REPORT OF THE FIRST
MÉDECINS SANS FRONTIÈRES
PAEDIATRIC DAYS 2016

23-24 September
STOCKHOLM

MEDECINS
SANS FRONTIERES

PAEDIATRIC DAYS
STOCKHOLM 2016
CONTENT

ACRONYMS .................................................................................................................. 4
ORGANISATION COMMITTEE 2016 .................................................................................. 5
SCIENTIFIC COMMITTEE 2016 ....................................................................................... 5
EXECUTIVE SUMMARY .................................................................................................. 6
CRITICAL CARE AND SHOCK MANAGEMENT ............................................................... 6
SICKLE CELL – A NEGLECTED DISEASE ..................................................................... 6
WELCOME BACKGROUND AND OBJECTIVES ................................................................ 8
WELCOME GREETINGS AND PRESENTATIONS .............................................................. 9
CRITICAL CARE AND PAEDIATRIC SHOCK TREATMENT POST FEAST TRIAL ............. 10
CRITICAL CARE IN FIELD PROJECTS ......................................................................... 10
SEPSIS AND THE FEAST TRIAL FOR TREATING SHOCK ............................................ 11
CHALLENGES OF SEPTIC SHOCK TREATMENT IN RESOURCE-LIMITED SETTINGS: SUMMARY OF PRESENTATIONS 12
KEY POINTS CRITICAL CARE AND PAEDIATRIC SHOCK TREATMENT POST FEAST TRIAL .............................................................................................................. 14
RECOMMENDATIONS ON CRITICAL CARE AND PAEDIATRIC SHOCK TREATMENT POST FEAST TRIAL ............................................................. 15
CONCLUSION .................................................................................................................. 15
SICKLE CELL ANAEMIA .................................................................................................. 16
BACKGROUND AND CONTEXT ...................................................................................... 16
SICKLE CELL DISEASE IN MSF SETTINGS .................................................................... 16
MANAGING SCD IN LRS: PROPOSED SOLUTIONS, RATIONALE AND BARRIERS ... 17
BASIC PROPHYLACTIC MEASURE AND COMPREHENSIVE PRIMARY CARE ............. 17
SCD MANAGEMENT IN KIBERA (MSF) ......................................................................... 22
OTHER CONTEXT RELATED CHALLENGES ................................................................. 22
KEY POINTS: SICKLE CELL DISEASE ......................................................................... 23
RECOMMENDATIONS SICKLE CELL DISEASE .............................................................. 24
NEWBORN CARE IN HUMANITARIAN AND LOW RESOURCE SETTINGS ................... 25
BACKGROUND AND CONTEXT ...................................................................................... 25
THE PRE-TERM, LOW- AND VERY LOW BIRTH-WEIGHT INFANT: SUMMARY OF PRESENTATIONS .............................................................................................................. 27
KEY POINTS NEWBORN CARE IN HUMANITARIAN AND LOW RESOURCE SETTINGS ......................................................................................................................... 29
RECOMMENDATIONS FOR NEWBORN CARE IN HUMANITARIAN AND LOW RESOURCE SETTINGS ............................................................ 30
NEONATAL INFECTIONS IN FIELD SETTINGS .............................................................. 31
SUMMARY OF PRESENTATIONS ...................................................................................... 31
KEY POINTS OF NEONATAL INFECTIONS IN FIELD SETTINGS .................................. 34
RECOMMENDATIONS ON NEONATAL INFECTIONS IN FIELD SETTINGS .................. 34
APPENDICES .................................................................................................................. 35
POSTERS AND ORAL PRESENTATIONS ........................................................................... 35
AGENDA .......................................................................................................................... 39
DAY 1 ............................................................................................................................. 39
MORNING SESSION ....................................................................................................... 39
AFTERNOON SESSION ................................................................................................. 39
DAY 2 ................................................................................................................................ 39
MORNING SESSION ....................................................................................................... 39
AFTERNOON SESSION ................................................................................................. 39
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paediatrics.msf.org
### ACRONYMS

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Definition</th>
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<tbody>
<tr>
<td>AMR</td>
<td>Antimicrobial Resistance</td>
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<tr>
<td>AQUAMAT</td>
<td>Artesunate versus quinine in the treatment of severe falciparum malaria in African children trial</td>
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<td>bCPAP</td>
<td>Bubble Continuous Positive Airway Pressure</td>
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<td>CAR</td>
<td>Central African Republic</td>
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<tr>
<td>CFR</td>
<td>Crude Fatality Rate</td>
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<td>CHX</td>
<td>Chlorhexidine</td>
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<tr>
<td>CPAP</td>
<td>Continuous Positive Airway Pressure</td>
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<tr>
<td>CRUO</td>
<td>Centre de Référence en Urgence Obstétricale</td>
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<tr>
<td>DRC</td>
<td>Democratic Republic of the Congo</td>
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<tr>
<td>EmONC</td>
<td>Emergency Obstetric and Newborn Care</td>
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<tr>
<td>EPI</td>
<td>Expanded Programme on Immunisation</td>
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<tr>
<td>ER</td>
<td>Emergency Room</td>
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<tr>
<td>ESBL</td>
<td>Extended Spectrum Beta-Lactamase</td>
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<td>ETAT</td>
<td>Emergency Triage and Treatment</td>
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<td>FEAST</td>
<td>Fluid Expansion As Supportive Therapy</td>
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<tr>
<td>GAVi</td>
<td>Global Alliance on Vaccines and Immunization</td>
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<td>Hb</td>
<td>Haemoglobin</td>
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<td>HbS</td>
<td>Haemoglobin Sickle Variant</td>
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<td>HFNC</td>
<td>High-Flow Nasal Cannula</td>
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<td>HIC</td>
<td>High-Income Country</td>
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<td>HR</td>
<td>Human Resources</td>
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<td>HU</td>
<td>Hydroxyurea (also called Hydroxycarbamide)</td>
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<td>IC</td>
<td>Infection Control</td>
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<tr>
<td>ICU</td>
<td>Intensive Care Unit</td>
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<tr>
<td>IPISTOSS</td>
<td>Immediate Parent-Infant Skin-To-Skin Study</td>
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<td>IV</td>
<td>Intravenous</td>
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<td>KMC</td>
<td>Kangaroo Mother Care</td>
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<td>LBW</td>
<td>Low Birth Weight</td>
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<td>LRS</td>
<td>Low-Resource Settings</td>
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<td>MSF</td>
<td>Médecins Sans Frontières</td>
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<tr>
<td>NGO</td>
<td>Non-Governmental Organisation</td>
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<td>NICU</td>
<td>Neonatal Intensive Care Unit</td>
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<td>NIV</td>
<td>Non-Invasive Ventilation</td>
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<td>NTD</td>
<td>Neglected Tropical Disease</td>
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<td>OT</td>
<td>Operating Theatre</td>
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<td>PaED</td>
<td>Paediatric Days Conference</td>
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<td>PCV</td>
<td>Pneumococcal Conjugate Vaccine</td>
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<td>PICU</td>
<td>Paediatric Intensive Care Unit</td>
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<tr>
<td>POC</td>
<td>Point-Of-Care</td>
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<td>R&amp;D</td>
<td>Research &amp; Development</td>
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<td>RBS</td>
<td>Red Blood Cell</td>
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<td>RDS</td>
<td>Respiratory Distress Syndrome</td>
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<td>SCD</td>
<td>Sickle Cell Disease</td>
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<td>SSC</td>
<td>Skin-to-Skin Care/Contact</td>
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<td>US</td>
<td>Under 5 years of age</td>
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<td>UNICEF</td>
<td>United Nations Children’s Fund</td>
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<td>VOC</td>
<td>Vaso-Occlusive Crisis</td>
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<td>WAIMH</td>
<td>World Association for Infant Mental Health</td>
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<tr>
<td>WFPIICCS</td>
<td>World Federation of Pediatric Intensive and Critical Care Societies</td>
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<td>WHO</td>
<td>World Health Organisation</td>
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EXECUTIVE SUMMARY

MSF is an international medical humanitarian organization specializing in humanitarian emergencies such as conflict, natural disaster and epidemics. A majority of MSF beneficiaries are children under the age of 15 who are also one of the most vulnerable groups in the fragile contexts in which MSF operates. MSF faces significant challenges in providing paediatric care at field level, frequently struggling to locate those with adequate paediatric skills and to match them to vastly differing field and emergency contexts. There is also a lack of paediatric guidelines and tools that are adapted to these low resource humanitarian settings.

The first ever Médecins Sans Frontières (MSF) Paediatric Days took place in Stockholm on 23-24 Sept 2016 in order to address these concerns. The days brought together a diverse mix of 180 MSF staff, academic clinicians, and researchers with the shared goal of improving medical care for children in humanitarian settings around four urgent paediatric topics:

CRITICAL CARE AND SHOCK MANAGEMENT

Shock is one of the major causes of under-5 (U5) mortality. It is part of a complex continuum of disease processes rather than a single event. There is a lack of research for paediatric shock treatment, complicated by a wide range of definitions of shock. Furthermore, shock patients are a heterogeneous group of patients (e.g. those with malaria vs extreme dehydration vs. sepsis) who require different treatments. One approach that could improve shock management is to train hospital staff to deliver tailored care specific to the underlying condition (e.g. those with anaemia; dehydration; malnutrition; sepsis). Another approach that could improve paediatric critical care could be to define MSF medical facilities by standardised levels of care based on capacity (incl. equipment, resources, HR and services offered). This would not only allow the use of checklist and standardized tools and manuals adapted to each setting but would also better highlight specific needs for each setting. Many questions remain regarding paediatric shock treatment in low resource settings (LRS), such as what kind of fluid should be given, how much and at what rate, as well as whether sub-groups of shock patients can be broken down further, and specific treatments defined. Guidance is also urgently needed for neglected patient groups such as children with severe dehydration due to gastroenteritis or malnutrition.

SICKLE CELL – A NEGLECTED DISEASE

Sickle Cell Disease (SCD) causes an estimated 5% to 9% of all under-five child mortalities in Africa. The absence of comprehensive strategies and clinical guidelines for managing SCD at field level are major constraints. Widespread stigma and misconceptions about the disease add to the challenges. Early diagnosis, followed by a basic preventive care package should be scaled up at primary care level. Treatment of complications includes antibiotics, pain management, intravenous fluids and blood transfusion. Patient education and psychosocial support are also crucial. Today, most children with SCD die undiagnosed but promising point-of-care tests currently in development could soon allow early diagnosis on a large scale. Long-term treatment with hydroxyurea (HU), a simple, inexpensive and highly effective drug could also have an impact in LRS but its safety, feasibility and effectiveness in patients in LRS needs further assessment. Meanwhile more standardised clinical strategies and models of care are needed. Public awareness campaigns are urgently needed to promote a better understanding, acceptance and knowledge of SCD in communities as well as for advocacy.

NEWBORN CARE IN HUMANITARIAN AND LOW RESOURCE SETTINGS

Neonatal mortality represents approximately 44% of U5 mortality. Neonatal survival in low-resource and remote settings depends on staff skills, hygiene and organisation of care rather than complicated technology. Examples from several different settings show how staff trainings and improving organisation of care (e.g. infection control, increasing uptake of Kangaroo Mother Care (KMC) and neonatal resuscitation) can enhance outcomes. Task-shifting from some of nurses’ tasks to mothers can also improve KMC outcomes.

