Of these, 42 (13.3 %) were very low birth weight (VLBW) infants (i.e., birth weight < 1500 g) (extrapolated: 84/year), including 8 (2.5 %) extremely low birth weight infants (i.e., birth weight < 1000 g) (extrapolated 16/year)
- There were 26 deaths (mortality rate 8.3 %) with 20 (76.9 %) related to prematurity, 5 (19.2 %) related to perinatal asphyxia with hypoxic ischemic encephalopathy (HIE) and 1 (3.9 %) related to a congenital malformation (no details provided); therefore, if the current mortality rate remains unchanged, 52 deaths occur annually
- The mortality rate of VLBW infants was 35.7 % (15/42) and the mortality rate of ELBW infants was 62.5 % (5/8)

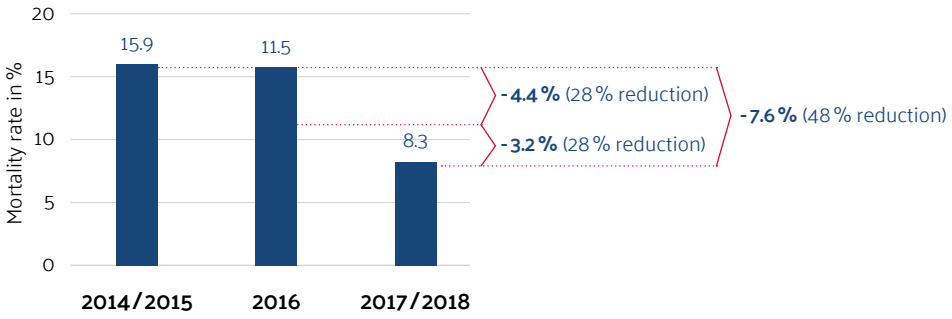

Fig. 19. Mortality rate of neonates admitted to the Prem Unit in three different time periods: from 2014/15 to 2017/18, the mortality rate decreased by almost 50 % (note: the figures for 2014/15 are estimates only).

5.3 CPAP registry

The first three Pumani® bCPAP devices were introduced at Rundu State Hospital in July 2017. We requested that a registry form should be completed for every patient who was put on CPAP. Retrospectively, we cannot be sure whether the registry is complete. Over the first 9 months, registry data of 34 patients has become available. Obviously, health care professionals were initially hesitant to use the new machine (Fig. 20). During our visit in November 2017, theoretical and practical training sessions were repeated; in addition,

we were able to assist in putting several patients on CPAP. Since then, 4–10 patients were treated with CPAP every month (with a notable exception in Mach 2018 when only one patient was registered, likely because Dr. Isha Kamara (who is most familiar with the device) was on leave) (Fig. 20). The patient population demographics are shown in Table 1.

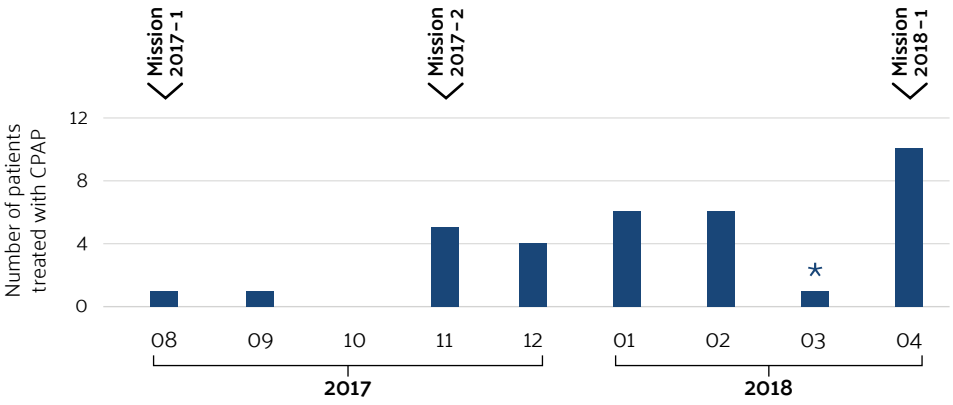

Fig. 20. Number of patients treated with bCPAP per month (*: pediatrician with CPAP experience on leave).

The median birth weight was 1640 g (range 790–4170 g) with an estimated median gestational age of 32 weeks (range 26–40 weeks). There was a total of 126 CPAP days with a median duration of CPAP support of 2 days (range 1–20).

CPAP registry (01.08.2017–28.04.2018)	
Number of patients registered, n	34
Birth weight in g, median (range)	1640 (790–4170)
Estimated GA in weeks, median (range)	32 (26–40)
CPAP days, total	126
Duration of CPAP support in days, median (range)	2 (1–20)
Documented air leak complications, n (%)	2 (6)
Survival rate in %	61.8

Table 1. Patient characteristics, CPAP days, CPAP duration and outcome of patients recorded in the CPAP registry between August 20, 2017 and April 28, 2018.

Overall, 21 patients survived (survival rate 61.8 %). The smallest survivor had a birth weight of 990 g and an estimated gestational age of 30 weeks. Of the 14 infants who died, 10 were born prematurely and diagnosed with hyaline membrane disease (however, it is unclear whether chest X-rays were obtained in all of them). Initiation of CPAP was delayed in at least 3 of these patients. Another 2 deaths occurred in term or near-term infants with hypoxic-ischemic encephalopathy (HIE) stage III, and 1 death was attributed to early-onset sepsis.

Thus, when analyzed retrospectively, CPAP support was not indicated in 2 patients (HIE stage III, both died) and initiated with undue delay in 3 patients (preterm infants with

hyaline membrane disease, all died). This observation illustrates the fact that appropriate strategies for the use of CPAP must be reemphasized.

