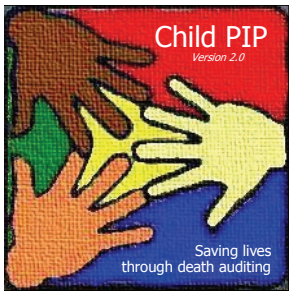

CHILD HEALTHCARE PROBLEM IDENTIFICATION PROGRAMME

Saving lives through death auditing

Saving Children: 2005-2007

A fourth survey of child healthcare in South Africa

Compiled by Child PIP Users and the MRC Unit for Maternal and Infant Health Care Strategies

Edited by CR Stephen, MC Mulaudzi, S Kauchali and ME Patrick

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Foreword

During the past few months infant and child survival have been foremost in the thoughts of those of us who have been concerned and involved in these issues for several decades. It is therefore apposite that this fourth survey, *Saving Children 2005-2007*, makes its appearance in this period. This is an exceptional time as it marks 30 years since the critical ideas on Primary Health Care (PHC), developed, espoused and championed from Alma-Ata, burst into our consciousness and became an ineradicable part of our public health discourse.

This *Saving Children 2005-2007* reminds me of the richness of the South African medical scientific culture, preceding Alma-Ata, when the concept of healthcare for the community first emerged during the immediate post-war years to the research accomplishments in major diseases of humankind today. Like the fluctuating successes and multiple failures of PHC globally in the intervening years, the advances in medical research and health service implementation in this country have not been an unbroken record. There have been many ups and downs, and in recent years we appear to have sunk into a trough of failure. Current published data on maternal and under-five year mortality, and other indicators of outcomes of PHC in this country, should give us pause. For our relative global economic status in South Africa we are performing very badly.

It is the latter which gives me cause to appreciate the fine contribution *Saving Children 2005-2007* makes to our country and its people, especially the poor and marginalised. The Child Healthcare Problem Identification Programme (Child PIP), together with similar programmes, the National Committee on Confidential Enquiries into Maternal Deaths and the Perinatal Problem Identification Programme, provide a superb account of what matters in maternal, infant and child health, and disease in this country.

This edition once again offers an insight into facility-based mortality for children. In a series of linked chapters, *Saving Children 2005-2007* examines mortality rates in children and explores the associations which link predisposing factors with death. The effort to identify remediable or preventable elements in the cause of these deaths is most important as practical improvements can be made.

An audit such as this provides a factual basis for making policy recommendations and setting priorities at different levels of the health service and system, and for designing interventions that are affordable, effective and sustainable. The impact at local and hospital levels of mortality patterns and their optimized prevention and treatment, gives immediacy to Child PIP that should be gratifying to the programme managers and their patients.

The section on the most important causes of mortality in children - HIV, acute respiratory infections, tuberculosis, and malnutrition - is particularly relevant to finding the best solutions to reduce morbidity and mortality. The current slogan in HIV prevention is "Know Your Epidemic"! Using the provincial data in this report, programmers and implementers will obtain a much deeper knowledge on which to base action according to sites and regions.

The information contained in *Saving Children 2005-2007* will certainly save children in this year and the next, and the times to come, and will be one of numerous building-blocks in constructing a first class PHC in this country. This, as the cliché has it, is the age of knowledge and power; the knowledge which comes from Child PIP and accompanying programmes can give us the power to consolidate all these individual building blocks into a solid foundation for an effective, just and equitable health system.

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- The Child PIP Users, both those whose work appears in this report, as well as current and future users

This report is dedicated to all the health workers in South Africa
who care about looking after children properly.

Executive Summary

Introduction

This is the fourth *Saving Children* report, following the 2004, 2005 and 2006 reports. It presents the findings from South African hospitals that used paediatric mortality auditing over the three-year period, 2005 to 2007, to assess the quality of child healthcare in South African hospitals. The hospitals used an auditing tool that was developed in South Africa, the Child Healthcare Problem Identification Programme (Child PIP).

Objectives

This survey has several objectives, namely to:

- Continue the collection of demographic, social, nutrition, HIV, cause of death and modifiable factors data on children who die in South African hospitals, in order to assess the quality of care,
- Strengthen the recommendations for improvement made in *Saving Children 2005* and *Saving Children 2006*, and
- Identify trends emerging from the cumulative 2005 to 2007 data.

Settings

Fifty-one hospitals from the nine provinces of South Africa participated in the study during the three-year period. The sites represented different levels of paediatric healthcare serving rural, peri-urban and urban populations.

Methods

As in the previous reports, all sites used Child PIP to structure the mortality review process. Each site integrated collection of the data with their ongoing local audit process and used the data to compile a site report. Data from the sites were amalgamated into a national database.

Survey Period

1 January 2005 to 31 December 2007.

Survey Population

All children, from birth to eighteen years, admitted to children's wards in the participating hospitals.

Findings

Data in the report are presented annually to highlight trends. In total, there were 121 368 admissions and 6 758 deaths, giving an overall in-hospital mortality rate (IHMR) of 5.6 per 100 admissions. The careful audit of 8 060 deaths identified 17 215 modifiable factors, giving rise to a rate of 2.1 modifiable factors per death. The health context of children who died was one of HIV, malnutrition and poverty, and the main causes of death were acute respiratory tract infection (including Pneumocystis pneumonia), diarrhoeal disease, sepsis and tuberculosis. Most deaths (63%) occurred in children under one year of age, and 33% occurred during the first 24 hours after admission. Sixty-four percent of the children who died were malnourished. Almost half of the children who died (47%) were eligible for antiretroviral therapy (ART) based on clinical HIV staging.

Modifiable factors occurred in the home, clinics, emergency and paediatric wards with the majority attributable to clinical personnel.

Recommendations

The Child PIP data from 2005 to 2007 highlighted and emphasised five key areas of importance that were first identified in *Saving Children 2005*, and from which the recommendations flow:

1) HIV and AIDS
    - Prevention: Reduce vertical transmission of HIV.
    - Identification and Treatment: Give children and their parents ready and universal access to antiretroviral treatment.
2) Nutrition
    - At Clinic Level: Correctly identify, assess and manage underweight children, and refer earlier, where necessary.

- At Hospital Level: Provide emergency treatment and effective case management to children with severe malnutrition.

3) Standards of Care
   - At Clinic Level: Identify and manage sick children correctly. The integrated management of childhood illness (IMCI) must be strengthened and sustained.
   - At Hospital Level: Adopt/develop and implement paediatric treatment guidelines and protocols systematically, including Emergency Triage Assessment and Treatment (ETAT).

4) Norms to be Established and Implemented
   - Develop and implement staffing norms for the care and treatment of sick children. These norms arise out of the needs of children at each level of care, and must be sustainable.
   - Create and implement equipment norms by level of care in every institution caring for sick children.
   - Develop and/or implement transport norms for sick children.

5) Improve Paediatric Quality of Care
   - Paediatric mortality review and quality of care audits should take place in all institutions caring for sick children.

For each recommendation, corresponding implementation levels (policy, administration, clinical practice and education) and responsibilities are suggested in the report.

The remainder of the report reviews, by chapter, Child PIP data pertaining to the top causes of death, (i.e., acute respiratory infections, malnutrition, HIV, tuberculosis and acute diarrhoeal disease), and looks at the modifiable factors in greater depth.

The final part contains an overview of Child PIP data from each of the nine provinces in South Africa.

PART ONE
THE CHILD HEALTHCARE SURVEY

Chapter 1

Paediatric Inpatient Mortality in South Africa: 2005-2007

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Introduction

Following South Africa's first democratic elections in 1994 and the ensuing transformation of the South African health system using the primary healthcare approach, many children's health workers began to feel hopeful about the impending changes that would bring about improved health for all. Instead, there has been a steady decline in health over the past decade and increasing mortality rates for children in South Africa, in contrast to some other African countries,[1] publicised widely during 2008 and at the Countdown 2008 Conference held in Cape Town.

The underlying causes of this decline in South Africa are myriad and include the extensive prevalence of HIV, poverty and inequality, and the increasing evidence that the quality of care received by children throughout the health system is suboptimal. Although South Africa is unlikely to meet the health-related Millennium Development Goals (MDGs) there has been some progress in the political arena towards addressing the HIV pandemic and redressing issues of inequality.[2] For

[1] The State of Africa's Children 2008, UNICEF

[2] Editorial *Lancet* 2008; 371:1215

child healthcare workers, issues around suboptimal quality of care remain a daily challenge.

In 1996, the Perinatal Problem Identification Programme (PPIP),[3] and in 1997 the Confidential Enquiry into Maternal Deaths (CEMD)[4] were launched, to investigate the quality of care received by babies (unborn and newborn) and pregnant women. Both PPIP and the CEMD pioneered the use of the mortality review process in South Africa for assessing and improving quality of care received by these health populations.[5]

Drawing on the philosophy and experience of these two programmes, Dr Angelika Krug piloted an Under Five Healthcare Problem Identification Programme (U5PIP) in the early 2000s in four sites in the Mafikeng region of North West Province.[6] The programme was then field-tested in eight sites in 2004,[7] giving rise to the report, *Saving Children 2004*.[8] After field testing the programme was extended to include all children (0-18 years) admitted to children's wards, the software platform was substantially updated and improved, and the package was renamed the Child Healthcare Problem Identification Programme, or Child PIP.