KMC is a practice for the routine care of newborns under 2000g at birth and its effect on newborn survival is established. While technically simple, implementation presents challenges, such as physical space constraints, the lack of trained support staff, and hesitant attitudes of parents, staff and communities. This will require increased commitment within MSF, including the scale up of KMC training for nurses, midwives and nursing aides.
Non Invasive Ventilation (NIV) is an effective life-saving intervention for premature newborns in high-income countries but given implementation challenges, its use is limited to a few MSF (mid- and high-care level) settings. Pre-requisites for introducing NIV into MSF settings include basic newborn care and infrastructure in place, along with trained staff. Assessment of a few pilot settings could facilitate a broader implementation within MSF.

Neonatal Intensive Care Units (NICU) can reduce mortality in low birth weight (LBW) and pre-term infants, but surviving infants have an elevated risk of developmental impairments. Caring for these and other disabled children represents a particular burden for families in low-resource and conflict settings. MSF NICU programmes should therefore include follow-up of newborns after discharge, to identify those with developmental disabilities and as far as possible enable support to improve their quality of life.

**NEONATAL INFECTIONS IN FIELD SETTINGS – A MAJOR CAUSE OF MORTALITY**

Prevention is key in reducing neonatal deaths from infection in settings where diagnosis is difficult (due to lack of simple diagnostic tools and of laboratory capacity). Treatment is complicated due to lack of timely access to antibiotics and in light of growing antibiotic resistance.

The challenges in reducing mortality from neonatal sepsis are largely around scale-up and delivery of a few high-impact interventions, including distribution of clean birth kits, chlorhexidine chord care, rapid detection and treatment of infection in mothers and newborns; simplified and adapted antibiotic treatment schedule adapted to context, early initiation of exclusive breast feeding and scale up of KMC. Success requires both community- and hospital-based strategies.

As MSF improves the level of neonatal care at some projects and brings neonates together in NICUs, the risk of nosocomial infection grows, including with antibiotic-resistant pathogens that often have higher mortality rates than drug-sensitive infections. Priorities for optimising the organisation of care in NICUs should include measures aimed at lowering transmission of nosocomial infections (e.g. reducing crowded wards; increasing space between infant beds).
CONFERENE BACKGROUND AND OBJECTIVES
The first ever Médecins Sans Frontières (MSF) Paediatric Days took place in Stockholm on 23-24 Sept 2016. The Days brought together a diverse mix of 180 MSF staff, academic clinicians, and researchers with the shared goal of improving medical care for children in humanitarian settings. The meeting was the culmination of a grassroots initiative that began nearly two years earlier at the 2014 MSF-Sweden General Assembly, which passed a motion to improve the quality of paediatric medical care in MSF missions. In subsequent dialogue with the MSF Paediatric working group the idea developed into the idea of supporting an international humanitarian paediatric conference.

Why focus on paediatrics? Although MSF is a general medical humanitarian organisation a large majority (60%) of our patients are children under the age of 15. Children are also one of the most vulnerable populations in the fragile contexts in which MSF works, characterised by conflict, natural disaster, and large outbreaks of disease, often with a backdrop of weak health systems and low access to care.

The challenges that MSF faces today in providing paediatric care are both familiar and new. Internally, there are challenges to match the range of skills needed for adapting to different contexts, from a desert tent where there was previously no available care to a former high-tech hospital now damaged by war. Meanwhile there is a lack of field workers with paediatric experience; often little local capacity; and too few guidelines and tools adapted to LRS. Most evidence-based practices were generated in high-income countries and are often not directly transposable to LRS. Hence there is a need for temporary adaptation of guidelines whilst building evidence through operational research.

Furthermore, there are external challenges that can only be tackled collectively by the global paediatrics community—for example, on antimicrobial resistance (AMR), a rapidly growing threat to children's survival, especially newborns. The growing international attention to this problem, for example through the recent United Nations General Assembly Special Session on combatting AMR, is a crucial step but must be matched by effective policies and concrete actions. These wide-sweeping challenges feature heavily across all topics on the conference agenda.

Accordingly, an Organising Committee worked during 2015-2016 to further develop the meeting’s objectives based on consultations across MSF and topics based on identified urgent field needs.

Sessions were organised to feature a unique combination of field workers describing their on-the-ground experiences, including gaps and challenges faced, the approaches and strategies to tackle these challenges, and lessons learned. Meanwhile, academics provided up to date information from clinical studies followed by discussions on how to translate the latter information to improve practice.

Main conference objectives:

- To identify gaps in knowledge, research, and development of medicines and diagnostics geared towards paediatric patients in humanitarian settings.
- To understand the latest evidence and best practice and how it can be adapted to the MSF field.
- To generate possible solutions and recommendations for contexts where MSF and other humanitarian organisations work.
- To contribute in highlighting paediatric needs in MSF operations.
- To provide a platform for MSF's paediatrics community to interact, and share and reflect upon MSF paediatric goals, priorities and gaps with paediatric actors and academia.
**WELCOME GREETINGS AND PRESENTATIONS**

In welcoming conference participants to the Karolinska Institute, **Dr. Svante Norgren** (Director, Astrid Lindgren Children’s Hospital, Karolinska, Stockholm) described ways that academia can support the work of MSF and field-driven NGOs in general working in LRS. To fulfil its ambitions in this regard, the Karolinska Children’s Hospital has chosen to focus not on specific hospitals or regions, but on supporting NGOs or individuals. Hence this collaboration with MSF and support for Karolinska colleagues engaged in LRS, as well as inclusion of relevant topics in the medical school curriculum and opportunities for students and residents to train abroad. Current discussions are exploring other potential types of collaboration such as enabling consultation missions and support to the telemedicine platform.

Speaking by video, **Dr. José Antonio Bastos** (President, MSF, Barcelona) highlighted two key messages about MSF’s priorities. First, MSF’s emphasis on paediatric care is not the result of a deliberate decision to focus on children, but is based on first-hand experience that children in humanitarian settings have the highest mortality rates, especially in emergencies. Second, our focus is on addressing the needs of the whole child rather than on specific diseases. He urged MSF not to abandon “non-sexy” diseases such as: malaria, respiratory and diarrheal diseases, neonatal complications, malnutrition, HIV, tuberculosis, and vaccine-preventable diseases.

**Dr. Marie-Claude Bottineau** (Leader of the MSF International Working Group on Paediatrics, MSF, Geneva) reiterated the conference objectives, adding several “soft” ones:

- To reinforce the interest and commitment of universities, especially students, to humanitarian action. Organisations like MSF desperately need more skilled volunteers in MSF programmes.
- To allow MSF and other humanitarian health workers to benefit from academic knowledge and research.
- To allow MSF staff to participate in a bilateral sharing of expertise and experience focused on improving the quality of care in LRS, by creating better-adapted models of care based on state-of-the-art knowledge for LRS, emergencies, and highly vulnerable populations.

**PaED talk**

**Dr. Sahar Nejat** (Member of Organisation Committee for Paediatric Days, MSF Paediatric field worker) in her talk on **Frontline Paediatrics and the Birth of the Paediatric Days**, traced MSF’s progress in providing paediatric care over the past decade. Her first MSF project in 2006 lacked paediatric expertise and neonatal equipment. At that time there was little recognition of the need for newborn care in humanitarian emergencies. In contrast, today MSF has a Paediatric Working Group, much-improved technical quality through its technical advisors and telemedicine platform, a neonatal policy (including on integrating newborn care into humanitarian responses), paediatric guidelines about to come out, and a plethora of trainings, including via eLearning.

Along the way, MSF has learned a crucial lesson. Many decades of work on reducing child (and neonatal) mortality in high-income countries have shown that experience with newborns and commitment to provide them with life-saving care is more important than top-of-the-line equipment and environment. A recent study estimated that two-thirds of all neonatal deaths are preventable by simple, low-cost methods such as clean birth practices, prevention of hypothermia, skilled birth attendants, early treatment of infections, and neonatal resuscitation (see also section 5.1).
CRITICAL CARE AND PAEDIATRIC SHOCK TREATMENT POST FEAST TRIAL

Critical care in LRS was identified as one of the most important current paediatric challenges in MSF hospital settings. Two sessions were devoted to paediatric critical care. First was a series of reports from MSF field projects on efforts to improve the quality of critical care through approaches ranging from optimising hospital setup and systems for managing critically ill children to investigating the feasibility of new technologies. These talks were followed by updates from leading academic clinicians on the latest evidence pertaining to treatment of children with shock in LRS, an area of clinical practice that was upended in 2011 with the unexpected findings from the FEAST trial (see section 2.2, below).

CRITICAL CARE IN FIELD PROJECTS

Dr. Lisa Umphrey (Paediatric Advisor, Sydney Medical Unit, MSF Operational Center Paris) described a new Framework for the provision of paediatric care in MSF hospital settings. While MSF has standardised its approach to adult critical care by defining different levels of care, there has been no analogous approach for children or neonates. The new framework helps fill this gap, classifying paediatric intensive care units (PICUs) according to the level of monitoring, supportive treatment, invasive procedures and supportive services offered. It also extends beyond PICUs to encompass other settings where children needing critical care may present, such as pre-hospital, triage, emergency and inpatient departments, and post-discharge. Tools and documentation include checklists for medications, supplies, and human resources, competencies needed by staff to work in a given unit and guidance on comprehensive, child-appropriate clinical care, patient safety, continuous quality improvement and infrastructure. As of September 2016 the Framework was being implemented at four MSF projects by mobile implementers and field paediatricians, with support from headquarters.

Based on the Framework’s classification, most MSF projects with PICUs have Level 0 facilities, meaning that they provide only very basic care. But having these basics firmly in place is seen as essential for...
success in advancing the level of care and introducing new technologies.

Dr. Mark Lee (Northwick Park Hospital, London) continued the discussion of getting the basics right in his presentation on Lessons learnt from introducing increased monitoring of high-dependency unit patients in a Kenyan district hospital. Working in a busy neonatal unit in Narok District Hospital, SW Kenya, he saw an unusually high proportion of deaths (86%) occurring two days or more post-admission, suggesting problems in medical management after babies were stabilised. He therefore engaged with nursing staff to double the frequency of monitoring the sickest babies (from twice to four times/day), to detect deterioration sooner and intervene earlier. Implementation of this change was hindered by various staffing problems and solutions tailored to the circumstances were proposed. During his last observation period mortality data had improved significantly, although other findings suggested that this was probably not only due to increased monitoring. This experience illustrates that improvements in survival are possible without new technologies or tools but via the organisation of care and points to challenges in making these improvements sustainable.

