'Saving Children 2009': Evaluating quality of care through mortality auditing

The Child Healthcare Problem Identification Programme (Child PIP)[1] has contributed to both improving knowledge regarding child deaths and efforts to reduce these deaths since its introduction in 2004. Child PIP is a voluntary mortality audit process designed to ascertain the quality of care children receive in the South African health system. It provides structure and tools for conducting mortality reviews or audits of in-hospital deaths of children by:

- ensuring that all deaths are identified
- determining the social, nutritional and HIV context of each child who dies
- assigning a cause to each death
- determining modifiable factors that identify instances where failure to meet specific standards of care have, or may have, contributed to the child's death.

Child PIP encourages and enables teams of health care workers to reflect on the quality of health care children receive, to identify gaps or deficiencies in this care, and to find solutions that will improve care in the future. Child PIP was developed and initially implemented primarily by paediatricians (who are usually based at regional or tertiary levels), but has since been taken up by general doctors and professional nurses working in district hospitals.

In the most recent 'Saving Children' report,[1] which covers the period from 2005 to 2009, 101 out of a total of 339 South African hospitals in all nine provinces contributed Child PIP data, with some year-to-year variation. Ninety-eight hospitals submitted data in 2009, as shown in Table I.

Almost 30% of public sector hospitals in South Africa submitted data. District hospitals accounted for around two-thirds of these, although a higher proportion of regional (43%) and provincial tertiary (36%) hospitals participated.

This paper summarises the main findings for children who died in the participating hospitals for the period 2005 - 2009, with emphasis on the quality of care they received.

Paediatric hospital deaths – demographics and trends

A total of 19 295 deaths out of 343 408 admissions were audited in detail during the 5-year period. (Data were submitted by different hospitals in different years, and comparisons between years should be interpreted with care.) The in-hospital mortality rate (IHMR) has been stable at 5 deaths per 100 admissions over the past few years – the higher mortality rates recorded during the first 2 years of reporting may have resulted from the relatively small numbers of participating hospitals, but may also indicate an encouraging downward trend. Even so, one in 20 children admitted to participating hospitals still dies during the admission to hospital.

For these deaths, 53 326 modifiable factors were identified with an average of 2.8 modifiable factors per death. The number of modifiable factors identified per death appears to be increasing over time, as seen in Table II. This may reflect a decline in quality of care, but conversely may indicate a greater awareness of standards of care, and the need to strive towards meeting these standards.

Five conditions accounted for 77% of all audited deaths (79% in children less than 5 years of age). These conditions are acute respiratory infections (ARIs) (29% of deaths), diarrhoea (21%), septicaemia or possible serious bacterial infection (16%), tuberculosis (TB) (7%), and meningitis (7%) (Fig. 1).

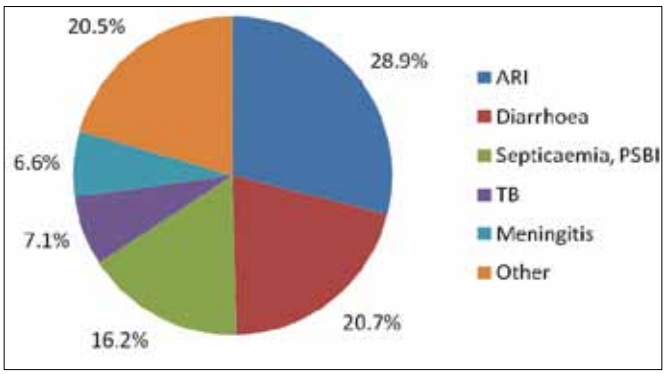

Fig. 1. Main causes of death, 2005 - 2009.