Prior to the first *Saving Children* report in 2004, information on children who were reached and then died in South African hospitals was scanty. The *Saving Children 2005*[9] and *Saving Children 2006*[10] reports began to

[3] http://www.ppip.co.za

[4] www.doh.gov.za/docs/reports/2004/savings.pdf

[5] Patrick ME, Stephen CR. Child PIP: Making mortality meaningful by using a structured mortality review process to improve the quality of care that children receive in the South African health system. *SAJCH* May 2008; Vol 2; No.2

[6] Krug A, Patrick M, Pattinson RC, Stephen C. Childhood death auditing to improve paediatric care. Acta Paediatr. 2006 Nov;95(11):1467-73.

[7] Krug A, Pattinson RC, Power DJ. Saving children - an audit system to assess under-5 health care. S Afr Med J 2004 Mar; 94(3):198-202.

[8] Krug A, Pattinson RC eds. Saving Children 2004: A survey of child healthcare in South Africa. Pretoria: University of Pretoria, MRC, CDC 2005. (www.childpip.org.za)

[9] Patrick ME, Stephen CR eds. Saving Children 2005: A survey of child healthcare in South Africa. Pretoria: University of Pretoria, MRC, CDC 2007. (www.childpip.org.za)

provide detailed information on the experience of children in the South African health system by using the mortality review process to assess the quality of care given to children. The current report, *Saving Children 2005-2007,* continues to build this understanding of paediatric inpatient mortality in South African hospitals and highlights the trends in Child PIP data over the three-year period.

The format, methodology and data tables of this report follow closely the format of the previous *Saving Children* reports to enable easy comparison. The primary difference remains the increasing numbers of participating hospitals over the three years, 2005 to 2007.

Methods

The Mortality Review Process

Child PIP provides a structure and tools for assessing the quality of healthcare that children receive in the health system, using the mortality review process. The mortality review process has four key steps:

1) The 24 hour review, whereby every death is reviewed and summarised within 24 hours of the death, to ensure that all necessary information is captured;
2) The preparatory meeting, at which the nurse and doctor compile mortality statistics, analyse all deaths and prepare selected cases for presentation at the mortality review meeting;
3) The mortality review meeting, held weekly or monthly in a supportive atmosphere with emphasis on identifying modifiable factors in the caring process (where and who); and
4) Epidemiology and analysis, which enables broader problem identification with trend assessment and the development of possible solutions.

By using Child PIP to review childhood deaths in hospital,

- All deaths are identified,

[10] Stephen CR, Patrick ME, eds. Saving Children 2006: A survey of child healthcare in South Africa. Pretoria: University of Pretoria, MRC, CDC 2008. (www.childpip.org.za)

- The social, nutritional and HIV context of each child who dies is determined,
- A cause of death is assigned, and
- Modifiable factors in the caring process for each child who died, are identified.

Thus the Child PIP process generates information about *the children who died* (i.e., their social, nutrition and HIV context, as well as cause-of-death profile), and the *quality of care* they received.

Setting

Fifty-one hospitals from all nine provinces of South Africa have contributed data to the Child PIP database over the three years, 2005-2007, as shown in Table 2. There were 19 participating hospitals in 2005, 30 hospitals in 2006 and 49 hospitals in 2007. These hospitals represent different levels of paediatric healthcare[11] serving rural, peri-urban and urban populations. The coverage of Child PIP by level of hospital during 2007 is shown in Table 1. In 2007, Child PIP was used in 25 out of the 53 districts in South Africa, (i.e., 47% of districts had at least one hospital doing child mortality audits with Child PIP).

Table 1. Child PIP coverage by hospital level: 2007

Hospital level	*Level 1*	*Level 2*	*Level 3*
Number hospitals using Child PIP	23	22	4
Total number of hospitals	262	67	15
% coverage of Child PIP	**9**	**33**	**27**

The children's wards were either medical only or mixed medical and surgical. Children's wards in level one hospitals generally accommodate children with medical and surgical problems. In level two and three hospitals, children's wards are usually either medical or surgical. No 'surgical only' wards participated in this survey. As in previous years, staffing levels and expertise varied widely between hospitals.

It is a credit to the dedicated healthcare workers using Child PIP, that only two hospitals that started using the programme have dropped out during the three-year period under review.

[11] Level of care according to the DHIS Database, South African Department of Health, September 2008

Table 2. Hospitals contributing data to Child PIP: 2005-2007

Province	*Hospital*	*Level of care*	*2005* *(n=19)*	*2006* *(n=30)*	*2007* *(n=49)*
Gauteng	Coronation	2	✓	✓	✓
	Kalafong	2	✓		✓
	Tembisa	2		✓	
Mpumalanga	Barberton	1	✓	✓	✓
	HA Grove/Belfast	1			✓
	Middelburg	2			✓
	Standerton	1			✓
	Waterval Boven	1			✓
	Witbank	3	✓	✓	✓
Limpopo	Warmbaths/Bela-Bela	2	✓	✓	✓
	Letaba	2		✓	
North West	Gelukspan	1	✓	✓	✓
	Lehurutshe	1	✓	✓	✓
	Mafikeng	2	✓	✓	✓
	Thusong	1	✓	✓	✓
	Zeerust	1	✓	✓	✓
KwaZulu-Natal	Addington	2		✓	✓
	Catherine Booth	1		✓	✓
	Christ the King	1	✓	✓	✓
	Edendale	2	✓	✓	✓
	Emmaus	1		✓	✓
	GJ Crookes	1		✓	✓
	Grey's	3	✓	✓	✓
	King Edward VIII	3		✓	✓
	Ladysmith	2			✓
	Madadeni	2			✓
	Mahatma Gandhi Memorial	2	✓	✓	✓
	Murchison	1			✓
	Port Shepstone	2		✓	✓
	Prince Mshiyeni Memorial	2			✓
	Newcastle	2			✓
	RK Khan	2		✓	✓
	Stanger	2		✓	✓
Free State	Metsimaholo	1	✓	✓	✓
	National District	1	✓	✓	✓
	Pelonomi	2			✓
Northern Cape	Kimberley	2	✓	✓	✓
Eastern Cape	Frere	2			✓
	Uitenhage	1		✓	✓
	Zitulele	1			✓
Western Cape	Caledon	1			✓
	Ceres	1			✓
	Eben Dönges	2	✓	✓	✓
	George	2	✓	✓	✓
	Hermanus	1			✓
	Karl Bremer	2		✓	✓
	Montagu	1			✓
	Otto Du Plessis	1			✓
	Robertson	1			✓
	Somerset	2			✓
	Tygerberg	3			✓

Survey period

Participating sites conducted the mortality review process and submitted data to the Child PIP database for all, or part of the period from 1 January 2005 to 31 December 2007. Duration of participation ranged from a few months to the entire three-year period. Seventeen hospitals had complete data from 2005 to 2007 as illustrated by the shading in Table 2.

Survey population

The survey population included all children from birth to 18 years of age who were admitted to children's wards, and those who died either before or after arrival in casualty or outpatient departments in the participating hospitals. The deaths of all infants and children from birth to 18 years of age were reviewed in detail.

The Perinatal Problem Identification Programme (PPIP)[12] used in a number of the Child PIP sites, audits perinatal care and neonatal deaths occurring in nurseries. Some hospitals re-admit neonates to nurseries, while others admit them to the children's wards. Neonatal deaths in nurseries are audited by PPIP, while neonatal deaths in children's wards are included in the Child PIP audit, and are sometimes audited by PPIP as well.

Survey process

The data were sourced from the Child PIP data capture sheets, namely, the monthly tally sheets that summarised ward admissions and deaths, and the death data capture sheets that were completed for each death. Each hospital carried out a mortality review process based on 'The Child PIP Mortality Review Process Guideline' (Appendix D), either during mortality meetings or through review of individual folders. The frequency of mortality review meetings varied (daily, monthly or weekly) according to workload, number of deaths and staffing. Professional nurses in paediatric wards were increasingly involved in the Child PIP process at most sites.

[12] Saving Babies 2003-2005: Fifth perinatal care survey of South Africa. Pretoria: University of Pretoria, Medical Research Council of South Africa, Centres for Disease Control; 2007.

Monthly tallies Monthly admission and death data from the wards were entered on the monthly tally sheet (Appendix B) and into the database. The monthly data were used to calculate in-hospital mortality rates (IHMRs) and crude case fatality rates (CFRs).

Individual death reviews For each death, a detailed one-page death data capture sheet was completed (Appendix B) to collect demographic, social, nutrition, HIV and AIDS, cause of death and modifiable factor data, as described below.

DEMOGRAPHICS Age, date and time of admission and death, and referral source data.

SOCIAL The parents' state of well-being, as well as the identification of the primary caregiver.

NUTRITION The nutritional status of the child, based on the Wellcome Classification.

HIV&AIDS Each death was classified for HIV status according to laboratory testing and clinical staging. The categorisation recorded in Child PIP reflects the while-alive status of the child, as it is this factor that affects clinical decision-making. The interim revised World Health Organisation (WHO) HIV staging for children was used.

Information on prevention of mother-to-child transmission (PMTCT) of HIV, infant feeding during the first six months of life, Pneumonocytis jirovecii pneumonia (PCP) prophylaxis (cotrimoxazole use) and antiretroviral therapy (ART) for the child and mother was also collected for each death.

CAUSE OF DEATH Child PIP uses 59 ICD-10-based categories for cause of death. One 'main cause of death', up to four 'other important diagnoses' and one 'underlying condition' can be assigned per death. The 'main cause of death' is what primarily led to the death of the child. 'Other important diagnoses' are severe diseases that were present in the days before the child died. 'Underlying conditions' include other health-related problems, which may or may not have had a causative link to the death. Information about the HIV status and nutritional status of *every* death is recorded in Child PIP, thus neither are included as a 'main cause of death'.