Turning to technology improvements, Dr. Hans-Joerg Lang presented a small observational study on Bubble continuous positive airway pressure (bCPAP) and the management of critically ill children on a busy paediatric unit in Malawi. To improve the level of respiratory support in critical care, this study in Lilongwe, Malawi explored the feasibility of introducing bCPAP into a facility with a recently-strengthened critical care pathway in place. Building on an initial study of bCPAP in the same facility, this assessment used a better-adapted bCPAP setup (oxygen flow/humidified air) for treating 115 critically ill children (29 days—59 months old). Survival was highest (94%) among children with single-organ failure and no co-morbidities, with mortality rising among children with co-morbidities or multiple organ failure. The findings suggest that bCPAP can play a role in establishing more advanced levels of care if the basic elements of critical care are in place, as other presenters also emphasised. During the discussion, it emerged that a particular bCPAP model (the Pumani), developed for LRS and costing 1/8 the price of traditional bCPAP devices, is being introduced more widely in Malawi.

Dr. Juliet Mwanga spoke about Management of cerebral malaria in children in resource limited settings: Experience from two clinical trials conducted at the Epicentre facility in Mbarara, Uganda. These sequential studies, both part of larger, multi-centre collaborative trials, evaluated treatments for severe malaria. First, the AQUAMAT trial found that artesunate was much more efficacious than quinine, and a follow-up study of inhaled nitrous oxide (iNO) then assessed whether this treatment reduced mortality further in children with cerebral malaria (a group that still showed high mortality) when given artesunate. While iNO has not proven to further improve survival, one conclusion that emerged from looking at comparable groups in these two studies was that enhanced nursing care, resuscitation, clinical monitoring and nutrition seemed to play a role in reducing mortality among the children with cerebral malaria. This suggests that even in busy clinics without the care level of this clinical trial facility, survival could be enhanced by providing a corner where more intensive monitoring is feasible.

SEPSIS AND THE FEAST TRIAL FOR TREATING SHOCK

The second set of talks focused on shock, with an emphasis on sepsis and the current controversies and knowledge gaps on appropriate treatment in LRS, an urgent topic for MSF.

Sepsis is the underlying cause of death from common childhood infections such as pneumonia, malaria and diarrheal diseases, making it a leading killer of children worldwide: over 6,000,000 newborn and small children die of sepsis every year in developing countries. Since it presents with nonspecific symptoms like fever and elevated heart or breathing rate, it is often not diagnosed, or diagnosed too late. Septic shock can kill quickly, usually within 36 hours of onset.

The standard of care for managing paediatric shock in the developed world includes respiratory support, inotropes and a “rule” of rapid fluid therapy with up to 60 ml of isotonic fluid per kg of body weight—although there had never been a randomized control trial on the latter proving its effectiveness. Before expanding its use in sub-Saharan Africa, in 2010 a group of investigators, led by Kathryn Maitland, launched the FEAST trial (Fluid Expansion as Supportive Therapy) at six sites in Kenya, Uganda and Tanzania, to test the safety and effectiveness of fluid bolus treatment in African populations and under local

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The results proved to be unexpected finding that children with shock who were treated with either saline or albumin boluses showed higher mortality than those in the control arm, who received maintenance fluids and standard of care (see also Maitland, section 2.3, below).

**CHALLENGES OF SEPTIC SHOCK TREATMENT IN RESOURCE-LIMITED SETTINGS: SUMMARY OF PRESENTATIONS**

In introducing this session, chair Elizabeth Molyneux opened the session by describing the fallout of the FEAST trial:

“the FEAST trial is turning some of what we thought we knew about shock on its head”

**Prof. Joseph Carcillo** (Critical Care Services, Pittsburgh) gave an overview on Resource-specific checklists and bundles, from the Global Sepsis Initiative of the World Federation of Paediatric Intensive and Critical Care Societies (WFPICCS). This initiative defines four levels of care (from A, the most basic, to D, for developed countries), and from the second level up, provides guidelines (“bundles”) for each level on managing shock in three groups of patients. Shock in severe malaria patients stems from plugged blood vessels, leading to haemolytic anaemia; these patients need blood, not fluids. In contrast, Dengue and other diseases associated with dehydration cause capillary leak syndrome leading to hypovolemic shock, treated with fluids. The third group is patients with septic shock, which is bacterial in origin (requiring antibiotics) and is a mixed form of shock involving capillary leak syndrome (requiring fluids) plus other dysfunctions that need more complex treatment. Since sepsis can kill quickly, fast and accurate triage to recognize sepsis is also essential. The talk reviewed components of these bundles at different care levels, “recognition trigger tools” for identifying sepsis at triage, and the evidence supporting their effectiveness. For MSF, Dr. Carcillo said, key decisions are about what level of care to provide, with what level of resources.

**Prof. Kathryn Maitland** (Principal investigator of the FEAST trial), presented Evidence from FEAST, focusing on aspects of the trial she is often asked about and those discussed a day earlier with the MSF Paediatric Working Group. One question is about the patient group enrolled, given that definitions of shock vary widely. FEAST investigators decided to use broad criteria that would include children typical of those seen in LRS emergency rooms: undifferentiated patients with shock, defined as severe febrile illness with impaired perfusion and either respiratory distress or impaired consciousness (defined as prostration, i.e. inability to sit up), or both. Patients with gastro-enteritis or other illnesses causing dehydration, and patients with severe acute malnutrition were excluded.

The trial’s finding that both types of boluses (with albumin or saline) led to higher mortality at 48h than did maintenance fluids only, astonished the trial researchers and the paediatric critical care field in general.

This outcome was consistent across every age group, all six trial sites and every pre-specified subgroup. Subsequent studies showed that increased mortality was due to the fluid bolus. Other clinical factors like anaemia, level of dehydration was assessed and impaired renal function, presence of sepsis or the range and/or severity of shock symptoms, were all ruled out. On the contrary, the more stringent the definition of shock, the clearer was the harmful effect.

Despite the FEAST findings, WHO guidelines kept its “aggressive” use of boluses while using a much more stringent definition of shock. Consequently the medical providers in LRS remain uncertain about appropriate treatment for these critically ill patients. Future treatments will need to be assessed with a rigor like that which was used in FEAST.

**Prof. Mike Levin** (Imperial College, London. Co-investigator of FEAST) followed with a talk on Learning from FEAST, describing studies aimed at understanding the trial’s very surprising outcomes and their implications for how to treat critically ill patients.
children like those in FEAST. His team’s approach was to identify characteristics of cohorts within the FEAST who were harmed by or benefited from bolus fluids, respectively. They first defined three clinical scores that could be derived for each patient from FEAST data and used as markers for key physiological functions (lung, brain and heart function) affected by shock:

- A **respiratory physiological score**, based on respiration rate and O₂ saturation, with decreased function indicated by faster breathing and decreased oxygenation;

- A **neurological score** for cerebral oedema, with decreased function indicated by decreased heart rate, increased blood pressure and deteriorating consciousness;

- A **cardiovascular physiological score**, based on heart and capillary refill time (which increases as child deteriorates) and blood pressure (decreases).

Based on these scores, patients could be grouped into three main clusters with distinct physiological profiles, and changes induced by bolus treatment could be assessed (summarised in Table 1). The worst outcomes (25-30% mortality) occurred among patients with the highest respiratory and neurological scores (i.e., worst lung and brain function), seen within subgroups of patients in Clusters 1 and 2. Fluid boluses increased both scores, hence increasing mortality in these subgroups. A third group, which comprised about 2/3 of all FEAST patients, had the best scores on three functions and mortality below 1%.

Extrapolating from these findings to decisions on treating critically ill children in FEAST-like contexts, Levin described the different treatment needs of children in these three clusters (and categories of children excluded from FEAST) and consequently, the difficulty of developing a single guideline that covers everyone. He closed by emphasising the need to improve decision-making around which patients need which interventions based on their physiological status/perturbations, while acknowledging the challenges of individualising care in the field.

**Prof. Andrew Argent** (Red Cross Children’s Hospital, University of Cape Town) discussed his insights on **Management of sepsis/severe dehydration and severe anaemia**, based on his experience treating children coming from LRS, but received by a high-resource setting with a “first class PICU.” He emphasized that shock represents a physiologically complex disease process rather than a single event, and that lack of understanding and wrong assumptions hinder our clinical response. For example, while we know that shock is ultimately about failure to deliver blood to tissues, it does not necessarily follow that pumping lots of blood will deliver oxygen to tissues, because shock may disrupt the normal mechanisms that get oxygen to where it is needed. He also discussed considerations on appropriate use of bolus fluids and questioned some practices on the use of transfusions. Given issues of blood product quality and risk of complications in some LRS, the use of strict haemoglobin threshold rather than the patient’s trajectory, might be more appropriate for deciding to transfuse.

**Table 1. Categories of patients in FEAST trial by types of physiological derangement**

<table>
<thead>
<tr>
<th>CLUSTER</th>
<th>CLINICAL SCORE AT ONSET 1,2</th>
<th>COMMENT</th>
<th>OUTCOME after bolus (mortality rate)</th>
<th>TREATMENT SUGGESTED</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Bad/ terrible (R)</td>
<td>Small group</td>
<td>Bolus → worse R, N score (25-30%)</td>
<td>Non-invasive ventilation + fluids?</td>
</tr>
<tr>
<td></td>
<td>Bad/ Terrible (N)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>OK*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>OK</td>
<td>Big group; Severe anaemia, lactic acidosis</td>
<td>Bolus → worse R, N score (4-7%)</td>
<td>Blood transfusion</td>
</tr>
<tr>
<td></td>
<td>OK</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>OK</td>
<td>Largest group (~2000 patients); Low-risk (&lt;1%)</td>
<td>Supportive care only</td>
<td></td>
</tr>
</tbody>
</table>

1 R, respiratory score; N, neurological score; C, cardiovascular score, all described above
2 Descriptions (bad; ok, etc.) are relative to other patients in FEAST, who were all critically ill
Overall, management of shock is not about a quick fix, but about reversing the patient’s downward trend. Above all it requires balancing complexity with pragmatism in a given setting.

The session concluded with Dr. Hans-Joerg Lang (MSF, Geneva) discussing Transfer of critical care strategies used in high-resource settings to low-resource settings. Dr Lang described how to go beyond defining levels of critical care in hospitals in LRS, focusing on feasible, life-saving interventions that can be added once a basic level of care is established, based on available resources, skill levels, workloads, etc.

Level 1 (equivalent to Level 0 described by Umphrey; see section 2.1) provides basic emergency care as defined by WHO and MSF and incorporating international sepsis guidelines (previously presented by Dr Carcillo). This includes managing airways, breathing and fluid and electrolyte balance; giving anti-microbials, fluids, correcting haemoglobin, and incorporating good monitoring and defined patient-to-nurse ratios. It should also include low-flow oxygen if possible, since even simple systems for supplemental O2 can make a big difference to survival.

Level 2: With minimal additional resources, hospitals in LRS can potentially improve outcomes significantly through improved monitoring and more nurses per patient; and, if possible, high-flow oxygen, non-invasive ventilation (NIV) for more serious cases of respiratory distress, and low-dose inotrope infusion. Among the options for NIV (also discussed in other talks—see sections 2.1, 4.2 and 4.3), Lang highlighted bCPAP, based on its cost-effectiveness and on several studies demonstrating its feasibility and effectiveness. These ranged from a randomised controlled trial in Bangladesh to a small study in Malawi showing improving outcomes in neonates, especially those with very low birth weights. For treating fluid-refractory shock in LRS, he emphasised a “back to basics” approach (as per Level 1) plus NIV and possibly low-dose adrenaline (mainly inotropic effect

### KEY POINTS CRITICAL CARE AND PAEDIATRIC SHOCK TREATMENT POST FEAST TRIAL

- **There is no single definition of shock but rather a wide range of definitions, and much debate.** The most stringent definitions (used by WHO) require that many symptoms are present together, while others call for fewer symptoms (as in the FEAST study). The core issue is the lack of oxygen delivery to the tissues. Session chair Elizabeth Molyneux proposed thinking about shock as impaired- versus severely impaired circulation.