TABLE I. NUMBER AND PERCENTAGE OF HOSPITALS SUBMITTING CHILD PIP DATA IN 2009

Level of hospital	Total hospitals	Hospitals submitting data	% of hospitals in that level
District	259	68	26
Regional	53	23	43
Provincial Tertiary	14	5	36
National central	13	2	15
Total	339	98	29

TABLE II. CORE CHILD PIP DATA

	2005	2006	2007	2008	2009
Total admissions	23 653	40 665	63 378	106 860	108 852
In-hospital mortality rate	6.5%	5.9%	5.0%	5.0%	5.0%
Audited deaths (all)	1 537	2 871	3 828	5 539	5 520
Total modifiable factors	3 757	5 539	7 986	16 773	19 271
Modifiable factors per death	2.4	1.9	2.1	3.0	3.5

Boys accounted for slightly more deaths than girls (52% compared with 47%). Most children who died (63%) were under 1 year of age, with children aged between 1 and 5 years accounting for a further 25% of deaths; 89% of audited deaths therefore occurred in children under 5 years of age, and 70% of under-5 deaths occurred in infants. Six per cent of deaths in children younger than 5 years of age occurred in the newborn period (0 - 28 days). It is concerning that newborns are admitted to (and die in) paediatric wards, which are generally not designed or adequately staffed to provide the specialised care for ill newborns that can only be provided in nurseries or neonatal units.

Causes of death in different age groups

The proportions of each cause of death varied across the age categories. Septicaemia was the leading cause of death in the newborn period, accounting for 28% of deaths, ARI was the leading cause of death in children between 1 month and 1 year of age (37%), and diarrhoea was the most common cause of death in children between 1 and 5 years of age (23%). TB was the leading cause of death for children between 5 and 18 years of age (20%) (Fig. 2).

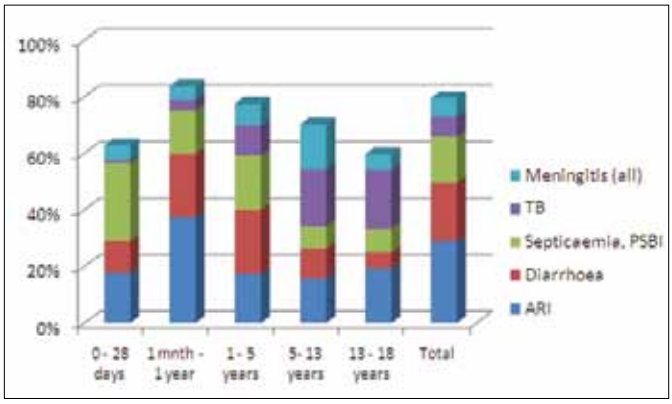

Fig. 2. Leading causes of death by age group.

Deaths within the first 24 hours of admission

In 3% of cases the child was dead on arrival, and a further 31% of deaths occurred within 24 hours of admission to hospital. This proportion was higher among newborn children, with more than half of deaths occurring within 24 hours of admission.

The three main causes of death in the first 24 hours (Fig. 3) were diarrhoeal disease (27%), acute respiratory infections (26%), and sepsis (15%). Half of deaths due to acute diarrhoea occurred within the first 24 hours. Most of these deaths result from shock and dehydration, suggesting problems with the management of these conditions.

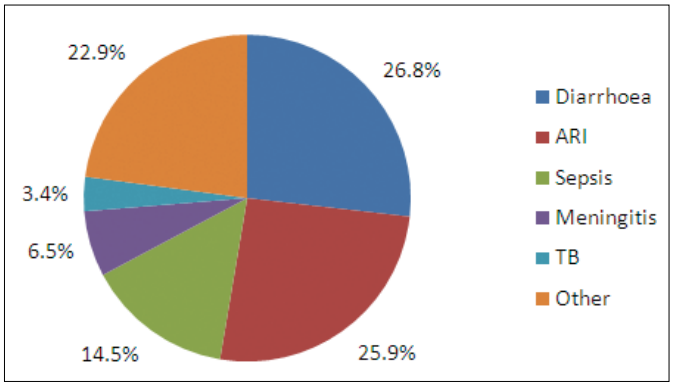

Fig. 3. Main causes of death in the first 24 hours.