MODIFIABLE FACTORS

Child PIP provides a structure for identifying instances of substandard care and missed opportunities for intervention during the process of caring. For each modifiable factor, it is important to ask, "Where did it occur?" (home, primary healthcare (PHC) clinic or hospital) and, "Who was responsible?" (caregivers, administrative staff or clinical personnel). Answers to these questions make it possible to identify and prioritise problems, and to devise solutions for implementation.

The modifiable factor list (Appendix C) was generated using the South African Standard Treatment Guidelines for primary healthcare and for paediatric hospital care, the integrated management of childhood illness (IMCI) guidelines, and South African national norms and standards for equipment in district hospitals as reference standards.[13] [14] [15] [16] The modifiable factor list has remained unchanged since 2005. It has been suggested that the list be 'internationalised' using the WHO Pocketbook[17] as an additional reference point and this will be included in Child PIP v3.0 programme.[18]

Results

The Child PIP data for three years, 2005, 2006 and 2007, are presented and compared. It is worth noting that the data for 2005 and 2006 have been updated since they were published in *Saving Children 2005* and *Saving Children 2006* respectively, and therefore differ slightly from that presented previously.

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[13] The WHO and UNICEF: Integrated Management of Childhood Illness. Geneva 1997. South African generic adaptations (South African National Department of Health) 1999.

[14] South African National Department of Health. Standard Treatment Guidelines and Essential Drug List. Hospital Level Paediatric. EDP South Africa 1998. www.sadap.org.za/edl/paed

[15] South African National Department of Health. The primary healthcare package for South Africa: National norms and standards for district hospitals. Pretoria 2001.

[16] The WHO. Management of the child with a serious infection or severe malnutrition. WHO/FCH/00.1.Geneva 2000.

[17] Pocket book of hospital care for children: guidelines for the management of common illnesses with limited resources. WHO; 2005.

[18] www.childpip.org.za

Baseline data

During 2007 there were 60 989 admissions and 3 016 deaths recorded in the monthly tally data, giving an IHMR of 5.0 per 100 admissions. The IHMR has dropped steadily since 2005 (6.5% in 2005 and 6.0% in 2006) but even though this is not directly comparable as the group of hospitals participating each year has been different, it is nevertheless an encouraging trend.

As in previous years, not all sites were able to provide complete sets of monthly tally data due to difficulties experienced with ward admissions and discharges registers. Once again, staff struggled to compile accurate monthly tallies, which was made even more complex in hospitals where patients are transferred between different paediatric wards such as general, intensive care unit (ICU) and convalescent wards.

A total of 3 555 deaths were audited in detail using Child PIP death data capture sheets. For these deaths, there were 4 970 modifiable factors giving a modifiable factor rate (MFR) of 2.1 per death. Since January 2005, more than 8 000 deaths have been carefully reviewed to assess quality of care, and the MFR has remained between 2.4 and 2.0 per death during this time.

Table 3. Total admissions, deaths, and modifiable factors from all sites: 2005-2007

	2005	*2006*	*2007*
Total admissions*	23617	38104	59647
Total deaths*	1525	2276	2957
IHMR (%)*	6.5	6.0	5.0
Audited deaths†	1 667	2 828	3 555
Total modifiable factors†	4 091	5 679	7 445
Modifiable factor rate (per death) †	2.4	2.0	2.1

* From monthly tally sheets † Individual audited deaths

Detailed baseline data from each province are recorded in Appendix A, Table A1.

Information about the children who died

Demographics

AGE Most children who died during 2007 were under one year of age (65%), and this has remained fairly constant since 2005. A slightly higher proportion of boys died each year than girls. (Appendix A, Table A3)

Almost ninety percent of deaths were in the under-five age group in each of the three years under review.

During 2007, there were 4 450 neonates (under one month of age) admitted to children's wards, of whom 176 died, giving an IHMR of 4.0%. The IHMR for neonates has also declined steadily from 5.5% in 2005, and 5.1% in 2006. (Appendix A, Table A2)

WHERE FROM

Most children who were referred came from primary health clinics (52%), and the vast majority came from inside the hospitals' drainage areas in 2006 and 2007. The proportion of children referred from the private sector has increased each year from 12% in 2005 to 19% in 2007. (Appendix A, Table A4)

HOW SOON THEY DIE

As in previous years, 33% of the children died within the first 24 hours in hospital, and 25% died during days 1-3 after admission. In 2007, 15% of children had stayed in hospital for more than 14 days before they died which was slightly higher than in 2005 and 2006. (Appendix A, Table A5)

Social context

PRIMARY CAREGIVER

In more than two-thirds of child deaths, the mother was the primary caregiver during 2006 and 2007, and in 13%, a grandmother was the primary caregiver. The father as primary caregiver has remained at 1% over the three years. The frequency of "unknown" caregiver has dropped markedly from 20% in 2005 to 12% in 2007. (Appendix A, Table A6)

MOTHER'S WELLBEING

In 8% of deaths, the mother was dead, and in 10%, she was sick. These proportions have remained constant over the past three years. In 2007, information about the mother's wellbeing was unknown in 13% as opposed to 28% in 2005. (Appendix A, Table A6)

FATHER'S WELLBEING

No information about the fathers' wellbeing was recorded in 60% of the deaths in 2007 compared to 75% in 2005. (Appendix A, Table A6)

Health context

NUTRITION

In 2007, almost two-thirds (64%) of children who died were undernourished and one-third were severely malnourished. These proportions have remained fairly constant since 2005. (Appendix A, Table A7)

HIV&AIDS

Thirty percent of children who died did not have a recorded laboratory assessment of their HIV status in 2007 compared to 46% in 2005. This represents a significant improvement in the rate of laboratory testing for HIV. In 2007, 13% of the deaths tested HIV-negative, 24% were HIV-exposed and 32% HIV-infected. There has been a steady increase in the proportion of children recorded as HIV-infected or -exposed from 46% in 2005 to 57% in 2007.

Almost half of all deaths since 2005 have been classified with Stage III or IV HIV disease (50% in 2005, 47% in 2006 and 46% in 2007). In 2007, 13% were not staged although it was indicated, which is an improvement on the 18% in 2005. (Appendix A, Table A8)

In 2007, 15% of those HIV-infected or HIV-exposed were not clinically staged, which was similar to 2006. A small group of children with a negative HIV test (1-2%) were staged each year. (Appendix A, Table A15)

PMTCT

In 53% of the deaths, there was no information on the child's experience of the PMTCT programme during 2007, compared to 65% in 2005. In 2007, 18% of all children who died received perinatal nevirapine and 15% did not receive nevirapine even though it was indicated. The mother was known to be HIV-negative at delivery in 14% of cases, an improvement on the 10% in 2006 and 8% in 2005. (Appendix A, Table A9)

FEEDING PRACTICE

In 2007, there was no information on feeding practices in the first 6 months of life in 42% of the cases, compared to 54% in 2005 and 48% in 2006. In 43% of the neonates who died, feeding practice was unknown, whereas it was unknown for only 35% in the 1-month to 12-month age group. Forty percent of infants who died were exclusively fed on either breast or formula, and 18% received mixed feeding. The proportion of infants receiving mixed feeding has stayed constant since 2005, whereas those receiving exclusive breast or formula has increased from 26% in 2005 and 33% in 2006. (Appendix A, Table A16)

PCP PROPHYLAXIS

Of those children dying with suspected or confirmed PCP, 35% had never received cotrimoxazole prophylaxis, in both 2006 and 2007. Information about whether children had received cotrimoxazole prior

to admission was 50% in 2005 compared to 20% in 2007. (Appendix A, Table A11)

ANTIRETROVIRAL THERAPY

Based on their clinical stage (III or IV), 46% of children who died in 2007 were eligible for ART, as compared to 47% in 2006 and 50% in 2005. Seven percent of children who died were documented as being on ART at the time of admission in 2007. Only 3% of mothers were on ART, but in the vast majority (60%), no information was available on their ART usage. (Appendix A, Table A12)

Inpatient mortality

CASE FATALITY RATES

The overall IHMR in 2007 for the 49 sites was 5.0 deaths per 100 admissions, with the highest rate in the 1-12 month age group (7.5%). The CFR for severely malnourished children was much higher (16.1%) than for children with weight above the third centile (3.0%). The CFRs for acute respiratory infections (ARIs) was 6.2% and for diarrhoeal disease (DD) was 5.0%. However, these may not be entirely accurate because of the difficulties experienced with ward admission and discharge registers mentioned previously. (Appendix A, Table A2)

Of significance is that the total IHMR has decreased each year from 6.5 in 2005, to 6.0 in 2006, to 5.0 in 2007, due to marked decreases in Gauteng and KwaZulu-Natal, and the participation of many more Western Cape sites where the IHMRs are consistently much lower than the rest of the country (Appendix A, Table A1). Although the IHMR at many sites has stayed more or less the same, there have been remarkable improvements at some individual sites over the three-year period (Table 4).

Table 4. IHMR at selected hospitals: 2005-2007

IHMR (%) / *Hospitals*	*2005*	*2006*	*2007*
Coronation Hospital	4.2	5.1	3.5
Edendale Hospital	9.3	6.4	5.4
Kimberley Hospital	4.1	3.5	3.0
Stanger Hospital	-	20.1	12.7
Zeerust Hospital	6.5	5.6	3.4

Causes of child deaths

CAUSES OF DEATH

The main and other causes of death identified in the mortality review from 2005 to 2007 are listed in Appendix A, Table A19.1, 2 and 3. Remembering that virtually half of the children dying had severe HIV disease (III or IV) during the three years under review, the leading final causes of death for all children have remained unchanged, namely ARIs, septicaemia, DD, tuberculosis (TB) and PCP (Table 5). It is worth noting that the proportion of deaths due to TB (pulmonary and extra-pulmonary) increased relative to PCP in 2006 and 2007.