- **Shock is part of a complex continuum of disease processes and should not be seen as a single event.** Children who come to critical care have often been sick for days or weeks.

- **Shock patients are a heterogeneous group, and distinct groups of patients (e.g. those with malaria vs extreme dehydration vs sepsis) require different treatment, which should fit the level of care available** (e.g. the “bundles” defined by WFPICCS, described above in section 2.3).

- **Critically ill children, especially those with sepsis, deteriorate quickly.** The sooner they get care, the better their chances of survival.

- **There is still a lack of evidence for paediatric shock treatment, leaving questions about MSF clinical guidelines and field practice.** The session emphasizes the need of continued clinical assessments building on the rigor of the FEAST study

- **Context-adapted, good-quality paediatric critical care in LRS requires efficient critical care pathways and evidence-based paediatric critical care guidelines.** In each context the critical care levels need to be defined based on available resources, skill levels and capacity available. At the community level, integration of parents into the critical care process, improvement of referral pathways and communication with communities are also needed.
Organisation of care:
- **Paediatric critical care units should be organized and classified by clearly defined levels of care** based on equipment, resources, including HR/patient ratio, procedures and services offered. Guidance should define how to advance to the next level once essential elements of a given level are solidly in place.

- **Hospitals should establish highly efficient triage systems** for rapidly identifying high-risk children at admission and throughout the hospital setting so these patients receive critical care without delay. Tools such as the WFPICCS “recognition trigger tool” (see section 2.3) can support decision-making at admission. Staff must also be able to recognise signs of critical illness elsewhere in the hospital, for example, in inpatient units using paediatric early warning systems. Implementing these systems has wide-ranging implications for training, logistics, HR management, and attention to quality of care.

**Future directions:**
**Further research is essential for building evidence on effective treatment.** Many questions remain about fluid use in LRS, what kind of fluid, how much and how fast? Can FEAST groups be broken down further, and specific treatments defined? Would fluid bolus in combination with non-invasive ventilation, to mitigate negative impact on lung function and improve survival in some subgroups? Guidance is also needed for patient groups not included in FEAST, in particular, children with severe dehydration due to gastroenteritis or malnutrition (an important MSF population). Another suggested study would be to evaluate the impact of increasing nursing care, including monitoring on patient outcomes.

**CONCLUSION**
MSF paediatrician and session panellist Roberta Petrucci summed up the discussion by saying that the Paediatric Working Group had looked to this session to help identify a “magic bullet”—a simple algorithm for treating patients in shock. Instead, it is clear that the evidence leaves us with as many questions as answers. Nevertheless, clustering patients in shock with a cluster targeted management approach will certainly be a way forward. The session and discussion also clarified that practices around good teamwork, close monitoring, strong critical care pathways, and triage to identify the sickest children faster may be as (or more) important than some of the highly technical clinical management issues—and that MSF Headquarters must re-think approach and its HR implications.
SICKLE CELL ANAEMIA

Sickle cell disease (SCD) is one of the most common genetic diseases, affecting at least 300,000 newborns every year, of whom over 60% live in sub-Saharan Africa. A 2006 report from WHO estimated that SCD accounted for 5% of all deaths in Africa, over 9% in West Africa and up to 16% in specific west African countries (DRC and Nigeria are especially affected). Yet, despite its significant role in mortality and morbidity,

**SCD is a neglected diagnosis by global health organisations, Ministries of Health in affected countries and in most MSF projects**

This session featured talks by an SCD patient, a nurse from an MSF project that is tackling SCD, and two clinician-researchers who spoke to the broad issues of managing SCD patients, and to specific challenges and possible solutions in LRS. For MSF, the question is what we can feasibly do to lower mortality and improve the quality of life for SCD patients.

**BACKGROUND AND CONTEXT**

SCD occurs in people with two copies of a mutant haemoglobin (Hb) gene called HbS (Hb sickle variant), or in a minority of cases, HbS and another Hb mutation. HbS is less efficient in carrying oxygen, and it causes red blood cells (RBCs) to have an abnormal crescent (rather than disc) shape that can clog blood vessels. This leads to acutely painful vaso-occlusive crises (VOC) which is a hallmark of SCD. Sickle RBCs are also destroyed more quickly, causing anaemia. SCD leads to many complications, including severe chronic pain, repeated infections, and life-threatening crises such as stroke, acute chest syndrome, splenic sequestration (of red blood cells, causing acute anaemia and shock), multiple organ damage and ultimately organ failure.

While there is no cure for SCD, in high-income countries early diagnosis (through routine newborn screening) and systematic care allow nearly everyone with SCD to live well into adulthood. In contrast, most people with SCD in LRS die in early childhood without ever being diagnosed, often from bacterial infections, malaria or severe anaemia, although few of the practices or technologies for managing SCD in high-income countries are widely available in LRS settings.

**PaED talk**

**David Issom** (Division of Medical Information Sciences, University Hospital of Geneva) opened the session with a talk on *My Life as a Sickle Cell Patient*. He was diagnosed only after his first sickle cell crisis. Fortunately, living in Geneva he could receive excellent health care and had strong family support—yet still he experienced many episodes of excruciating pain and hospitalisations. To end this cycle he set out to learn more about SCD and then to devise self-management strategies, starting with careful self-observation of what set off episodes so he could avoid these triggers. Gradually, he became able to sense in advance when an episode was imminent (“a vague feeling that I’m not well”) and then take steps to mitigate it, including resting, drinking lots of fluids, taking more oxygen, and reinforcing other healthy behaviours. These measures helped lower his hospitalisation rate by 80%.

He later began to focus on SCD professionally. Research into the worries of other SCD patients led him to identify a nearly ubiquitous set of fears—of an unpredictable crisis, of complications, of death—and of frustrations over feeling isolated and stigmatised. He is now developing technologies (including an app) that support comprehensive self-care, including a system of sensors for continuous health monitoring. He concluded by calling on health providers to support patients to become experts on their own disease, to help battle stigma, and to push for better tools and solutions.

**SICKLE CELL DISEASE IN MSF SETTINGS**

**Prof. Mariane de Montalembert** (Paediatric Haematologist at Hôpital Necker-Enfants Malades, Paris) gave an overview of SCD and patient management, describing preventive and therapeutic interventions in high- and low-resource settings, in a talk called Overview on *Sickle Cell Disease Lili-Marie Wanguru* (MSF Nairobi; University of Maryland), a nurse/MSF clinical officer, described the Challenges of managing sickle cell disease among children from an informal urban settlement, Kibera, Nairobi. This is one of the few MSF projects to specifically address SCD. The setting where she works,
Kibera, is the second largest slum in Africa and the MSF clinic is the primary care provider to roughly 150,000 people.

Prof. Isaac Odame (Medical Director of the Global Sickle Cell Disease Network and Paediatric Haematologist at the Hospital for Sick Children, Toronto) presented on Management of sickle cell disease: finding solutions in low-resource settings, focused on feasible interventions for context-adapted packages of care.

The speakers each brought different perspectives but raised many of the same issues and proposed solutions; their talks are therefore summarised together rather than speaker-by-speaker.

MANAGING SCD IN LRS: PROPOSED SOLUTIONS, RATIONALE AND BARRIERS

The presentations focused mainly on a core set of medical challenges in managing SCD. These are summarised both in Table 2 and in the text below, which provides the rationale and additional discussion for each issue. Diagnosis: Newborn screening is routine in most high-income countries (HIC) but rare in LRS, since current tests are relatively expensive and require good laboratory infrastructure. In some settings, an added constraint

(see in a pioneering SCD programme in Luanda, Angola) is the difficulty of following up a few days later with families whose children test positive (this programme reported a 50% loss to follow-up).4

Two new Point-of-Care (POC) diagnostics in late-stage development (Sickle Scan, an immunoassay, and HemeChip, based on electrophoresis) are a potential game changer. They work with fingerpick blood samples and give results within a few minutes. Sickle Scan needs no electricity, while the HemeChip manufacturer is developing a solar-powered battery system. One concern is pricing, with both tests currently costing above $1 per test. Prof. Odame thinks POCs are needed for wide scale public health uptake. He advocated for introducing these tests at the first vaccination visit and in general at primary care clinics, rather than via newborn programmes.

BASIC PROPHYLACTIC MEASURE AND COMPREHENSIVE PRIMARY CARE

Providing basic but regular, comprehensive care for children with SCD has been shown to significantly increase survival. For example, during the first three years of an SCD programme in Benin, 85% of children diagnosed as newborns were still in care, and the mortality rate in this cohort was 10-fold lower than the overall U5 national mortality rate,5 bringing it in line with that in high- and some middle-income countries.

The bulk of this care is prophylactic. Bacterial infections (pneumonia, upper respiratory tract infections, meningitis, septicaemia and other febrile illnesses) are leading causes of death in children with SCD. They can become life-threatening within hours, since SCD-associated splenic damage reduces the ability to fight certain infections.6 In addition, children with SCD who get malaria are more likely to die quickly than those without SCD. Preventing these infections is therefore a key objective of primary care for these children, achievable largely through basic measures such as routine vaccinations (including pneumococcal and meningococcal vaccines), daily penicillin and malaria prophylaxis.

Preventing and managing acute complications such as pain, severe anaemia, and stroke, is especially challenging in LRS (as is acute care in general) since it often requires tools or technologies that are not available, feasible or safe (such as repeated blood transfusion and Trans-Cranial Doppler imaging).

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6 A 2008 Lancet study showed 26.3-fold elevation in risk of bacteraemia in children with SCD, and specifically 33-fold for S. pneumoniae, 35.5-fold for non-typii Salmonella and 28.1-fold for H. influenzae.
Excess mortality in SCD in children U5s

<table>
<thead>
<tr>
<th>Low/Middle income countries with poor access to public health infrastructures</th>
<th>High income countries with good access to public health infrastructures</th>
</tr>
</thead>
<tbody>
<tr>
<td>90%</td>
<td>10%</td>
</tr>
</tbody>
</table>


Poor knowledge and awareness of staff is often associated with a delay in the acute specific care. For LRS, managing SCD complications will depend on building capacity across levels of care (see below), among other measures, but potentially even more so on prevention through scale-up of hydroxyurea therapy (below). Patient education is also valuable (and feasible) in helping patients understand and avoid known triggers. (See patient testimony in section 3.2 and online patient education materials from Dr. de Montalembert’s institute in Paris at www.rofsed.fr).

**Disease-modifying therapy with hydroxyurea** (HU, also called hydroxycarbamide). HU, an old, inexpensive drug, is the only known treatment that actually modifies the course of SCD. In HICs it was shown to be highly effective in reducing complications such as heart defects (in adults and children) and acute chest syndrome (in children), and is non-inferior to chronic transfusion in reducing the risk of stroke. Most patients in high-income countries take HU from a young age especially in the US.