Nutritional status

Almost 35% of children who died were severely malnourished, and a further 30% were classified as being underweight for age. Less than 30% of deaths occurred in children of normal or above average weight. The most common causes of death in children who died with severe malnutrition were diarrhoea, ARI and septicaemia, with each of these three conditions accounting for 24% of deaths. The proportion of children with severe malnutrition was particularly high among children who died from TB (50%), septicaemia (49%) and diarrhoea (39%). (Fig. 4). Over 80% of HIV-infected children who died had severe malnutrition or were underweight for age.

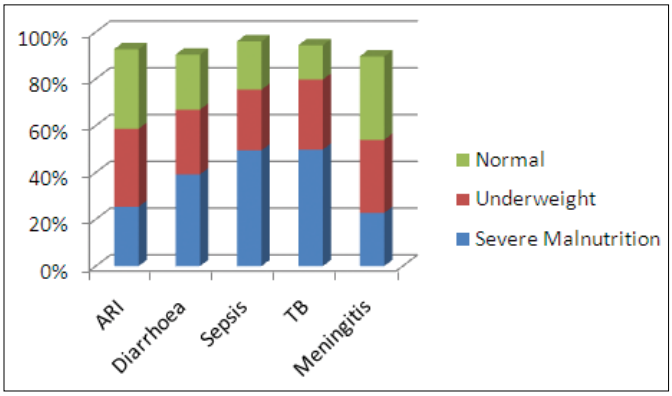

Fig. 4. Nutritional status of children who died from leading causes of death.

HIV infection status

HIV testing indicated that more than half the children who died had evidence of HIV infection or exposure (in the absence of a positive or negative confirmatory test). The HIV status of 35% of children who died was not known, with this proportion being even higher (more than 50%) in neonates. Only 14% of children who died tested negative.

The guidelines for identifying and treating children with HIV infection have changed substantially during the period 2005 - 2009. Every health care encounter with a child should be used as an opportunity to assess the child's HIV status and to provide appropriate treatment, including ART where indicated. It is of concern that the HIV status of such a high proportion of children was not known.

Children who died of TB and with severe malnutrition were most likely to be HIV infected (55% and 44%, respectively). Fifty-nine per cent of children who died of ARIs were HIV infected or exposed, compared with 47% of children who died from diarrhoeal disease.

Data on testing rates in children for each year are presented in Fig. 5. The percentage of children who were HIV infected or exposed has remained relatively constant, with approximately half of the children who died falling into this category. The percentage of children whose HIV status was not known has decreased slightly, but HIV status remains unknown for 1 in 3 children who die. The proportion of those who were known to be HIV negative has increased from 9% to 14%.

Efforts to reduce perinatal transmission of HIV infection through PMTCT programmes have also expanded during this period. Data

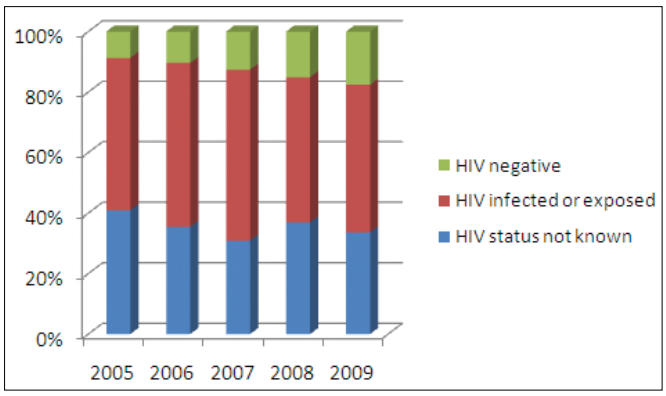

Fig. 5. HIV status of children who died, 2005 - 2009

on uptake of prophylactic ARVs during the perinatal period among children who died are shown in Fig. 6. In 54% of child deaths, no data were available regarding access or uptake of PMTCT. These data once more highlight the many missed opportunities for prevention of HIV infection in children who subsequently died.