Table 5. Top 5 causes of death (all diagnoses): 2005-2007

	2005		*2006*		*2007*	
Diagnosis	***No.***	***%***	***No.***	***%***	***No.***	***%***
Pneumonia/ARI	551	18.6	828	17.4	964	15.9
Septicaemia	375	12.7	784	16.4	874	14.4
Acute diarrhoea	336	11.4	626	13.1	755	12.5
TB: pulmonary/extrapulmonary	244	8.3	455	9.5	530	8.7
PCP (suspected or confirmed)	262	8.9	372	7.8	457	7.5

UNDERLYING CONDITIONS

In 2007, specific underlying conditions were identified in 5% of the deaths, with ex-low birth weight/prematurity accounting for half of these. Data regarding underlying conditions were increasingly poorly recorded during the three years. This section of the data collection tool will be reviewed. (Appendix A, Table A20)

Information about the quality of child healthcare received

Records

During the three years under review, there has been a progressive improvement in record keeping, with the number of folders assessed as complete and with adequate clinical recording, increasing from 42% in 2005 to 62% in 2007. Missing folders dropped from 8% in 2005 to 4% in 2007, and incomplete or inadequate notes from 39% in 2005 to 31% in 2007, as shown in Table 6.

Table 6. Quality of Records: 2005-2007

	2005		*2006*		*2007*	
Records	***No.***	***%***	***No.***	***%***	***No.***	***%***
Folder not available	126	7.5	152	5.4	136	3.8
Folder available: incomplete and/or inadequate	648	38.6	1153	40.8	1107	31.1
Folder available: OK	709	42.3	1446	51.1	2189	61.6
Unknown	194	11.6	77	2.7	123	3.5
Total	1677	100	2828	100	3555	100

Modifiable factors

During the period, 2005 to 2007, 17 215 modifiable factors were identified in the 8 060 deaths reviewed. For each child who died during this time there were, on average, more than two occurrences of substandard care (2.4 per death in 2005, 2.0 per death in 2006 and 2.1 per death in 2007).

WHERE DO THEY OCCUR AND WHO IS RESPONSIBLE?

The proportion of modifiable factors occurring within the health system decreased from 65% in 2005 to 58% in 2007, while the proportion occurring at home increased from 23% in 2005 to 37% in 2007. More modifiable factors were identified in hospital than in primary health clinics, both during admission/emergency and in the ward. (Table 7)

In 2007, a total of 3 200 clinical personnel modifiable factors was reported (0.9 per death), thus for each death there was one instance of substandard/modifiable care attributable to clinical personnel. A total 1 351 administrative modifiable factors were identified in the 3 555 deaths resulting in a rate of 0.4 per death. The modifiable rate for both clinical personnel and administrators has decreased over the three years under review, as shown in Table 7.

Table 7. 'Where' and 'Who' of Modifiable factors (MFs): 2005-2007

	2005		*2006*		*2007*	
Where they occur	***No.***	***%****	***No.***	***%****	***No.***	***%****
Home	958	23.4	1914	33.7	2737	36.8
Primary health clinic	570	13.9	720	12.7	999	13.4
Admission & Emergency care	1076	26.3	1227	21.6	1300	17.5
Ward	1027	25.1	1564	27.5	2060	27.7
Other	460	11.2	254	4.5	349	4.7
Total	4091	100	5679	100	7445	100
Who is responsible	***No.***	***Rate†***	***No.***	***Rate†***	***No.***	***Rate†***
Caregiver and family	1120	0.7	2027	0.7	2894	0.8
Administrator	903	0.5	960	0.3	1351	0.4
Clinical personnel	2064	1.2	2692	1.0	3200	0.9
Total	4087	2.4	5679	2.0	7445	2.1

* Proportion of total MFs † Rate, i.e. number of MFs per death

The most common modifiable factors occurring in the home, at the primary healthcare interface, during admission and emergency, and in the wards are presented below, grouped by those related to administrators and those related to clinical personnel. In each list, the

relative frequency of the modifiable factors occurring at that place is recorded in brackets for 2005, 2006 and 2007 respectively.

In the home and community

CAREGIVER AND FAMILY

The top four modifiable factors involving the caregiver:

- Delay in seeking care (2005 - 28%, 2006 - 33%, 2007 - 31%)
- Caregiver not realising the severity of illness (15%, 16%, 17%)
- Inappropriate nutrition (13%, 16%, 16%)
- Home treatment with negative effect (7%, 8%, 8%)

(Appendix A, Table A21)

At the primary healthcare interface: clinics and ambulatory care

CLINICAL PERSONNEL

The top six modifiable factors involving clinical personnel:

- IMCI not used for patient assessment (11%, 13%, 12%)
- IMCI not used for case management (9%, 15%, 11%)
- Delay in referring failure to thrive (10%, 8%, 11%)
- Insufficient assessment for failure to thrive (8%, 5%, 6%)
- Insufficient fluid management for DD (2%, 4%, 5%)
- No TB contact treatment (4%, 5%, 3%)

During the three-year period under review, a significant proportion of modifiable factors listed for clinical personnel at the primary healthcare level showed a failure to successfully practice the IMCI programme, (i.e., 82% in 2005 and 2006, and 78% in 2007).

ADMINISTRATORS

The top three modifiable factors involving administrators:

- Lack of transport between home, clinic and hospital (3%, 5%, 4%)
- Communication problems: staff-to-caregiver and staff-to-staff (2%, 4%, 2%)

- Lack of access to the clinic and limited clinic opening times (2%, 2%, 1%)

In 2007, administrator-related modifiable factors accounted for 15% of all those recorded at primary healthcare level compared to 21% in 2005 and 14% in 2006. During 2006 and 2007, most modifiable factors reflected inadequate transport and communication problems.

(Appendix A, Table A22)

During admission and emergency care: casualty

CLINICAL PERSONNEL

The top five modifiable factors applicable to clinical personnel:

- Appropriate antibiotics not prescribed (11%, 13%, 12%)
- Appropriate investigations not done (6%, 9%, 10%)
- History taking incomplete (8%, 9%, 10%)
- Physical examination incomplete (5%, 8%, 6%)
- Assessment of shock/dehydration insufficient (4%, 6%, 5%)

Four out of five modifiable factors recorded in casualty and outpatients departments related to clinical personnel in 2006 and 2007, and most were due to insufficient case assessment and poor patient management.

ADMINISTRATORS

The top three modifiable factors relating to administrators:

- Lack of high care beds and paediatric intensive care unit (ICU) facilities (6%, 5%, 6%)
- Lack of senior doctors (6%, 4%, 1%)
- Poor doctor-to-doctor communication, (e.g., no handover of critically ill patients) (2%, 2%, 2%)

Most of the modifiable factors related to administrators in casualty departments, from 2005 to 2007, described inadequate access to health services due to a lack of high care beds and resuscitation facilities. A lack of well-trained, senior doctors was also recorded.

(Appendix A, Table A23)

In the wards

CLINICAL PERSONNEL

The top five modifiable factors relating to clinical personnel in wards:

- Insufficient case assessment/management at previous admission or visit (4%, 4%, 5%)
- Appropriate investigations not done (4%, 5%, 4%)
- IV fluids incorrectly prescribed (6%, 4%, 4%)
- Inappropriate antibiotic and/or TB treatment prescribed (6%, 5%, 4%)
- Respiratory rate/O_2 saturation not monitored (3%, 5%, 3%)

The majority of the modifiable factors occurring in wards related to clinical personnel (74% in 2005, 65% in 2006, and 60% in 2007). Problems with case assessment were most prevalent in all three years, and although inadequate management and insufficient monitoring accounted for the remainder, the prevalence of both decreased from 2005 to 2007. Problems with fluids, in particular, decreased from 13% in 2005 to 8% in 2007.

ADMINISTRATORS

The top three modifiable factors related to administrators in wards:

- Lack of professional nurses (12%, 6%, 11%)
- Lack of high care beds/ICU facilities (2%, 6%, 9%)
- Lack of senior doctors (1%, 8%, 5%)

Of particular note was that during all three years, forty percent or more of the administrator-related modifiable factors referred to a lack of trained personnel, including both doctors and nurses. A lack of facilities, especially high care and ICU infrastructure, was also significant.

(Appendix A, Table A24)

Avoidable deaths?

When finally reviewing each death the following question was asked:

"In your opinion, had the process of caring been different, would this death have been avoidable?"

The data from 2005 were incomplete, but in both 2006 and 2007, almost one-third of deaths were considered to have been avoidable (30% in 2006, 28% in 2007). Uncertainty remained for approximately one-third of deaths, but the proportion considered not avoidable increased from 19% in 2006 to 28% in 2007. (Appendix A, Table A25)

Discussion

Saving Children 2005-2007 is the fourth report of a series that started in 2004. The findings for all three years have been presented and it is now becoming possible to compare findings over time. Trends are starting to emerge, some encouraging, and some worrying. These trends are described in the discussion that follows.

The significance of the information about children who die

Demographics

AGE Almost two-thirds of child deaths recorded in Child PIP occurred in children under one year of age, and ninety percent in those under-five. These findings have remained virtually constant over the three years and emphasise that infants and younger children have a higher risk of dying. Training and protocols must therefore focus on competencies to assess and treat the youngest. Neonates, who made up 6% of the total deaths, are an important part of this vulnerable group of very young children.