HU presents a major opportunity to better manage SCD in LRS, but there are caveats. First, its safety, feasibility, and effectiveness have not been established in African settings where malaria is endemic and many children have other co-morbidities and poor nutritional status. Dosage is individualised, and it takes up to a year to adjust (with monitoring every 4-8 weeks) and for the drug to show effect. Furthermore, HU must be taken regularly. Dr. Odame advocated strongly for tackling these issues, with the aim of devising a strategy for implementing this high-impact, low-cost intervention in Africa. To make a scaled-up approach feasible will also require simplifying treatment, ideally by finding a fixed (probably moderate) dosage that requires only minimal monitoring—with the caveat that most studies of HU’s effectiveness used high doses. A feasible model of care would probably task-shift routine HU treatment to primary care, linked to higher level of expertise for support.

Organisation of care for SCD requires systematically defining what interventions/level of care, infrastructure, staff capacity and training should be in place at primary, secondary and tertiary facilities. Suggestions were:

- **Primary/community level care** by community health workers must be able to:
  - diagnose SCD using POC tests;
  - provide education to patients;
  - implement a basic package of prevention and treatment (e.g. minor infections; mild maintenance of transcranial doppler flow velocities in children with sickle cell anaemia—tcd with transfusions changing to hydroxyurea (twitch): a multicentre, open-label, phase 3, non-inferiority trial. Lancet 2016;387:661-670.)
(pain) according to standardised guidelines;

- monitor growth and baseline Hb, and recognise symptoms meeting criteria for escalating to higher-level care.

- **Secondary care** that ensures the proximity of several hospitals must be able to:
  - manage anaemia, fever, and severe pain with interventions such as transfusion, antibiotic therapy, and morphine;
  - conduct basic lab tests.

- **Tertiary care**, based in a few expert centres with capacity to provide high-level treatment for managing severe complications.
Table 2. Medical Interventions for SCD in low-resource settings: Availability and Access

<table>
<thead>
<tr>
<th>TYPE OF INTERVENTION</th>
<th>INTERVENTION</th>
<th>AVAILABILITY/BARRIERS/FEASIBILITY IN LOW-INCOME SETTINGS</th>
<th>STEPS NEEDED TO EXPAND ACCESS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diagnosis</td>
<td>Early diagnosis or routine newborn screening</td>
<td>Few systems in place because: • Diagnosis requires laboratory test • High cost of test • Stigma of SCD → low acceptance by parents in many settings</td>
<td>• Advocate for speedy completion of R&amp;D: deployment of Point-Of-Care (POC) tests • Advocate for low price per POC test • Integrate diagnostic testing into infant’s early primary care visits (e.g. for vaccination) • Expand advocacy &amp; education among diverse stakeholders</td>
</tr>
<tr>
<td>Basic package of care (prophylactic measures)</td>
<td>Penicillin prophylaxis for prevention of pneumonia</td>
<td>Not universally offered; not always accessible despite low cost</td>
<td>Include in primary care package</td>
</tr>
<tr>
<td></td>
<td>Comprehensive vaccination, including Pneumococcal Conjugate Vaccine (PCV)</td>
<td>• Access to PCV remains limited • Routine vaccine coverage varies widely across settings</td>
<td>• Strengthen basic vaccination systems (primary care) • Increase availability of key vaccines (especially PCV) • Lower prices of PCV in non-GAVI countries and beyond EPI routine schedules (&gt; 2 years)</td>
</tr>
<tr>
<td></td>
<td>Malaria prophylaxis</td>
<td>Bednets; chemoprevention where appropriate</td>
<td>Bednets often available but may not be used consistently; chemoprevention available only in some settings</td>
</tr>
<tr>
<td>Other preventive measures</td>
<td>Hydroxyurea therapy to reduce complications incl. VOC/pain, stroke</td>
<td>• If available, usually at tertiary facilities • Dosing requires individual adjustment (to find maximal safe, effective dose) + frequent monitoring (every 4-8 weeks) • Usually involves cost to patient (for specialist physician; drug itself is cheap)</td>
<td>• Ensure that established basic comprehensive care is in place • Conduct studies to establish safety, efficacy, feasibility in LRS • Conduct studies to identify simpler treatment protocol, incl. standardised dose that still remains effective</td>
</tr>
<tr>
<td></td>
<td>Chronic transfusion</td>
<td>Not feasible for LRS due to low supply of blood; elevated risk of infections, blood mismatch</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>Trans-Cranial Doppler to detect risk of stroke</td>
<td>Low availability in LRS Cost: ~$600/test</td>
<td>N/A</td>
</tr>
<tr>
<td>Managing complications (acute care)</td>
<td>Managing infections &amp; fever Antibiotics; often fluids, diagnostics</td>
<td>• Requires rapid access to appropriate care, often at hospital level • Requires caregiver education on when to seek immediate treatment</td>
<td>Build capacity (training, infrastructure) for managing complications at community and hospital levels, based on defined levels of care at primary, secondary and tertiary facilities</td>
</tr>
<tr>
<td></td>
<td>Managing pain Strong analgesics</td>
<td>• Poor access to strong painkillers in most regions, since prescribing usually restricted to highest-level physicians (at hospitals)</td>
<td>• Improved/simpler access to strong analgesics, including by training wider cadre of medical staff • Education on avoiding triggers • HU therapy</td>
</tr>
<tr>
<td></td>
<td>Managing anaemia Transfusion</td>
<td>• Requires access to secondary care • Elevated risk of repeated transfusions in LRS. • Prophylactic repeated transfusion not feasible in many settings</td>
<td>• Need minimum standards for blood transfusion. Feasible in many MSF settings. • Define best Hb target for SCD patients in MSF settings</td>
</tr>
</tbody>
</table>

1 Items included in this table are limited to points discussed at the meeting, i.e. do not represent a complete list of everything needed to expand access.
2 List applies to steps needed more broadly, not by MSF specifically.
3 PCV, pneumococcal vaccine
4 GAVI, the Vaccine Alliance, subsidises vaccination in low- and lower-middle income countries.
5 VOC, vaso-occlusive crisis (“sickle cell crisis”)
SCD MANAGEMENT IN KIBERA (MSF)
Before 2012, the Kibera clinic referred suspected SCD patients (e.g. those with fever and jaundice but no HIV or malaria) to a tertiary facility for diagnosis. But this was unaffordable for many patients. So the project looked at what they could offer these patients, and in 2012 introduced SCD diagnosis and basic follow-up care for children below 18 years old. In May 2016 a retrospective analysis of patient characteristics gave the snapshot summarised in the box (right).

With its own limitations, this project has positive impact on MSF-operations showing the feasibility of decentralising SCD care.

OTHER CONTEXT RELATED CHALLENGES
- **Neglect of SCD by public health systems, actors and policy makers.** Few affected countries have national policies concerning SCD, and there are no national (or international/WHO) clinical guidelines on its management. Thus responders on the ground must devise their own ad hoc strategies and protocols. Nor is SCD included on WHO’s list of priority NTDs, further depriving the disease of attention and funding.

SCD patients in MSF Kibera project (May 2015-May 2016)
- 149 symptomatic patients tested for SCD; 110 confirmed
- 21/48 (44%) were on penicillin prophylaxis
- 7% had sickling crisis in prior 3 months
- 65 clinic visits were for acute SCD (5.4 per month)
- No mortalities in observation period

- **Weak public health infrastructure and few trained staff** for providing essential primary care.
- **Absence of early diagnosis programs, gaps in coverage for routine vaccination and lack of access to free health care** are key drivers of high mortality rates and result in many children presenting to clinics only when they have an SCD crisis. Staff at primary clinics may not consider SCD or recognize its clinical signs, since SCD is often not part of their training.
- **Widespread misconceptions and stigma attached to SCD,** present both in high- and low-resource settings. One example is the belief that SCD is transmitted only by mothers, a myth that can lead to terrible consequences for women whose children are diagnosed.
KEY POINTS: SICKLE CELL DISEASE

- SCD causes an estimated 5% of all under-five child mortality in Africa, and up to 16% in the most affected regions. It is a neglected disease by many Ministries of Health and global health actors. The absence of comprehensive strategies and clinical guidelines for managing SCD are major obstacles to an appropriate response. Widespread stigma and misconceptions about the disease add to the challenges in responding, and to patients and families living with the disease.

- A comprehensive response to SCD starts with early diagnosis, followed by basic preventive care including malaria and penicillin prophylaxis, PCV vaccination and other EPI vaccines. These simple but life-saving preventive interventions are feasible at the primary care level but are not being implemented in most African settings. Treatment of complications can include antibiotics, pain management, intravenous fluids, and blood transfusion (where available). Patient education and psychosocial support are also crucial.

- Currently most children with SCD in Africa die undiagnosed. But new point-of-care tests could open the door for early diagnosis on a public health scale, if their price can be brought down and their efficacy field tested. Two tests in late-stage development could be ready within 1-2 years.

- Long-term treatment with hydroxyurea (HU), a simple, inexpensive and highly effective drug for reducing the risk of several life-threatening SCD complications, is widely used in high-income countries—and could have a major impact in LRS, especially since other treatments are unavailable. Introducing HU on a public health scale will require filling in knowledge gaps through clinical studies and developing simpler strategies for its use.

- Success in building comprehensive strategies and effective programmes will require strong political commitment throughout the public health system. A robust response should be backed by funding, clear strategies and a unified approach.
RECOMMENDATIONS SICKLE CELL DISEASE

Each level of care (primary, secondary, tertiary) should be clearly defined in terms of SCD services offered, equipment, and level of skills required by staff. Training staff and building infrastructure across all levels of care should be a priority in scaling up a response to SCD.

**Diagnosis**

MSF and other stakeholders should engage in helping to ensure final development and deployment of POC diagnostics, and should advocate for an affordable price that will allow widespread uptake. Early diagnosis with these new tools should be integrated into primary care and offered to all infants, ideally at the time of their first vaccination visit. These sites will also need to provide education and information on SCD for parents, to foster acceptance of testing and of the regular care needed by children who test positive.

**Prevention**

Medical actors should identify a basic preventive package that can be integrated into primary care in LRS, and participate in developing clinical guidelines for managing SCD patients in patient- and family-centred ways.

**Treatment**

SCD patients in LRS could potentially benefit greatly from HU. Efforts should be scaled up to assess HU safety, feasibility and effectiveness in patients in poor settings, and to find simpler, more standardised clinical strategies and models of care.

**Advocacy**

Vigorous, strategic advocacy and public awareness campaigns are urgently needed—to promote better understanding, acceptance and knowledge of SCD in communities and to generate momentum and commitment among actors who can develop a comprehensive response. Progress will require strong collaboration among patients/families, advocacy groups and NGOs, health care professionals, government and policymakers.
NEWBORN CARE IN HUMANITARIAN AND LOW RESOURCE SETTINGS

Day 2 of the conference focused on the first month of life—the period of highest mortality risk for children, when 45% of all U5 deaths occur; of these early deaths, up to half occur during the first 24 hours, and 75% in the first week. While the past two decades’ efforts under the Millennium Development Goals to reduce U5 childhood mortality, led to significant declines overall, there was little progress in newborn survival.