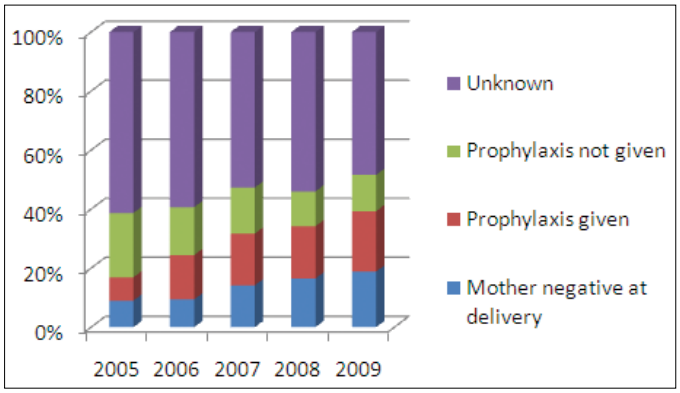

Fig. 6. Uptake of perinatal antiretrovirals among children who died, 2005 - 2009.

Among HIV-infected children who died, 20% were assessed as having stage III disease and 68% stage IV disease. Only 3% of these children had stage I or stage II disease. The clinical stage was unknown in 10%. Thirty-one per cent of children with documented stage III or IV HIV disease had received ART.

Information about quality of care

Quality of records

The folder was available with adequate records and notes in 55% of deaths, whereas notes were found to be incomplete in 43% of cases. Folders were not available, or the quality of records was unknown, in just over 7% of audited deaths.

Was the death avoidable?

Approximately one-quarter (26%) of deaths were considered to be avoidable. A further quarter (24%) of deaths were considered unavoidable, while in 35% of deaths there was uncertainty. This pattern was consistent across all of the leading causes of death, with the exception of deaths due to diarrhoeal disease, where a higher percentage of deaths (35%) were assessed as being avoidable.

Modifiable factors

A total of 53 328 modifiable factors were identified during audit of the 19 295 deaths, with an average of almost 3 (2.8) modifiable factors being identified for every child who died. More modifiable factors per death were identified for children dying from acute diarrhoea (3.2 per death) and within 24 hours of admission to hospital (3.1 per death).

Modifiable factors – where?

Overall, approximately one-quarter of modifiable factors occurred in the wards (27%) and a further quarter in the accident and emergency or casualty unit (24%). Modifiable factors at clinic or OPD level accounted for 14% of the total, with a further 1.5% identified during transit. Two-thirds of modifiable factors therefore occurred within the health system, while home- or community-level modifiable factors accounted for 33% of the total. A similar distribution with regard to the place where modifiable factors occurred was evident for each of the leading causes of death (Fig. 7).

The fact that almost a quarter of modifiable factors occurred in emergency units highlights an important gap in the care that children receive. Children usually spend a relatively short time in these units where the emergency care they receive impacts on their outcome, especially in the case of critically ill children. Most of the modifiable factors were related to clinical personnel, and there is an urgent need to improve the quality of care provided to children (often by generalist doctors and nurses) in these units.

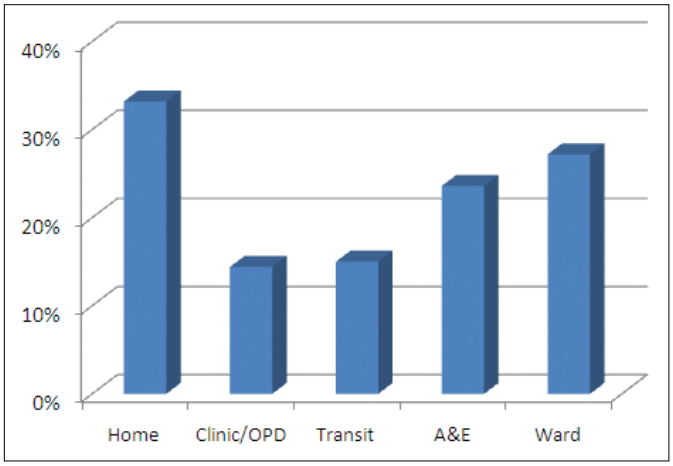

Fig. 7. Modifiable factors: where? (%).