WHERE FROM About half the children dying in hospital had initially consulted primary health clinics and were then referred to hospitals in the appropriate drainage area. Since 2005, an increasing number of children had consulted healthcare workers in the private sector. Ensuring a high standard of first-line care for children at clinics and in the private sector is important for their survival. Widespread use of IMCI would assist in identifying children at risk and in need of urgent referral to hospital.

HOW SOON CHILDREN DIE

The data from 2005 to 2007 have consistently shown that one-third of the children died within the first 24 hours in hospital. This suggests that there are problems with the entire pre-admission chain of care including late presentation, suboptimal management at the point of entry into the health system, and in the transportation of sick children. It is vital that the initial assessment and management of sick children be scrutinised to identify problems occurring in the first 24 hours. Training of health workers in the WHO programme, Emergency Triage, Assessment and Treatment (ETAT) would be valuable in this respect.

At the other end of the spectrum, 13-15% of children had stayed in hospital for more than 14 days before they died and this proportion has remained constant over the three years, 2005 to 2007. Again, it may reflect more severe and/or chronic illness in children admitted to hospital or a shortage of hospice-type beds for children dying with HIV and AIDS. Longer hospital stay contributes to overcrowding in paediatric wards, which in turn exacerbates problems with quality of child healthcare.

Social context

PRIMARY CAREGIVER AND PARENTS' STATE OF HEALTH

The percentage of children dying without a mother able to care, either because she herself had already died or was too sick, has remained constant at 17% in the period under review. In other words, almost one in five children died without having their mother as the healthy primary caregiver. Although this may be a consequence of a broader social problem created by the increased numbers of orphans because of the HIV pandemic, it is more likely to imply that children without mothers as their primary caregiver are at greater risk of dying.[19]

It was encouraging that more information about caregivers was collected in Child PIP from 2005 to 2007, implying better history taking which ultimately leads to better care for children.

Health context

NUTRITION

As noted previously, there have been improvements in weight recording from 2005 to 2007. Nevertheless, 8% of deaths in 2007 still

[19] Zaba B, Whitworth J, Marston M et al. HIV and mortality of mothers and children: evidence from cohort studies in Uganda, Tanzania and Malawi. *Epidemiology* Volume 16(3) May 2005;275-280

did not have their weights recorded even though this is an essential part of the proper basic assessment of each child.

Almost two-thirds of children who died were underweight-for-age and more than one-half of these had severe malnutrition. Of concern is that these proportions have remained unchanged over the past three years. Under-nutrition is the most common underlying problem in child deaths associated with infectious diseases worldwide. Being underweight increases the case fatality rate for infectious diseases markedly, more than doubling the risk of dying.[20]

Despite the existence of good specific clinical protocols for severe malnutrition[21], there were many instances of substandard care, from inadequate assessment of failure to thrive at clinic level to poor basic management and monitoring in hospital.

In 2007, only 12% of the underweight children who were tested for HIV were negative. Only 6% of the tested children with marasmus were HIV-negative and 75% were HIV-exposed or HIV-infected (Appendix A, Table A13). This demonstrates the tremendous overlap of HIV infection and severe malnutrition in South African children. Improved feeding and poverty alleviation to improve food security must go hand in hand with ART access for HIV-infected children with severe malnutrition.

The impact of malnutrition and related Child PIP data is reviewed in Chapter 7 of this report.

HIV&AIDS

South Africa remains at the very centre of the global HIV pandemic, and it is universally acknowledged that HIV and AIDS is the most serious health challenge facing South Africa, along with increasing TB co-infection.

Through using Child PIP, it has become apparent that the way a child is assessed for HIV serves as a valuable marker for the quality of care that the child received. A meticulous HIV assessment includes an interpreted HIV laboratory test (depending on the age of the child and

[20] Black R, Morris S, Bryce J. Where and why are 10 million children dying every year? *Lancet* 2003; 361:1-10.

[21] The inpatient management of severe malnutrition: Eastern Cape, KZN, adapted from WHO.

the nature of the test), and conscientious clinical staging based on the South African adaptation of the WHO clinical staging guideline.[22] Thus, the information about HIV testing and staging are important indicators of the quality of care that children receive in South African hospitals.

HIV TESTING

In 2007, 30% of children dying in hospital did not have an HIV test. Although this is an improvement compared to previous years, testing remains an essential part of HIV care plans for children, both sick and well. Lack of testing is thus a major obstacle to accessing holistic HIV care.

As a reflection of the increasing impact of the HIV pandemic, the proportions of both HIV-infected and HIV-exposed children have increased each year since 2005, with 57% being either HIV-infected or HIV-exposed in 2007.

HIV STAGING

Clinical staging has improved slightly during the three years under review. It remains an essential part of HIV assessment as staging alone can determine eligibility for ART. Approximately one-half of the children who died each year from 2005 to 2007 were classified at either stage III or IV, and thus qualified for ART.

PMTCT, FEEDING AND PCP PROPHYLAXIS

The serious shortcomings of the PMTCT programme were highlighted in *Saving Children 2005* and *Saving Children 2006*. Of great concern is that, despite improvements in clinical record keeping, (i.e., fewer "unknowns") the efficacy of the PMTCT programme itself has not improved.

As before, only one in two mothers who were eligible for PMTCT prophylaxis (nevirapine) actually received it. When reviewing children born to mothers who tested negative during PMTCT, Child PIP data revealed that 11% of these children were either HIV-infected or HIV-exposed. This suggests that a significant proportion of mothers were infected with HIV during pregnancy[23] and lends support to the

[22] South African National Department of Health (Khomanani). Guidelines for the management of HIV-infected children. First Edition 2005.

[23] Rollins N, Little K, Mzolo S. Surveillance of mother-to-child transmission prevention programmes at immunisation clinics: the case for universal testing. *AIDS* Volume 21(10 June 2007;1341-1347

recommendation to test all mothers for HIV at least twice during pregnancy.

Information on early infant feeding patterns improved from 2005 but still indicated that one in three infants received mixed feeding, a contravention of the PMTCT feeding guidelines. The proportion of formula-fed infants increased markedly from 14% in 2005 to 25% in 2007, reflecting PMTCT guidelines. However, this data may add to the growing body of evidence that even in HIV-infected mothers, breast-feeding may be safer in terms of long-term infant survival than formula feeding.[24]

Although the information gathered about cotrimoxazole prophylaxis was much improved, only one in two eligible children dying of suspected or confirmed PCP actually received cotrimoxazole. This remained unchanged from 2006, and is cause for serious concern, as PCP can be prevented with cotrimoxazole prophylaxis.

The HIV information provided by Child PIP is further explored in Chapter 6 of this report. The Child PIP data should encourage rapid and effective responses to strengthen PMTCT programmes and PCP prophylaxis for all eligible mothers and children. It is hoped that with the introduction of dual therapy for PMTCT during 2008, significant gains will start to be seen in the Child PIP data.

ANTIRETROVIRAL THERAPY

Forty-six percent of children in this report were eligible for ART, based on clinical staging. For the 7% of children who died on ART, it is assumed that the ART was initiated too late. Some hospitals report substantial numbers of children on ART, but overall access for HIV-infected children is far below what is required.

The reason for lack of implementation of the basic measures for HIV assessment and management for all children has not been established in this audit, and remains worrying. Apart from infrastructural problems, health workers still seem unable or unwilling to assess children for HIV properly, and many opportunities for intervention are thus missed. Factors that may contribute to this suboptimal HIV care include:

[24] Rollins N, Editorial: Infant feeding and HIV. *BMJ* 2007:334;487-488

- Inadequate undergraduate training on the importance of HIV testing and clinical staging,
- Shortage of all categories of health workers,
- Overcrowded children's wards, and
- Lack of capacity in hospital laboratory services.

Inpatient mortality

IN-HOSPITAL MORTALITY RATES

The overall IHMR for all child deaths in the nine provinces during 2007 was 5.0 deaths per 100 admissions. The rates differed markedly among the provinces, ranging from 1.1% in the Western Cape to 6.8% in KwaZulu-Natal (Appendix A, Table A1). These differences reflect a number of factors including the demographics of the population, poverty levels, local HIV prevalence, quality and coverage of the PMTCT programme, and access to ART.

One of the strengths of Child PIP is its ability to monitor an institution over time. The IHMR of the hospitals shown in Table 4 decreased from 2005 to 2007, which is a very positive development. Most hospitals showed a variable IHMR over the three years. Several factors may account for this, particularly the progression of the HIV pandemic, especially where paediatric ART services are not well established, and the widespread and increasingly severe staff deficiencies in paediatric care. Major inequities in child healthcare should be identified and addressed. The growing HIV pandemic and associated TB co-infection makes additional human and other resources for paediatric inpatient care an urgent necessity.

Causes of child deaths

CAUSES OF DEATH

The pattern of disease causing child deaths as described in 2007 has remained similar to that found in 2005 and 2006, and comparable with trends in other sub-Saharan African countries. HIV infection accounts for almost half of all the child deaths and is preventable, as are the top five final causes of death. (Table 3)

Acute respiratory infections (ARIs) are the leading cause of death in children in developing countries.[25] [26] When PCP data are included with ARIs, they account for almost one-quarter of the child deaths audited in Child PIP during 2007. Child PIP ARI data are examined more closely in Chapter 5 of this report.

As in previous years, sepsis remained the second most frequent cause of death and is often the terminal event in HIV-infected children. The co-occurrence of two or more infectious diseases (e.g., ARI, gastroenteritis and septicaemia) is common in malnourished and/or HIV-infected children. This comorbidity may result in synergism, leading to an increased risk of death.[14]

Tuberculosis was more frequently the main cause of death as opposed to PCP in 2007, although the rate decreased slightly from 2006. The increased incidence of TB may reflect problems in adult TB management as well as a lack of contact tracing and treatment. The increase in TB incidence rates in South Africa has been described in Kharsany et al.[27], and TB services in Africa are under-funded and understaffed.[28] Chapter 8 in this report looks at the Child PIP TB data in more detail.