The day’s sessions focused on two of the three leading causes of death in this group: complications of prematurity, and infections/neonatal sepsis. (The third leading cause is birth asphyxia.) Talks based on experience at various field projects were followed by overview presentations on non-invasive ventilation and kangaroo mother care.

BACKGROUND AND CONTEXT

Every year, an estimated 15 million babies—over 1 in 10—are born prematurely (before 37 weeks), a number that continues to rise. In 2015, nearly one million premature infants died. Overlapping with this group, each year more than 20 million infants weighing less than 2.5kg are born (15-20% of all births), the vast majority in developing countries. These low birthweight (LBW) babies are also at increased risk of death, and both groups face elevated risks of a wide array of health problems, including infections and developmental impairments.

Yet many of these infants (WHO estimates up to 75% for pre-term babies) could be saved by simple interventions, including essential pre- and post-natal care for mothers and babies, resuscitation at birth, thermal care, and treatment for infections.

For MSF, sick newborn care was a neglected area until a few years ago. This is now changing, as reflected and supported by the MSF Neonatal Care Policy finalized in January 2016, which calls for MSF projects to work towards decreasing neonatal mortality and morbidity and tackling their main causes in our project settings. The recommended strategy is to focus on providing essential care for the mother-child pair during pregnancy, birth and the postpartum period, to the extent possible within local contexts and constraints. In practice, this recent engagement in caring for neonates has led some of our programmes to become almost overrun. The challenge for MSF is to identify simple, context-adapted tools and packages of care that reduce deaths and disability in LRS.

Next, Laura Acheson (MSF, Paris) described work on Kangaroo Mother Care (KMC) in Afghanistan: an assessment of barriers and facilitators to implementation, conducted during her mission as a paediatric nurse in the busy newborn unit at Dasht-e-Barchi Hospital in Kabul. KMC is a simple intervention with well-known benefits, especially in keeping babies warm and stimulating mothers’ breast milk production (see talk by Bergman, section 4.4.), yet implementation can be challenging. Although KMC is

9 WHO. Pre-term birth. Fact sheet (updated Nov 2016)
10 WHO. GLOBAL NUTRITION TARGETS 2025: LOW BIRTH WEIGHT POLICY BRIEF. 2014
recommended by MSF—particularly for premature and LBW babies—it was only implemented sporadically at the Dasht-e-Barchi unit, which had just opened in November 2014. To identify and resolve obstacles, Acheson conducted informal surveys among the community and staff and then, based on her findings, designed and launched a series of measures to boost uptake. Upgrading the KMC room to an inviting space and having staff show mothers how to hold their babies had a catalytic effect.

**PaED talk**
In her talk on *Field perspectives from a paediatrician, Dr. Nadia Lafferty* (MSF, Barcelona) used her personal experience with MSF to reflect on the work of paediatricians in different roles within the MSF organisation. Her first mission to CAR as the project’s only paediatrician began with the common experience of feeling that her previous training left her unprepared for the work at hand—she faced diseases she didn’t know well, without laboratory diagnostics, technology or expert colleagues to guide her. But gradually she realised that she brought much-needed skills, for example, in doing a proper paediatric examination—a skill that takes years to develop, and that leads to improved diagnosis, among other outcomes. At her second mission in a facility with a very basic neonatal unit, she was able to identify hypothermia as a common problem among newborns and a potential contributor to mortality, and to implement a series of fixes. She also worked on the “softer side” of paediatrics, creating a more child-friendly atmosphere within the unit.

These experiences led her to seek roles that impacted many projects rather than one at a time. So she took on a role as paediatric implementation officer, helping to establish new approaches at many projects and to train staff. She recently became a paediatric advisor—an even more strategic role (based at headquarters but connected to the field) that involves helping to develop new practices, guidelines and tools and to improve support to new field doctors like she once was. Reflecting on the question of whether paediatricians (or doctors with good paediatric experience) are needed at all MSF projects, her view is that they are important for large MSF projects, especially those with hospitals and/or specialised services, but not necessarily everywhere. Support from headquarters and good training (a growing emphasis of several MSF operational centres) can equip non-paediatricians with sufficient skills.

Once mothers realised KMC was easy and increased milk production, they not only accepted, but helped with spreading it to other mothers. Staff also embraced KMC once they saw its impact on babies’ body temperature. Other steps which fostered uptake included adding a KMC-kit into medical orders for premature or small babies (<2500g) and having a KMC “champion” to provide support, since consistency also appeared to play a role. Acheson speculated that in this particular environment, it was also advantageous to have a ward with mainly female staff. Despite the lack of hard data, five months after launch, there appeared to be considerable improvement, judging from engagement of mothers and consistent support from “champions”, nurses and paediatricians.

**Dr. Ryan Carrol** (Center for Global Health, Massachusetts Gen Hospital) followed with a presentation on *Breathing Made Simple: Developing Simple Continuous Positive Airway Pressure in Uganda for Resources Limited Settings*, aimed at making respiratory support part of the package of care for critically ill neonates.

Neonates are especially vulnerable to respiratory distress as they consume oxygen at a higher rate than adults but have smaller airways and lack the bony structure that keeps airways open. Adding challenges like illness can therefore quickly lead to respiratory distress. Non-invasive ventilation (NIV) interventions are lifesaving in high-resource settings but current CPAP devices are costly and too specialised for LRS. Even the least expensive (~$1000) machines require an external supply of breathing gases and someone trained to maintain the setup. Ryan’s team therefore set out to create a simple, locally-adapted CPAP machine. They bought the basic components in bulk and built them into a plastic box; completing one in about 45 minutes. The resulting device was tested and calibrated on site to ensure the correct output. Cost-per-unit was below $100 in terms of materials when excluding start-up costs of assembling the team.

Next, **Dr. Anne Pittet** (MSF, Geneva) described how improvements in training and organisation of care led to a *Sharp Decrease in Mortality for Neonates Admitted to a New Neonatal Unit of a Regional Hospital in DRC: a Retrospective Case*. In 2014 Pittet arrived at the remote Gety Regional Hospital in northeastern DRC, to find sick neonates treated scattered around in different wards of the hospital (ER, ICU, paediatric and nutrition wards) with a neonatal mortality rate of 22%. Hoping to reduce this rate, the team created a new 14-bed neonatal unit.
Continuing the theme of how training and organisation of care can improve outcomes, a PaED talk by Dr. Christopher Hands (Children’s Hospital, Freetown, and Royal College of Paediatrics and Child Health, London) discussed Emergency Triage and Treatment in Freetown 2015-2016, focusing on an initiative to improve acute care at the city’s main children’s hospital during the Ebola crisis. When he began working at the hospital, arriving children were screened for Ebola in an outdoor tented area, but otherwise triage was slow, minimal and ineffective. An informal assessment found the triage nurses failed to detect ETAT emergency or priority signs in roughly 2/3 of all patients, who typically had 2-4 hour wait times (without any care) to see a doctor. A new strategy was clearly needed. Despite the nursing staff being short-handed and highly demoralized, after some discussion they agreed—as did hospital leadership—to try a nurse-led approach consisting of: (1) triaging patients immediately, then quickly sending them wherever they needed to be seen within the hospital; (2) creating an area within triage where acutely ill children could be seen right away, and treatment begun; and (3) starting a programme of training, mentoring, and supervising nurses to effectively carry out these new duties.

In Dec 2015, after completion of training, the hospital opened a re-organised outpatient department staffed and managed by junior nurses. By June 2016, another informal assessment found that these nurses reliably identified emergency signs right away (30/30), and that children were assessed far faster than before the training (time from triage to assessment dropped from 49 minutes to 7 minutes) and given oxygen or IV treatment far faster (215 to 8 minutes and 175 to 19 minutes, respectively). Dr. Hands attributes these improvements largely to success feeding on itself. Better nurse-led patient care meant fewer deaths, which led to enormous recognition of the nurses and their value within the hospital and by the community. Training has since been extended to nurses within inpatient departments, and to the launch of a train-the-trainers programme.

Preterm Infant? Prof. Mats Blennow (Karolinska University Hospital, Stockholm) gave an overview of non-invasive ventilation support for infants. He began by discussing CPAP and its well-established role (in HIC) in improving survival of LBW babies with RDS. The vast majority of babies do not need positive pressure ventilation for resuscitation, since even most LBW and extremely LBW babies breathe spontaneously at birth. Rather, CPAP’s main use is to stabilise these babies. Its positive physiological effects in these infants include improving oxygenation, building functional residue capacity and reducing the risk of oedema.

Several relatively simple CPAP devices are available, such as bCPAP (see talk by Lang, section 2.1), the variable flow CPAP which can be combined with KMC, and the low-cost device described above by Carrol (section 4.3), which deliver gases to infants through different types of interfaces such as nasal prongs or face masks. Other components of CPAP setups include sources of compressed gases (which should be humidified and heated when used at high pressure), mixed according to an algorithm for determining the best concentration of oxygen to deliver, and a source of pressure, with the optimal pressure level based on

**PRESENTATIONS**

**THE PRE-TERM, LOW- AND VERY LOW BIRTH-WEIGHT INFANT: SUMMARY OF**

Between the maternity & paediatric wards, with areas for intensive care and warming, and simple equipment (e.g. two O2 concentrators, heating and phototherapy lamps, secretion aspirator). There were 12 nurses (3/shift) who each received a few hours of training, and a physician and a paediatric nurse, who each attended a two-week training in Geneva. Key priorities were to improve infection control (through better hygiene and adapted antibiotic therapy), avoid hypothermia in the babies, and improve nutrition and glycaemia control.

To assess the impact of these basic measures, the in-hospital mortality rate in the first half of 2014 (before the changes) was compared with the same period of 2015 (after the changes) in a small retrospective case-control study involving a total of 313 neonates. Almost immediately after opening the new unit overall mortality decreased by half (from 22% to 11%), a statistically significant drop over the study period (p<0.05). The biggest improvement, also statistically significant, was among babies in the 1500-2000g weight category (from 37% to 3%; p <0.01). Antibiotic use also dropped. There were no significant differences between the 2014 and 2015 infant groups in mean weight, day of life at admission, or proportional morbidities, suggesting that these improvements reflect the impact of the basic measures changed from 2014 to 2015.
the type of CPAP device and its performance, and the type of interface used. Beyond these technical components, quality nursing care is crucial in CPAP programmes are dependent on well-trained nurses who can adjust the devices to the infants, help babies find a comfortable position that lets them breathe well, and keep the nasal passages clear, among several essentials.