As in other settings, the most common modifiable factors in the outpatient department/primary care setting related to failure to follow well-recognised standards of care, such as the Integrated Management of Childhood Illness (IMCI) guidelines.

Delays in seeking care and caregivers not recognising the severity of illness were identified as modifiable factors in a high percentage of child deaths. It is important to emphasise that caregivers are *not* being blamed for these deaths. Because many home and community modifiable factors are broader in scope than health system factors, they are listed far more frequently than those associated with health system factors. For example, the modifiable factor 'delay in seeking care' encompasses a wide range of factors and may indicate difficulties in overcoming a variety of geographical, transport, financial and other barriers to accessing care.

However, delays in seeking care and caregivers not recognising the severity of illness are identified as modifiable factors in a high percentage of child deaths. This highlights the need for better community-based care, and for empowerment of caregivers to identify when and how to access care for their children. The fact that the third most common modifiable factor in this category relates to children not being provided with adequate food at home highlights the contribution of poverty, lack of information and other social determinants of feeding behaviour to ill-health and mortality in children. It is also of concern that inappropriate and harmful home or traditional treatments are identified as modifiable factors in a relatively high proportion of child deaths.

Modifiable factors – who is responsible?

Clinical personnel were considered to be responsible for more than half (55%) of modifiable factors. This finding was consistent for all causes of death. It is noteworthy that at least 4 of the 5 leading personnel-related modifiable factors occurred in the emergency assessment and care setting, suggesting that improved training and supervision of personnel in this area is a key intervention for improving the care children receive within the health system (Fig. 8).

Discussion

Child PIP has enabled information on deaths and quality of care to be collected on an ongoing basis. While the overall picture is starting to show the promise of real improvement, there are areas of health care for children in need of urgent attention.

Pneumonia and diarrhoeal disease remain the leading causes of death in South Africa – together they account for half of all deaths in children. Preventive and promotive interventions can prevent

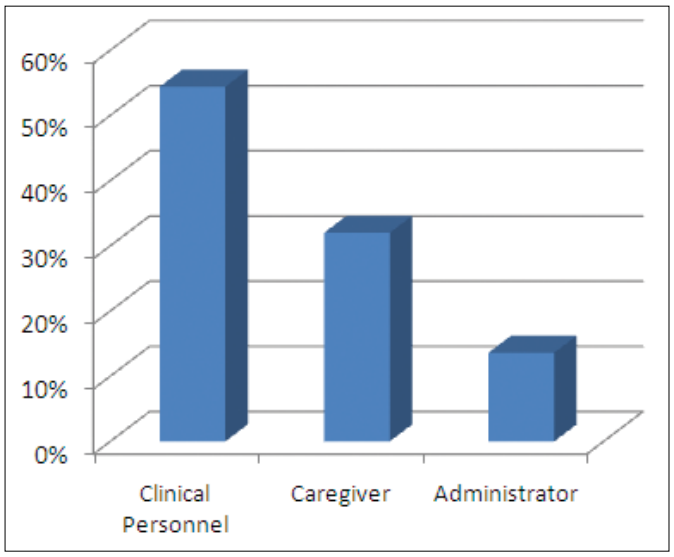

Fig. 8. Modifiable factors: who? (%).

many cases, and case fatality rates can be reduced if children receive treatment based on standard case management guidelines.