Improved case management for common conditions such as ARI, sepsis, PCP, gastroenteritis and TB, which make up approximately two-thirds of child deaths, could improve outcomes considerably. Many hospitals already have protocols for these common conditions. Possible obstacles to the implementation of such protocols must be explored, as well as the impact of local working conditions for clinical personnel on the implementation of improved case management. Chapter 9 in this report describes how Child PIP data were used to

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[25] Eichenwald HF, Mulholland K, Margolis P, Gove S, McCaul F, Parker S et al. Etiology and clinical signs of serious infections in young infants in developing countries: a WHO collaborative study. Ped inf dis J 1999; 18: S1-S69.

[26] Reyes H, Perez-Cuevas R, Salmeron J, Tome P, Guiscafre H, Gutierrez G. Infant mortality due to acute respiratory infections: the influence of primary care processes. Health Policy Plan 1997; 12: 214-223.

[27] Kharsany A B M, Connolly C, Olowolagba A, Abdool Karim S, Abdool Karim Q. Increasing burden of pulmonary tuberculosis in young women. *S Afr Med J* 2006; 96: 524-525.

[28] Corbett E L, Marston B, Churchyard G J, De Cock K M. Tuberculosis in sub-Saharan Africa: opportunities, challenges and change in the era of antiretroviral treatment. *Lancet* 2006; 367: 926-937.

explore problems in the management of gastroenteritis at Witbank Hospital, and to monitor changes resulting from interventions that were implemented.

Child PIP does not yet capture trauma deaths in childhood adequately. Only 22 surgical deaths, 10 burns, 7 abuse-related deaths, 6 other accidents (including drowning), and 3 transport-related injuries were recorded (Appendix A, Table A19.3). This is because Child PIP continues to be used mainly in paediatric medical wards. In district hospitals, paediatric wards have both medical and surgical patients but surgical and trauma patients are usually referred to regional or provincial hospitals early, if their condition is critical. However, Child PIP is hoping to include more surgical causes of death in the future and surgeons are encouraged to implement the programme.

The significance of information about quality of child healthcare

Problems in the health system

The Child PIP audit helps managers and health workers identify gaps in healthcare delivery. The knowledge and understanding gained by this analysis of child deaths, however, must be translated into action.[29] [30] Barriers and constraints to the implementation of child survival interventions should be identified and overcome. It is known globally that weak health systems and inequitable distribution of effective interventions lead to poor coverage and ineffectiveness.[31] [32]

Quality of care information in Child PIP comes from the assessment of the quality of the health records, as well as the identification of modifiable factors in the overall processes of care, categorized by where they occurred and who was responsible.

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[29] Victora C G, Wagstaff A, Armstrong Schellenberg J, Gwatkin D, Claeson M, Habicht J P. Applying and equity lens to child health and mortality: more of the same is not enough. *Lancet* 2003; 362: 24-32.

[30] The Bellagio Study Group on Child Survival. Knowledge into action for child survival. *Lancet* 2003; 362: 33-38.

[31] Bryce J, Arifee S, Pariyo G, Lanata CF, Gwatkin D, Habicht J. Reducing child mortality: can public health deliver? *Lancet* 2003; 362: 18-24.

[32] Darmstadt G L, Bhutta Z A, Cousens S, Adam T, Walker N, De Bernis L et al. Evidence-based, cost-effective interventions: how many newborn babies can we save? *Lancet* 2005; 365: 977-988.

Record keeping

LACK OF INFORMATION

The proportion of files that were complete, and included adequate clinical notes and information on pre-hospital care, has increased steadily, from 42% in 2005 to 62% in 2007 (Table 5). This is a very encouraging trend as it is essential that clinical records are satisfactorily completed to ensure that children are cared for properly.

Another important (and often difficult) aspect of record keeping is the collection of basic ward statistics for all admissions (and discharges) from which denominators for IHMRs are calculated. For accurate collection of this data, a standard ward admissions and discharges register must be used (see Appendix D). It is vital that information be gathered with due regard for accuracy by all healthcare workers, from ward clerks to hospital managers. A new adaptation of the register is currently being piloted in some provinces and will be included in the next *Saving Children* report.

Modifiable factors: Where and Who?

The profile of modifiable factors in 2007 continued the trend from the previous year with increasing numbers occurring in the home and being ascribed to caregivers. This reflects the ever-increasing challenges faced by caregivers and communities who form an essential part of the health system. Primary health clinic modifiable factors remained constant over the three years under review. The overall proportion of modifiable factors occurring in hospitals decreased slightly with considerably fewer occurring in the Admission and Emergency departments and the same being recorded in wards. The modifiable factor rates for health administrators and clinical personnel remained constant with clinical personnel being responsible, on average, for at least one modifiable factor per death (Table 7).

HOME AND COMMUNITY

The proportion of caregiver-related modifiable factors increased significantly from 23% in 2005 to 37% in 2007. The most significant problems have remained the same over the three years under review and include delays in seeking care, caregivers not realising the severity of their child's illness and inappropriate nutrition. In this regard, the Household and Community Component (HHCC) of IMCI would be a useful tool for positively influencing appropriate home management and care-seeking behaviour, through, for example, teaching danger

signs to caregivers. Home and caregiver modifiable factors are explored further in Chapter 10 of this report.

PRIMARY HEALTHCARE (PHC)

Although information on primary healthcare remained scanty due to Child PIP being primarily hospital-based, there was sufficient evidence to show that IMCI coverage and implementation were still very inadequate. Healthcare worker attitudes are an important factor in the successful implementation of IMCI, a challenge faced by many developing countries.[33] The IMCI HHCC, and improved care at PHC level and at level one hospitals should be delivered as a package, so that improved care-seeking behaviour is met by improved quality of care provided by clinical personnel in both clinics and level one hospitals.[25]

Administrative issues such as inadequate transport, poor communication (staff and caregivers) and limited access to primary healthcare facilities remained significant and need to be carefully reviewed. Improved outcomes require adequate resources and cooperation at family and PHC level. Further discussion on modifiable factors at primary healthcare level can be found in Chapter 11 of this report.

HOSPITAL: ADMISSION & EMERGENCY AND WARDS

The initial care of sick children when they arrive in hospital is an area of great concern, and thorough review of the Child PIP data identified problems in all areas of clinical care: assessment, management and monitoring. Training for heath workers in emergency departments using the WHO programme, ETAT, would be of great benefit and is described in Chapters 9 and 12 of this report. Problems with a lack of beds and high care facilities in the emergency sections were increasingly reported during 2007, as well as staff shortages, both of which constitute major challenges for health administrators.

In the wards, staff shortages have been reported increasingly during the three years under review. The shortage of professional nurses was listed as the top administrator-related modifiable factor in the ward setting during 2007. Staffing norms (per inpatient) for doctors and

[33] Walter N, Lyimo T, Skarbinski J, et al. Why first-level health workers fail to follow guidelines for managing sever disease in children in the Coast Region, the United Republic of Tanzania. *Bull World Health Organ* 2009:87;99-107

nurses at all levels of child healthcare are an urgent requirement to ensure effective monitoring and proper clinical care for children. Strategies for attracting and retaining senior health workers in the public sector, especially in underserved areas, need to be developed and effectively implemented. The ward modifiable factors are further discussed in Chapter 13 of this report.

Were deaths avoidable?

Responses to the question about whether a child's death could have been avoided are always useful for initiating discussion and reflection on the quality of care given to children by health workers. The question is not clearly defined or standardised, and may be interpreted at different levels within the healthcare system. Notwithstanding these variations, almost one-third of all deaths during 2006 and 2007 were assessed as being avoidable. This dismaying statistic can motivate healthcare workers who care about what they do to look for ways to improve the quality of care they give to children.

The significance of this information for Child PIP

Child PIP has grown enormously as an organisation since 2005. Healthcare workers have responded to the positive benefits of implementing a mortality audit such as Child PIP and many dedicated doctors and nurses have become part of the Child PIP network. Child PIP currently has a coordinator in each province (i.e., a health worker employed at a hospital with full clinical responsibilities) who provides support and oversight of the hospitals using Child PIP in that province. The provincial coordinators, as well as some additional experts, form the Child PIP Technical Task Team that drives the organisation along with the National Executive Committee who manage the finances and take final responsibility for the growth and sustainability of the programme. The United States Centers for Disease Control and Prevention (CDC) has funded Child PIP since its inception.

New sites are provided with a start-up package, which includes a comprehensive Child PIP training programme that was developed in 2007 for use by individual sites or at workshops.[18]

National and international interest in Child PIP has grown. Child PIP was invited by the World Health Organisation (WHO) to participate in

a workshop on hospital care for children in the developing world.[34] In addition, the South African Human Rights Commission asked Child PIP to make representations for child health in South Africa.

Partnerships between Child PIP, PPIP and the CEMD have been strengthened with the publication of *Every Death Counts* in March 2008,[35] which received significant media coverage. This publication integrated the recommendations arising out of the three programmes, the first time that something of this nature has been done anywhere in the world.

There has also been growing interest in and considerable support for Child PIP from both the national and provincial Departments of Health, with the hope that the programme will contribute to immediate improvements in child healthcare and to future health system planning.