Turning to the use of oxygen for pre-term infants, Blennow described its advantages while cautioning that it is crucial to monitor babies’ $O_2$ saturation continuously during use, since too much $O_2$ can cause severe damage to the eyes (including blindness), lungs or brain. Oxygen can be administered in incubators or using free-flow masks with either low- or high-flow (>1L/min) nasal cannulas. Heating and humidifying the gases is essential for high-flow setups, to avoid drying out infants’ mucosa (which could also increases infection risk). One promising approach garnering huge interest in paediatrics is the use of high-flow nasal cannula (HFNC) systems, which were shown in 2010 to equal CPAP as primary breathing support for babies after extubation from mechanical ventilation. Blennow suggested that HFNC may be more usable than CPAP in LRS, especially in settings with frequent electricity cuts. They are also simpler and therefore require less training. (More information on its advantages and how it works in Dysart et al, 2009).11

**PaED talk**

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KMC is a WHO-recommended practice for newborns weighing 2000g or less at birth, with guidelines for its implementation. The practice includes three components: the kangaroo position, also called skin-to-skin care (SSC); nutrition (frequent breastfeeding, facilitated by the SSC position); and, where feasible, early discharge from hospital. By warming infants through the skin-to-skin care (breast temperature is higher in lactating mothers) and making them feel safe, KMC supports physiological responses on infant’s hormones, heart rate, suckling and appetite. Meanwhile, KMC also supports bonding via oxytocin in the mother. In contrast, infants who were separated from their mothers and from “feeling safe” were more likely to have fear responses (driven by cortisol) that activate the body’s stress management systems; these include lowered body temperature/hypothermia, and hypoglycaemia.

Past studies that established the impact of KMC on LBW babies typically focused on stable infants. Among the few assessing KMC in all LBW newborns (no exclusion of unstable infants), is one early study in Zimbabwe that showed higher survival across all weight groups compared with pre-KMC controls at the same hospital. Survival was particularly seen in the 1000-1500g group (50% vs 10% survival). A


randomised control study ten years later compared composite cardio-respiratory stabilisation scores in newborns weighing 1200-2199g at birth and given either KMC or incubator care. The KMC group showed superior stabilisation and prevention of instability within 6 hours. A major new study, the 5-country IPISTOSS randomised controlled trial, will compare conventional care (with separation) to SSC started within 60 minutes of birth and continued until stabilisation in 5000 newborns weighing 1000-1800g, assessing mortality and disability of survivors over a 2-year follow-up.

On the practical front, success in implementing KMC requires, among other factors, an enabling environment that keeps mothers and newborns together and where nurses and doulas actively support KMC, including proper (and frequently changing) positioning of infants to ensure clear airways; breastfeeding; and involvement of other family members in SSC. Promoting KMC in accordance with local cultures can also aid in engagement.

Bergman concluded by discussing the complicated ethics around questions of 'how small to get care?' Building on a position paper on infants’ rights released by the World Association for Infant Mental Health (WAIMH), he argued that 'no life is too small' to get basic care through SSC, with addition of available technologies for those infants who respond. The IPISTOSS trial described above should shed further light on whether and how SSC benefits these smallest, most fragile infants.


15 The Immediate Kangaroo Mother Care study also called Immediate Parent Infant Skin-to-Skin Study (IPISTOSS), will start in 2017 and run to 2020. Partners include WHO, the Gates Foundation and Karolinska Institute.

16 https://www.waimh.org/i4a/pages/index.cfm?pageID=3361

RECOMMENDATIONS FOR NEWBORN CARE IN HUMANITARIAN AND LOW RESOURCE SETTINGS

- MSF should increase its commitments and investment in training nurses and midwives, and in optimising the organisation of care, as a core component of efforts to improve quality of care.

- MSF NICU programmes should incorporate follow-up of babies after discharge, to identify children with developmental disabilities and link them and their families to support aimed at improving their quality of life. These follow-up programmes should be rooted in engagement with communities and creation of local networks of actors (such as other NGOs) who can provide different types of support.

- Facilities where women give birth should prioritise keeping mothers and infants together 24/7. The use of incubators isolates babies from their mothers and risks doing more harm than good.

- Facilities with deliveries should pro-actively support KMC, especially for LBW and pre-term infants, by assessing obstacles and implementing appropriate measures to resolve them. This will require increased commitment within MSF, including more training of nurses, midwives and aides.

- Expanding use of NIV in selected mid- and higher-level care settings, and assessing how to introduce and run these programmes effectively, could ease the way for broader implementation within MSF.
**NEONATAL INFECTIONS IN FIELD SETTINGS**

*Dr. Harriet Roggeveen (MSF Amsterdam)* opened the session with the fact that infections are the third-biggest cause of neonatal deaths, accounting for about 9% of all U5 mortality. Many of these deaths happen in communities since many women still deliver at home, presenting an additional challenge in lowering mortality from infection. Hospitalisation of infected infants can be life-saving but also carries the risk of nosocomial infections. Her talk was followed by an overview of the risk factors for neonatal infections and feasible, evidence-based solutions for reducing their mortality.

**SUMMARY OF PRESENTATIONS**

*Dr. Ulrike Müller (MSF, Berlin)* spoke about the Challenges of nosocomial infections in a Neonatal Intensive Care Unit (NICU), based on her involvement in responding to an extended outbreak of multi-drug resistant *Klebsiella pneumoniae* at a NICU in Port-au-Prince, Haiti. The setting was the Centre de Référence en Urgence Obstétricale (CRUO), a busy secondary care facility for women with complicated pregnancies and emergencies, and which also has a 60-bed NICU that averages 200-300 admissions per month. CRUO was relatively well-equipped and had well-trained, highly motivated staff. Müller arrived in July 2014 to find that neonatal mortality had spiked to 30% from previous levels of 10-15%, with many deaths caused by sepsis. Blood cultures from sick babies soon confirmed a massive outbreak of ESBL-positive *Klebsiella pneumoniae*. The highest risk was among the smallest, most pre-term babies (i.e. those with the longest hospital stays).

Reinforced by specialists in epidemiology, infection control (IC), and microbiology, the team escalated its response by implementing a series of measures to improve IC, antibiotic protocols and organisation of care (see box).

These intensive efforts initially paid off: mortality, case numbers and crude fatality rate (CFR) decreased significantly through Sept 2015, and *K. pneumoniae* colonisation rate was halved (from 31.4% in Feb 2015 to 14.3% in September 2015). But November/December brought another spike, with colonisation reaching its highest rate ever (68.8%), although gains in lowering CFR remained. When Müller left the project the team was still battling this outbreak. Her talk ended with a call for MSF to standardise infection control strategy in neonatal projects, and to engage with the question of how to provide a higher level of care without bringing the
increasing nosocomial infections to these highly vulnerable patients.

Next, Prof. Zulfiqar Bhutta (Sick Kids Centre for Global Child Health, Toronto, and Centre of Excellence in Women and Child Health, Aga Khan University, Karachi) gave an overview of the Challenges and opportunities for addressing Newborn Sepsis Globally. He began with a discussion of known risk factors and then described established, impactful preventive and treatment strategies that should be scaled up.

The main risk factors associated with neonatal sepsis are well-known: home births in unclean environments, instrumental/invasive deliveries, birth asphyxia, prematurity, LBW, bottle feeding, what happens with these babies soon after birth. He also reviewed evidence that maternal infection is an important cause of both neonatal sepsis directly and of prematurity, which in turn increases the newborn’s infection risk. Partial- and late initiation of breastfeeding (after day 3) also elevate risk relative to early, exclusive breastfeeding (but also reduces risk relative to no breastfeeding; see below). Yet surveys of breastfeeding practices around the world show that no more than 50% of all newborns are initiated early on breastfeeding.

He then turned to potential solutions, outlining a series of simple, feasible interventions and summarising key evidence for the effectiveness of each. The list strongly emphasised preventive strategies, based on the rationale that prevention is not only cost effective but adds value in improving outcomes: even in neonatal units offering a high level of care, infections can have significant case fatality rates (e.g. 16% at the Karachi university clinic, and previous presentation on CRUO, Haiti). Moreover, growing antibiotic resistance is likely to worsen outcomes—and so preventing these infections is crucial to saving lives. Below, the key interventions proposed:

- **Clean birth kits.** Multiple studies report significant impact of clean birth kits used at scale in real-life settings. In those which assessed both mothers and newborns in the same study,18 composite outcomes showed mortality reductions in the range of 80%. On this basis Dr. Bhutta argued for clean birth kits to be widely available wherever in the world they are needed.19, MSF fears that “Clean birth kits” strategy could indirectly...

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19 During the session’s discussion, several participants raised the concern that distributing birthing kits could deter women from coming to deliver at clinics with skilled attendants. Dr. Bhutta’s response was that, with the right messaging, this isn’t seen in practice, also citing a recently updated Cochrane review.
encourage home deliveries. But Prof Bhutta commented that where those strategies have been put in place, it has not been associated with lower rates of deliveries in health facilities.

- **Antibiotic treatment for pregnant women with infections (or risk of infections) associated with significant mortality.** For example, in women with premature rupture of membranes, antibiotics were shown to reduce the risk of premature birth (within 48 hours and 7 days, by 29% and 19%, respectively), maternal chorioamnionitis (by 36%20) and neonatal mortality from infections such as pneumonia. This simple intervention can be implemented by low skilled care providers.

- **Umbilical cord care.** For decades WHO recommended dry care; applying anything to the cord was considered unnecessary. But home births in unclean environments carry higher infection risks than births at facilities. Evidence shows that using chlorhexidine (CHX, added to birth kits) at home births by birth attendants, and then applied daily to the umbilical stump by a family member until the cord falls off, reduced both infections and neonatal mortality. Pooled analysis of 3 cluster-randomised studies in South Asia showed a 23% reduction in all-cause mortality.21,22

- **Breastfeeding.** Breastfeeding is well-known to protect infants against infections and mortality, especially when initiated early and used exclusively. Another key finding is that even partial breastfeeding provides benefits through gradient of benefits in terms of neonatal survival.23

- **Kangaroo mother care (KMC).** KMC impact on survival was discussed earlier (see section 4.3); one component of this impact is that KMC reduces severe infection/sepsis by about 50% compared to conventional care.24 Dr. Bhutta emphasised that there is no single way to provide KMC, and that data from a randomised controlled trial just concluded in Karachi show the same benefits for small babies breastfed on demand.

Modelling studies25 suggest that wide-scale implementation of these interventions (during labour, childbirth and by care of sick newborns) could reduce newborn mortality by as much as 70% (see figure), a potentially enormous impact that adds urgency to finding ways of achieving this scale-up. Dr. Bhutta highlighted a few approaches:

- **Task-shifting care to mothers.** In the mid-1990s, shortages in space and human resources led the neonatal unit at the university hospital in Karachi to pilot a new approach by training mothers to do the interventions nurses normally do, from routine observations and infection control to oral/nasogastric breast milk feeds. Outcomes were excellent: small babies could be sent home much earlier, and survival rates were as good as or better than in the hospital. And nosocomial infection rates plummeted, due to less crowding on the ward. A randomised trial of this approach is underway in Toronto.

- **Emollient therapy.** Breaks in the skin due to intravenous needles create entry points for infection. Coconut oil or skin-cream were shown in a randomised controlled trial to lower neonatal mortality, mainly due to fewer infections.26

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21 Studies on African facilities-based births did not show an impact.

22 More information, including a global tracker of countries moving towards implementation of CHX for cord care, see Chlorhexidine for umbilical cord care. Healthy Newborn Network.


Outpatient treatment of severe neonatal infections in the most difficult contexts. For infected neonates and young infants with either clinical severe infection or fast breathing (but who are not critically ill), and whose caregiver refused referral to the hospital, oral amoxicillin given at ambulatory care proved to be equivalent to the more complex reference treatment (injected procaine penicillin plus gentamicin). These key findings led WHO in 2015 to issue new guidelines for outpatient management of serious bacterial infections in young infants.