HIV infection continues to contribute significantly to childhood deaths, and substantial reductions in child mortality are unlikely to be seen without a reduction in the occurrence of HIV infection in children. The Child PIP data demonstrate some improvements in testing rates and uptake of prevention of mother-to-child transmission (PMTCT) in patients who died, but many missed opportunities persist. While the scale-up of PMTCT and ART programmes have prevented many child deaths, ongoing strengthening is required to ensure that all mothers and children benefit from these programmes. Likewise undernutrition remains an important contributing factor in many childhood deaths, and it is of great concern that food insecurity remains one of the leading community or home modifiable factors.

In addition to HIV-infected and undernourished children, the data highlight two vulnerable groups of children.

Newborn infants account for more than 5% of children admitted to paediatric wards, yet these wards are seldom specifically equipped or staffed to care for the needs of neonates such as extra warmth, special feeding requirements (e.g. breastmilk), close monitoring, and protection from nosocomial infectious diseases.

The data also identify children requiring emergency care as a vulnerable group. More than one-third of deaths occurred within 24 hours of admission, and a disproportionate number of modifiable factors occurred in this emergency care setting. Assessment and management of critically ill children appears to be a particular problem, and highlights the need for the introduction of a standard approach to provision of emergency care. The Emergency Triage, Assessment and Treatment (ETAT) approach, which was developed by the World Health Organization and adapted for use in South Africa, provides an excellent system for ensuring adequate care during this period.

Recommendations

The Child PIP process not only provides valuable data regarding child deaths, but also provides direction for addressing identified gaps. While the strength of audit processes such as Child PIP lies in their potential to inspire teams of health care workers at local levels to develop local solutions to identified problems, analysis of the data also highlight areas which require particular attention at a national level.

Below are a set of recommendations that have arisen from analysis of the Child PIP data. The recommendations are targeted at different key functions within the health sector and are therefore divided into four sections, namely policy, management and administration, clinical practice and education.

Policy level

- Develop a co-ordinated and intersectoral response to child poverty and ill health, with special emphasis on improving water supply and sanitation, improving food security through the creation of employment, addressing barriers to accessing social grants, and providing supplementary feeding programmes.
- Develop a national plan for improving the quality of emergency care for critically ill children in South Africa. This should target all levels of care within the district health system to build capacity for health workers, improve systems for provision of emergency care, and ensure that adequate resources are allocated.
- Define and implement a package of perinatal and postnatal care for newborn babies (including home postnatal visits and appropriate hospital care for sick newborns), as well as strengthening of primary maternal and obstetric care.
- Clarify the policy regarding infant feeding and provision of formula at health care facilities, and communicate this clearly to all role players.
- Review and improve the paediatric section of the National Tuberculosis Guidelines and ensure that health care workers have access to clear and practical guidance with regard to assessment, diagnosis and management of children with suspected or proven TB.

Management and administration

- Appoint district/regional specialist teams to support maternal and child health service delivery at district level.
- Ensure the availability of infrastructure, equipment, staffing, and record keeping and monitoring systems for delivering emergency care, based on agreed country standards.
- Ensure that high-care facilities for severely ill children are adequately equipped and staffed.
- Provide hospital facilities that are adequately staffed and equipped to provide care for newborn and small babies. Ensure that all newborns (including those admitted from home) are admitted to these facilities, and not into general paediatric wards.
- Ensure that paediatric Essential Drug List drugs, including paediatric antiretrovirals, are available at all health care facilities.
- Ensure that supplies used in management of severe malnutrition (pre-mixed F75 or F100 or the combined vitamin and mineral mix) are available at all hospitals, at all times.
- Strengthen the vaccine supply chain in order to improve coverage with all recommended immunisations.