Conclusion

A mortality review process, such as Child PIP, is a low cost strategy that can improve the quality of care that children receive by improving the overall processes of caring for sick children. The data can be used to monitor and evaluate child healthcare and to give feedback to health workers and managers. Data can also be used to advocate for the overall improvements in child healthcare.

Most of the necessary interventions to reduce preventable child deaths are well known and coverage of many programmes is good. The task now is to ensure that children actually receive quality healthcare so that the millennium development goal of significantly reducing childhood mortality can be achieved, even if 2015 has become an unrealistic target for South Africa.

It is encouraging to note improvements in the IHMR at some Child PIP sites, and the specific interventions identified by Child PIP at local sites that have made a difference to child healthcare. The challenge for

[34] Campbell H, Duke T, Weber M, et al and Pediatric Hospital Improvement Group. Global Initiatives for Improving Hospital Care for Children: State of the Art and Future Prospects. *Pediatrics* 2008: 121;e984-e992

[35] Bradshaw D, Chopra M, Kerber K, Lawn J, Moodley J, Pattinson R, Patrick, Stephen C, Velaphi S. Every Death Counts: Saving the lives of mothers, babies and children in South Africa, 2008. www.childpip.org.za

Child PIP is to shift from problem identification alone to encouraging the interpretation of data for use in initiating programmes to improve the quality of care in individual institutions. Child PIP can then also be used to measure the effect of such strategies and will ultimately become a tool that actually makes change happen!

The Child PIP audit continues to provide information about the health profile of a paediatric population ravaged by HIV and poverty, and dying of preventable conditions. It also describes the quality of paediatric healthcare in the South African health system and suggests improvements. It is now the responsibility of healthcare workers and managers to respond to the challenges posed, and to create solutions. It is hoped that Child PIP and the *Saving Children* reports will contribute positively to this process.

Chapter 2

Recommendations

The strength of the Child Healthcare Problem Identification Programme (Child PIP) is its ability to generate information that can lead to improved quality of care. In making recommendations for improvement, Child PIP follows two main principles:

- Recommendations must arise out of actual information.
- Recommendations must be clear in their formulation with regard to the level for action (i.e., policy, administration, clinical care, and education) and to who is responsible (i.e., policy makers, managers, clinical personnel and educators – especially at medical schools and nursing colleges).

The findings in *Saving Children 2005-2007* reinforce the recommendations made in the 2005 report, which have remained essentially unchanged. In the soon-to-be-released latest version of the Child PIP programme (v 3.0), it will be possible to analyse modifiable factors in greater depth, and specifically in relation to disease processes. This will provide improved information and direction for the development of future recommendations.

The five areas of importance remain:

1) HIV and AIDS
    - Prevention: Greater effort must be made to reduce vertical transmission of HIV.
    - Identification and treatment: Provide ready and universal access to antiretroviral treatment (ART) for children and their parents.

2) Nutrition

- Underweight children must be properly identified, assessed and managed at *primary health-care level*, and referred earlier, where necessary.
- Children with severe malnutrition need emergency treatment and effective case management in *hospital*.

3) Standards of Care

- Sick children must be identified and managed correctly at *primary health-care level* (strengthen integrated management of childhood illness (IMCI).
- Paediatric treatment guidelines and protocols must be systematically adopted or developed, and implemented (including Emergency Triage Assessment and Treatment (ETAT).

4) Norms

- Staffing norms for sick children must be developed, urgently implemented, and sustained at each level of care.
- Equipment norms by level of care must be created and implemented in every institution caring for sick children.
- Transport norms for sick children need to be developed and/or implemented.

5) Improved paediatric quality of care

- Paediatric mortality/quality of care audits should be conducted in all institutions caring for sick children.

The Child PIP Group presents these recommendations, with their implementation levels and responsibilities, as an interpretation of the updated information that has arisen directly from the survey conducted during the three years, 2005 to 2007. The recommendations aim to stimulate discussion and debate, which should lead to action that will improve the quality of care that children receive in the South African health system. This is a goal shared by all Child PIP users and by all those entrusted with caring for sick children.

HIV and AIDS

Preventing HIV infection in children

What Child PIP says

Only 70% of the children who died in 2007 had been tested for HIV. Of these, almost half were HIV-infected and a further third were HIV-exposed. Although the proportion of children tested increased significantly during the three-year period under review, the proportion of those HIV-infected and HIV-exposed remained the same. Prevention of mother-to-child transmission (PMTCT) data collection has improved since 2005 but were still lacking in 53% of deaths in 2007. In those with data, and at risk for mother-to-child transmission, only one in two received nevirapine prophylaxis. This represents a noteworthy change from 2005, when only one in four received nevirapine, but is still extremely worrying. Safe infant feeding (exclusive breast or formula) has increased from 26% in 2005 to 40% in 2007. Pneumocystis jirovecii pneumonia (PCP) prophylaxis with cotrimoxazole has remained static since 2006, with 28% of all deaths receiving cotrimoxazole but only 36% of those diagnosed with PCP.

Recommendation

Greater effort must be made to reduce vertical transmission of HIV

Action

The PMTCT programme must be strengthened.

Implementation

POLICY

- Implement, as a norm, universal opt-out HIV testing in early pregnancy, with repeat testing in late pregnancy.
- Fast-track pregnant women with CD4 counts of less than 250 onto ART.
- Clearly document all PMTCT interventions, especially the administration of nevirapine, in the mothers' and babies' clinical records and in the Road-to-Health Charts (RTHCs).
- Integrate follow-up of HIV-exposed and HIV-infected children into immunization services, with particular emphasis on effective cotrimoxazole administration, and support for safe infant feeding choices.

Responsibility: National and provincial Departments of Health.

ADMINISTRATION

- Ensure local capacity for opt-out testing, clear documentation and ART provision for eligible pregnant women.

  Responsibility: Institutional (clinics and hospitals), district and provincial managers.

CLINICAL PRACTICE

- Provide comprehensive perinatal care by all doctors and nurses responsible for perinatal care. Inherent in this recommendation is proper documentation of all clinical information including the following:

  - Ensure early identification of HIV-infected women, and treat (including ART when indicated) appropriately.
  - Inform HIV-infected pregnant women about safe infant feeding options, and encourage individual decision-making based on each woman's particular socio-economic circumstances.
  - Systematically institutionalise follow-up for the HIV-exposed infant.
  - Ensure that trained staff are the core, non-rotating members of the service delivery team.

  Responsibility: Unit and district supervisors and managers (nursing and medical).

EDUCATION

- Medical and nursing students must be trained to provide comprehensive perinatal HIV care. HIV is the most serious health challenge facing South Africa today. Medical and nursing curricula must respond to this challenge, so that qualified graduates do not need to attend extracurricular workshops on how to deliver comprehensive perinatal HIV services.

  Responsibility: Heads of nursing colleges and medical schools, specifically heads of obstetrics and paediatrics departments.

Identifying and treating children infected with HIV

What Child PIP says

A laboratory assessment of the HIV status of 30% of children who died during 2007 was not done. Of those tested in 2007, 19% were negative, 35% were HIV-exposed and 46% HIV-infected, and these proportions have remained fairly constant since 2005. In terms of clinical staging of HIV, 15% of infected or exposed children were not clinically staged in 2007, and this too remained unchanged from the previous years. Almost fifty percent of all the deaths were assessed as stage III or IV and thus were eligible for ART in all three years under review. Seven percent of children who died were documented as being on ART in 2007, which may indicate late initiation of treatment. Only 3% of mothers were documented as being on ART but information was lacking in 60% of deaths.

Recommendation

Provide ready and universal access to ART for children and their parents

Action

Increase capacity to improve ART services.

Implementation

POLICY

- Conduct an HIV polymerase chain reaction (PCR) test on all infants at six weeks of age, during their first vaccination visit, so that HIV-infected children are identified early.

  Responsibility: National and provincial Departments of Health.

- Admission to hospital must be used as an opportunity for accessing ART. All children admitted to hospital who have no documented HIV test, must be tested on an opt-out basis for HIV infection (PCR under 18 months, rapid serology over 18 months). Eligibility for ART must be established through clinical criteria and CD4 testing.

  Responsibility: District, institutional (hospitals and clinics) and unit managers.

ADMINISTRATION

- Develop laboratory systems to meet children's need for universal PCR testing at six weeks of age.

  Responsibility: National Health Laboratory Service.

- Employ additional staff to provide ART services for the rapidly increasing number of children in need of treatment.

  Responsibility: District, institutional and unit managers.

CLINICAL PRACTICE

- Assess all children admitted to hospital for HIV so that an holistic, appropriate and comprehensive HIV care plan can be instituted. Doctors treating hospitalised children must categorise all children's HIV status using clinical, laboratory and social criteria. The opt-out testing approach should be used. Barriers to testing should be equated with barriers to accessing ART for the child.

  Responsibility: Heads of paediatric departments and medical staff in children's wards.

EDUCATION

- Medical schools should ensure that graduates know how to classify children in relation to HIV and AIDS. Students should be taught that HIV testing and staging improves quality of care, rather than reduces it.

- Child PIP data relating to HIV and AIDS can be used in training and education to highlight the poor HIV assessment of children in the South African health system.

  Responsibility: Heads of paediatric departments at South African medical schools.

Nutrition

Early identification of children who are nutritionally compromised

What Child PIP says

Almost two-thirds of children who died were underweight, and just over half of these had severe malnutrition. These proportions have remained virtually constant during the three years under review.

Recommendation

Underweight children need to be properly identified, assessed and managed at primary healthcare level, and referred earlier where necessary

Action

Improve the primary healthcare capacity for identifying and managing children who are nutritionally compromised, by insisting

on the implementation and use of IMCI and the Integrated Nutrition Programme (INP) in all clinics in South Africa.