In closing, Dr. Bhutta emphasised the growing threat to newborns of antibiotic-resistant infections, and highlighted the need for interventions to focus on the mother-child pair.

27 Injectable gentamicin once daily plus injectable procaine penicillin once daily for 7 days (14 injections total).
29 African Neonatal Sepsis Trial (AFRINEST) group. Simplified antibiotic regimens compared with injectable procaine benzylpenicillin plus gentamicin for treatment of neonates and young infants with clinical signs of possible serious bacterial infection when referral is not possible: a randomised, open-label, equivalence trial. Lancet 2015; 385: 1767–1776.
30 WHO. Managing possible serious bacterial infection in young infants when referral is not feasible. 2015
## APPENDICES

### POSTERS AND ORAL PRESENTATIONS


<table>
<thead>
<tr>
<th>Titles</th>
<th>Authors</th>
</tr>
</thead>
<tbody>
<tr>
<td>A nosocomial outbreak of multi-resistant ESBL-positive Klebsiella pneumoniae in a neonatal advanced care unit in Port-Au-Prince,</td>
<td>Ulrike Müller, Daan Van Brusselen, Evens Estiverne, Olumide Faniyan, Annick Lenglet, Marine Berthet</td>
</tr>
<tr>
<td>Nonclassic Congenital Adrenal Hyperplasia In A School Age Girl With Severe Virilization Diagnosed Through The MSF Telemedicine</td>
<td>Vargas A, Jacobson M, Guinovart S, Martínez C, Martínez D, AL Khafaji A</td>
</tr>
<tr>
<td>Rationale For The Use Of Systematic Thiamine At Pharmacological Dose In Malnourished Children Requiring Hospital Admission</td>
<td>Laurent Hiffler, Daniel Martinez Garcia, Nuria Salse, Nadia Lafferty, Marie-Claude Bottineau</td>
</tr>
<tr>
<td>Potential Effects Of Aluminium And Lead Containing Cookware On Health</td>
<td>Laurent Hiffler, Sebastián Tornero Patricio</td>
</tr>
<tr>
<td>How Do Low-Birth-Weight Neonates Fare Two Years After Discharge From A Low-Technology Neonatal Care Unit In A Rural District....</td>
<td>Wilma van den Boogaard, Isabel Zuniga, Marcel Manzi, Rafael Van den Bergh, Séverine Caluwaerts, Annabel Lefevre, Kassi Nanan-N’zeth, Bruno Duchenne, William Etienne, Juma Nderyere, Brigitte Ndelema, Tony Reid and Rony Zachariah</td>
</tr>
<tr>
<td>Kangaroo Mother Care In Afghanistan: An Assessment Of Barriers And Facilitators To Implementation</td>
<td>Laura Acheson, RN &amp; Dr. Nikola Morton</td>
</tr>
<tr>
<td>Reasons For Admission To The Neonatal Ward Of Mbarara Regional Referral Hospital And Outcome Of Treatment – A Review Of Records</td>
<td>Cajsa Schalling, Helena Nordenstedt, Juliet Mwanga-Amumpaire</td>
</tr>
<tr>
<td>Framework For Provision Of Paediatric Care In MSF Hospital Settings</td>
<td>Marco Olla, Belen Caminoa, Lisa Umphrey, David Green, Myrto Schaefer</td>
</tr>
<tr>
<td>Clinical Features And Factors Associated With Death In Ebola Virus Disease Among Children Aged ≤5 Years: A Retrospective Cohort</td>
<td>Tejshri Shah, Jane Greig, Linda Margaretha van der Plas, Jay Achar, Grazia Caleo, James Squire, Alhaji Turay, Grace Joshy, Catherine D’Este, Emily Banks, Florian Vogt and Kamalini Lokuge</td>
</tr>
<tr>
<td>Reducing Mortality In A Paediatric SARI Outbreak In Nakuru, Kenya.</td>
<td>Dr Nikola Morton</td>
</tr>
<tr>
<td>“Give A Man A Fish And You Feed Him For A Day”. Teach A Man to Fish: Implementation Of A Paediatric Emergency Training Course In MSF Projects</td>
<td>Johanna Thomson</td>
</tr>
<tr>
<td>Fluid Management And Mortality In Pediatric Intensive Care, Koutiala, Mali</td>
<td>Matthew Coldiron, Joseph Sagara, Cécile Cazes, Christopher Mambula, Marco Olla, Belen Caminoa, Lisa Umphrey, Myrto Schaefer and Rebecca F Grais</td>
</tr>
<tr>
<td>Title</td>
<td>Authors</td>
</tr>
<tr>
<td>----------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Mortality And Diagnosis Of Tuberculosis In Children 6-59 Months Of Age Admitted To Inpatient Therapeutic Feeding Centres (ITFC)</td>
<td>Helena Huerga, Florence Tapié de Céleyran, Kerstin Hanson, Cecilia Ferreyra, Didier Tshialala, Seybou Diarra, Yazi Abdoula</td>
</tr>
<tr>
<td>MSF OCBA And MSF Canada Experience With Testing Hybrid Model Of Telemedicine In Providing Remote Paediatric Training And Supervision</td>
<td>Fabien Schneider, Yogesh Jha, Annie (Liying) Liang, Daniel Martinez, Laurent Hiffler, Carol Bottger, Cristian Casademond</td>
</tr>
<tr>
<td>Attitudes towards diagnostic testing among guardians of children admitted to the pediatric wards of Mbarara Hospital, Uganda</td>
<td>Linus Kullänger, Helena Nordenstedt, Juliet Mwanga-Amumpaire</td>
</tr>
<tr>
<td>Vit D Deficiency A Neglected Disease.Nutritional Rickets In Children &lt;5 At Al Salam In Khamer, Amram Governorate, Northern Ye</td>
<td>Emanuela Bertoli, Saif Eldin Abdallah, Myrto Schaefer</td>
</tr>
<tr>
<td>Management Of Cerebral Malaria In Children In Resource Limited Settings: The Experience From Two Clinical Trials In Mbarara</td>
<td>Juliet Mwanga-Amumpaire, Ryan W. Carroll Arinaitwe Rinah, Yap Boum</td>
</tr>
<tr>
<td>Early Warning Scoring Systems for MSF Paediatric Projects</td>
<td>Marco Olla, Daniel Martinez Garcia, Belen Caminoa, Lisa Umphrey, David Green, Myrto Schaefer</td>
</tr>
<tr>
<td>Sharp Decrease in Mortality for Neonates Admitted to a New Neonatal Unit of a Regional Hospital in DRC: a Retrospective Case Con</td>
<td>Anne Pittet, Joseph Djoki Bahati, Jules Malikidogo, Florence Zangalia Fongo, Michel Quere, Marie-Claude Bottineau</td>
</tr>
<tr>
<td>Treatfood: Effectiveness On Fat-Free Mass Of Improved Supplementary Foods For Children With Moderate Acute Malnutrition: A 2x2x3.</td>
<td>Christian Fabiansen, Kevin PQ Phelan, Bernardette Cichon, Christian Ritz, André Briend, Kim F Michaelson3, Henrik Friis, and Susan Shepherd</td>
</tr>
<tr>
<td>Short children with a low mid-upper arm circumference respond to food supplementation: an observational study from Burkina Faso</td>
<td></td>
</tr>
<tr>
<td>Lessons Learnt From Introducing Increased Monitoring Of Hdu Patients In A Kenyan District Hospital</td>
<td>Mark Lee</td>
</tr>
<tr>
<td>Screening for rheumatic heart disease in refugee children in Europe – MSF leads, will others please follow?</td>
<td>Gianfranco De Maio, Miguel Lupiz, Fortunata Condemi, Antonio Pagano, Gabriele Rossi</td>
</tr>
<tr>
<td>Breathing Made Simple: Developing Simple Continuous Positive Airway Pressure in Uganda for Resource Limited Settings</td>
<td>Aartik Sarma, Patrick Ssonko, Ryan W. Carroll</td>
</tr>
<tr>
<td>Newborn Intoxication With Natron (Traditional Medicine). Case Report.</td>
<td>Valori, Ana., Jeff Muntombo, Laurent Hiffler</td>
</tr>
<tr>
<td>Sickle Cell Disease (Scd) In Madaoua, Niger: A Neglected Morbidity Burden Within Inpatient Paediatric Department (Ipd) And Inten</td>
<td>Valori, Ana Jeff Muntombo, Laurent Hiffler</td>
</tr>
<tr>
<td>Topic</td>
<td>Authors</td>
</tr>
<tr>
<td>----------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Building Therapeutic Alliances Between Health Workers And Guardians In Nutritional Rehabilitation Units: A Qualitative Study</td>
<td>Emilie Macher, Stephen Allen, Moses Kumwenda and Kate Chidzalo</td>
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<td>Bubble Contious Positive Airway Pressure (Bcpap) And The Management Of Critically Ill Children On A Busy Paediatric Unit In Mal</td>
<td>HJ Lang, S Myers, P Dinga, M Anderson, R Mlotha, A Phiri, T Colbourn</td>
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<td>Management of Refractory Status Epilepticus (RSE): The use of Ketamine as part of the MSF-CH- Status Epilepticus Algorithm - Man</td>
<td>Hans-Joerg Lang, M Madika, G Tchilongo Mpubu, T Kamusau Tshinkoy, F Kisula Kllefu, V Kazadi Kamanda</td>
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<td>Using Nurse-Led Care To Improve The Quality Of Emergency Triage And Treatment In A West African Tertiary Children's Hospital</td>
<td>Dr Sandra Dankwa, Dr Christopher Hands</td>
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<td>A Qualitative Study of Child Well-being and Community Recovery Four Years After a Natural Disaster in Chile</td>
<td>Elizabeth Peacock-Chambers, Pilar del Canto Douglas Ahlers, Mario Valdivia Peralta, Judith Palfrey</td>
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<td>Pancytopenia And Pyrexia Of Unknown Origin In A Four Year Old Boy In Rural Ethiopia; A Diagnostic Dilemma In The Resource Limited Setting: A Case Report</td>
<td>Kay Hodgetts</td>
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</table>
AGENDA

DAY 1

MORNING SESSION
Welcome and introduction

**PaED Talk** Frontline paediatrics and the birth of the Paediatric Days

Oral Abstract presentations

Challenges in septic shock treatment in resource-limited settings (RLS)

AFTERNOON SESSION

**PaED Talk** My life as a Sickle Cell Patient

Sickle cell disease (SCD) in MSF settings

Oral abstract presentations

**PaED Talk** Bringing Paediatrics to the frontline with Telemedicine – The MSF experience and way forward

DAY 2

MORNING SESSION

**PaED Talk** Field perspectives from a Paediatrician

Oral abstract presentations

**PaED Talk** Added value of nurse-lead care in MSF paediatric projects

The preterm / low and very low birth weight infant

AFTERNOON SESSION

Neonatal infections in field settings

**PaED Talk** Challenges of nosocomial infections in Neonatal Intensive Care Unit

Conclusions and recommendations