Clinical practice

- Scale up and strengthen paediatric nurse-initiated ART services by means of a mentorship programme.
- Use each and every health care encounter with a child as an opportunity to ascertain his/her HIV status.
- Improve the recognition and management of children with malnutrition through universal use of Integrated Management of Childhood Illness guidelines at clinic level, and national guidelines for severe malnutrition (based on WHO Ten Steps) at hospital level.
- Improve hospital care through obligatory use of available guidelines and protocols. Areas that require particular attention include:
  - improved emergency care including development and implementation of a national guideline for the management of children with severe sepsis
  - better management of children with acute diarrhoeal disease
  - correct and early use of oxygen in children with ARI
  - development and implementation of guidelines for neonatal care, with special emphasis on perinatal HIV care and emergency care for small babies.

Education

- Empower community caregivers to provide home care for children, and to recognise danger signs of serious illness that require immediate care at health facilities.
- Ensure that all health workers are aware of the importance of exclusive breastfeeding and are able to advise mothers on optimal feeding choices and good nutrition.
- Ensure that all health professionals dealing with children are competent to identify and manage those conditions that account for most deaths in children, and that undergraduate medical, nursing and allied health curricula offered in South African institutions are relevant to the health needs of the country's children.
- Ensure competence in emergency triage and treatment by providing certified emergency care training, based on a national standard, to doctors, nurses and paramedics (ambulance personnel).
- Ensure that health care professionals understand the contribution of neonatal deaths to under-5 mortality and are competent in providing the specialised care required by small babies.

Lesley Bamford
Child and Youth Health Directorate, National Department of Health, and School of Health Systems and Public Health, University of Pretoria

Cindy Stephen
Department of Paediatrics, Pietermaritzburg Metropolitan Hospitals Complex, and Child PIP National Co-ordinator

Mark Patrick
Department of Paediatrics, Pietermaritzburg Metropolitan Hospitals Complex and Nelson R Mandela School of Medicine, University of KwaZulu-Natal

Corresponding author: *L Bamford (bamfordlj@mweb.co.za)*

Reference

1. Stephen CR, Bamford LJ, Patrick ME, Wittenberg DF, eds. Saving Children 2009: Five Years of Data. A Sixth Survey of Healthcare in South Africa. Pretoria: Tshepesa Press, MRC, CDC, 2011.

NEWS

Collaborating to save children's sight in sub-Saharan Africa

Ten paediatric eye-care clinics in ten years – that was the commitment from multinational sight-saving organisation ORBIS, announced at a recent conference they hosted in Cape Town, when eye-care NGOs, ophthalmologists, health department officials and academics from 15 countries gathered to strategise on how to prevent children from going needlessly blind in sub-Saharan Africa.

With a direct link between the incidence of blindness and poverty, sub-Saharan Africa is home to 23% of the world's blind (India has 19% and China 13%). 'In terms of global blindness alleviation Southern Africa is a priority region,' said Lene Øverland, Director of Programme for ORBIS Europe, Middle East and Africa. Furthermore, the poorer the community, the lower are the chances of children surviving blindness. The World Health Organization estimates that up to 60% of infants die within two years of becoming blind. 'With a one hour procedure you can not only make a huge difference to a life, you can save it,' said Dr Hunter Cherwek, Medical Director of ORBIS, one of speakers at the meeting.

At the meeting Øverland challenged other stakeholders to embrace and add on to ORBIS's pledge of a $1 million (R6.7 million) paediatric eye care clinic each year, over the next ten years.

Far from being a luxury, the experts concurred that paediatric eye care gives a significant return to society; childhood blindness is estimated to account for a third of the total economic cost of blindness. 'Restoring a child's sight offers you one of the best returns on medical investment,' said Dr Cherwek. 'It is one of the most cost-effective procedures of all medicine if you consider the years of use subsequent to treatment. Saving one child's sight can be the same as operating on 10 elderly people with cataracts in terms of blind years saved.' Training of specialist eye care professionals was another key issue that arose.

Dr Daniel Etya'ale, Executive Director for Africa for the International Agency for the Prevention of Blindness, described the meeting as 'historical' but warned that the next step is to make sure the plan is implemented. 'Every child that can be treated is a chance given to them to go to school and be productive, and realise their potential simply because they can see.'