5.4 Significant improvements in survival

Even though the quality of the analyzed data is difficult to assess, it still appears likely that the mortality rate of neonates admitted to the Prem Unit has decreased significantly over the past 3 years (Fig. 19). Assuming an average of 650 admissions per year, there may be as many as 54 deaths less in 2017/18 compared to 2014/15, equivalent to a 50 % reduction in the mortality rate.

Since our first visit in 2015, a number of changes have gradually been implemented in the Prem Unit. It is likely that these have contributed to the significant decrease in mortality rate. Table 2 highlights some of these changes and the degree to which these are used.

Suggested changes	Degree of adherence
Obtaining daily weights in all infants in the Prem Unit	+++
Introduction of minimal enteral nutrition	+
Facilitating Kangaroo Mother Care (folding chairs, tube cloths)	+
Using orogastric rather than nasogastric feeding tubes in infants with respiratory distress	+++
Positioning of sick babies (use of prone positioning)	++
Use of CRP values to guide antibiotic therapy	+
Improved documentation of respiratory support (nasal cannula oxygen: l/min rather than + or -)	+++
Oxygen saturation monitoring	++
Introduction of Continuous Positive Airway Pressure (bCPAP)	++
Obtaining Chest X-rays in infants with respiratory distress	+
Obtaining babygram after UVC insertion	++
Writing structured fluid and nutrition orders	++
Structured ward rounds, uniform approach	+
Routine use of caffeine in all infants < 34 weeks of gestation	+++
Prevention of hypothermia in the delivery room	-
Uninterrupted supply chain for consumables	+
Improve communication between Obstetrics and Pediatrics	-

Table 2. List of suggested interventions to improve neonatal care at Rundu State Hospital (- not yet implemented; + used occasionally; ++ used commonly; +++ used regularly).

These changes would not have been possible without the support of Dr. Isha Kamara, an experienced and dedicated pediatrician who joined the physician staff in December 2016. Her tireless efforts to implement important changes have been instrumental for the progress made.

6. FAREWELL – WE WILL COME BACK!

We were delighted to see the progress made (Fig. 21, 22). The day before our departure, Dr. Mapanga, the Prem Unit nurses and the mothers surprised us with a farewell song and some presents (Fig. 23). We were very touched and promised to come back and continue our efforts.

Fig. 21. Once the acute phase of their illness is over, the babies become «feeders & growers» and move into a calmer corner of the unit: the mothers feed their babies through a nasogastric tube.

Fig. 22. «Feeders & growers»: once they feed well on their own, they are ready for discharge.

Fig. 23. On the day before our departure, the nurses and mothers gathered to bid us farewell: even though we could not understand the words, their song went right into our hearts!

7. MEETING WITH THE HEALTH MINISTER

We were fortunate to meet the Health Minister, Dr. Bernard Haufiku, at the Rundu State Hospital. We were able to demonstrate our work in the Prem Unit and to show the first estimates of the impact of our work (see above). We were pleased to see that the Minister understood the potential impact of our work and are confident that he will continue to support our project.

We again informed the Minister that NEO FOR NAMIBIA – Helping Babies Survive would be interested in supporting the opening of the new maternity and neonatology unit. Since our interventions seem to have a significant impact, we are also interested in expanding our educational efforts to other hospitals. While this would require local assessments, training could possibly be centralized at Rundu State Hospital (see below: Neonatology Training Center).

8. NEXT STEPS

8.1 Mission 2018-2

Continuation and consolidation of our efforts at Rundu State Hospital remain a priority for 2018. We plan to return to Rundu in September of this year. We hope that both Flurina Prevost, RN, and Deborah Gubler, MD, will have an opportunity for a first visit to meet with local health care professionals. We will purchase two more Pumani® bCPAP machines (to get to a total of 5 machines) and additional pulse oximeters (2 for the Prem Unit and 2 for Labor and Delivery). We also promised to purchase intraosseous needles that can be used in Casualty when live saving intravenous access cannot be obtained.

8.2 Minimal Neonatal Data Set (MNDS) and CPAP registry

To better document the effects of various interventions, a minimal neonatal dataset (MNDS) should be established (Dr. Isha Kamara is in the process of developing such a database). We also realized that the CPAP registry must be improved, and the registry form has been modified to facilitate review. We are happy that Dr. Kundai Mapanga volunteered to provide us with monthly reports. We can thus analyze CPAP cases regularly and provide rapid feedback.

In the future, detailed analysis of all Prem Unit deaths should be undertaken (including a review of the medical record, laboratory results and imaging studies) to determine the precise causes of death. This might help us to further improve the care of these vulnerable patients.

8.3 Neonatology Training Center (NTC)

As outlined in previous mission reports, NEO FOR NAMIBIA – Helping Babies survive will focus on neonatal and pediatric intermediate and intensive care bundles. Preliminary data suggests that these interventions are successful (see above) and expansion of the program to cover other hospitals is desirable.

It is conceivable that a Neonatology Training Center (NTC) could be established. Visiting physicians and nurses from other hospitals could then be trained at Rundu State Hospital by experienced local staff and the NEO FOR NAMIBIA – Helping Babies Survive Team. Such a project could well be developed in conjunction with the opening of the new maternity and neonatology unit (which would require the acquisition of additional equipment, such as open units, cot beds, phototherapy units, additional monitoring equipment, etc.).

8.4 Avoiding brain drain

It will be crucial to make sure that skilled health care workers stay in Rundu and that their contracts are renewed. Without their support, further success of the program would be jeopardized. We therefore urge Dr. Bernard Haufiku and his Ministry of Health and Social Services to pay close attention to this critical issue.

Prof. Thomas M. Berger, MD
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Helping Babies Survive

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