Implementation

POLICY

- Conduct a national audit of clinic-based nutrition services to assess barriers to the proper nutritional assessment of children using IMCI, and to the comprehensive and efficient implementation of the INP.

  Responsibility: National and provincial Departments of Health.

ADMINISTRATION

- Maternal, Child and Women's Health (MCWH) Directorates should conduct the audit.

  Responsibility: Directors, provincial MCWH.

CLINICAL PRACTICE

- Primary healthcare clinical personnel must identify and treat children who are nutritionally challenged according to basic principles of medicine and nursing using RTHCs, growth charts and IMCI.

  Responsibility: PHC supervisors and district managers.

- INP personnel should make their programme accessible to children in need, and should encourage clinical personnel to access the programme through a national awareness campaign. Cooperation between clinical personnel and dieticians must be strengthened.

  Responsibility: INP personnel and district managers.

EDUCATION

- Medical schools must emphasise growth monitoring and other preventative aspects of paediatric nutrition, so that graduates have a working knowledge of what is required at PHC level, and of the WHO Ten Steps for the inpatient management of a child with severe malnutrition.

  Responsibility: Heads of paediatric departments at South African medical schools.

- Nursing colleges must ensure that all graduates are able to weigh and measure children and monitor their growth using the RTHC, and are able to use IMCI as a basis for the assessment and management of children at PHC level.

  Responsibility: SA Nursing Council.

Managing children with severe malnutrition in hospital

What Child PIP says

Severe malnutrition was identified in approximately one-third of all deaths during each year under review. The case fatality rate for children with severe malnutrition was three times higher than the overall IHMR for children, from 2005 to 2007.

Recommendation **Children with severe malnutrition need emergency treatment and effective case management in hospital**

Action

Implement the WHO Ten Steps for the inpatient management of severe malnutrition in all South African hospitals.

Implementation

POLICY

- Adopt the WHO Ten Steps case management for severe malnutrition urgently as provincial policy and implement it in all provinces.

  Responsibility: National and provincial Departments of Health.

ADMINISTRATION

- Teach, implement and monitor the WHO Ten Steps case management for severe malnutrition in all hospitals as a matter of urgency.

- Monitor case fatality rates for admissions with severe malnutrition (as in Child PIP).

  Responsibility: District, institutional and unit managers.

CLINICAL PRACTICE

- Ensure that nurses and doctors working in children's wards follow the WHO Ten Steps. Develop Nursing Flow Charts to assist with the efficient administration and monitoring of the care process.

EDUCATION

- Medical schools and nursing colleges must teach the WHO Ten Steps.

  Responsibility: Heads of paediatric departments at South African medical schools, and heads of nursing colleges.

Standards of Care for looking after sick children properly

Improving quality of care at primary healthcare level

What Child PIP says

Participation of PHC staff in audit meetings was limited and records of pre-hospital care were often incomplete. Nevertheless, from 2005 to 2007, 13% of all modifiable factors occurred at PHC level. The clinical personnel modifiable factors at PHC level are almost entirely based on IMCI guidelines and almost 80% of modifiable factors reported at this level reflected a lack of IMCI implementation each year. A specific lack of IMCI assessment and management accounted for about one-third of the clinical personnel modifiable factors at PHC level. In addition, during all three years under review, one-third of children died during the first 24 hours in hospital, providing a further pointer to problems with pre-hospital quality of care.

Recommendation

Sick children must be identified and managed correctly at primary healthcare level

Action

Implement IMCI effectively as the priority programme for children at primary healthcare level.

Implementation

POLICY

- Make IMCI a priority programme in the strategic plans of all provinces. This should be reflected in financial and human resource planning and management of the provinces.
- Roll out the Household and Community IMCI component.

  Responsibility: National and provincial Departments of Health.

ADMINISTRATION

- Strengthen and sustain IMCI implementation at all PHC facilities.
- Support and evaluate IMCI trained nurses every six months.

Responsibility: Provincial MCWH.

CLINICAL PRACTICE

- Integrate IMCI, ART, TB and nutrition services at all levels of care.

- Ensure that all clinical personnel use IMCI classification and case management at all levels of care as the minimum standard when caring for sick children.

- Link the Child PIP process with quality of primary healthcare by involving PHC staff in the mortality review process. Improve communication and cooperation between hospitals and clinics. The Child PIP process may help to achieve this.

  Responsibility: Primary healthcare managers.

EDUCATION

- Implement IMCI pre-service training in all nursing and medical curricula.

  Responsibility: Medical schools and nursing colleges.

- Train doctors, casualty staff and nurses, who work with children or in paediatric wards, in IMCI.

  Responsibility: Unit managers and district MCWH coordinators.

- Provide further training for PHC workers where there is attrition of IMCI-trained clinic nurses.

  Responsibility: Provincial MCWH.

Improving quality of care at hospital level

What Child PIP says

Each year from 2005 to 2007, acute respiratory infections, sepsis, PCP, gastroenteritis and TB were responsible for two out of three child deaths, with almost half of these being HIV-related. Almost two-thirds of children who died were underweight. TB increased as a main cause of death each year from 4.9% in 2005, to 7.9% in 2006, to 8.7% in 2007. Almost one out of three deaths was considered avoidable, and on average, there was one modifiable factor related to substandard care by clinical personnel, per death. As highlighted previously, one-third of deaths occurred during the first 24 hours in hospital, which reflects problems with initial

assessment and emergency care of children on admission to a facility.

Recommendation

Paediatric treatment guidelines and protocols should be systematically adopted or developed, and implemented

Action

Every health institution should have an identified set of standard treatment guidelines and nursing protocols that address the priority conditions and problems with the process of caring for sick children. This should include ETAT for emergency care. Once identified, the most senior doctor responsible for the care of children in each institution must insist on their implementation.

Implementation

POLICY

- Develop policies and standards for first, second and third level paediatric hospital care and referral in all provinces.

  Responsibility: National Department of Health with departments of paediatrics at medical schools.

ADMINISTRATION

- Institute protocols and training, according to ETAT, for paediatric triage and resuscitation as well as emergency transport in all hospitals and community health centres.

- Investigate and monitor obstacles to the implementation of standard treatment guidelines. Child PIP may help in this regard.

  Responsibility: Institutional managers.

CLINICAL PRACTICE

- Develop the ability to assess severity of illness in all health workers working with children. It is the responsibility of each individual health professional to be familiar with the assessment, management and monitoring aspects of children in their care, and to refer at all times to the identified set of treatment guidelines.

- Conduct orientation programmes to familiarise new staff with priority paediatric problems and with the identified institutional guidelines, including ETAT.

- Ensure that ward rounds are conducted during weekends and public holidays in hospitals caring for sick children.

  Responsibility: Medical managers and doctors in charge of children's wards.

> Standards which are helpful and widely used are the "WHO Pocket Book of Hospital Care for Children" (2006), "Emergency Triage Assessment and Treatment" WHO (2005), the South African "Standard Treatment Guidelines and Essential Drugs List, Hospital Level Paediatrics" (2006), the "Handbook of Paediatrics" by Harrison (Oxford 2004) and "Paediatrics and Child Health" by Coovadia and Wittenberg (2004).

EDUCATION

- Instil an awareness of priority childhood morbidities and mortality in the paediatric curriculum at medical schools. The focus should shift from "How to make a diagnosis" to "How to look after a sick child". Encourage standardised treatment guidelines that originate in the needs of sick children rather than on the qualification of the person looking after them.

- Implement ETAT pre-service training in all nursing and medical curricula.

- Revisit the initiative to develop a South African "Core Paediatric Curriculum", based on information arising from the Child PIP process.

- Encourage the participation of paediatric academics in the mortality review processes conducted in regional and district hospitals. This would provide important feedback to paediatric educators about the capacity of South African graduate doctors to care for sick children in South African hospitals.

  Responsibility: Heads of paediatric departments at South African medical schools.

Norms for resource provision for sick children

Staff provision

What Child PIP says

Lack of staff in hospitals accounted for approximately one-third of the hospital administrative modifiable factors each year, from 2005 to 2007. The main shortages were of professional nurses and senior doctors (post-community service).

Recommendation

Staffing norms for sick children must be developed, urgently implemented and sustained, for each level of care

Action

Develop a National Department of Health sanctioned guideline on staffing norms for child health services at all levels.

Implementation

POLICY

- Develop national norms for staffing children's health services at all levels of care for the provinces to implement.
- Develop non-rotating core teams of staff to provide patient monitoring, treatment, feeding and the management of IV fluids in paediatric wards, which require specialized and continuous attention and supervision by stable and experienced staff.

Responsibility: National and provincial Departments of Health.

ADMINISTRATION

- Create an organogram that reflects national staffing norms and provincial directives in each institution. Then find the necessary funding and create posts to achieve this goal.
- Pay special attention to coverage by clinical personnel (doctors and nurses) during the night and at weekends.
- Make the employment and retention of clinical personnel in paediatric services a key performance area for hospital managers.
- Prioritise the filling of vacant doctors' and nurses' posts in understaffed hospitals.
- Monitor staffing levels in paediatric health services regularly.

Responsibility: Institutional management with the support of provincial health departments.

CLINICAL PRACTICE

- Encourage the development of clinical skills in paediatrics for all levels of staff. Acknowledge and nurture staff who show aptitude and commitment. Establish core teams and abolish staff rotation systems that disrupt core service delivery.

- Ensure that paediatric nurses are responsible for paediatric wards in district hospitals.
- Provide doctors receiving sick children in casualty or working in paediatric wards with support from senior doctors experienced in paediatrics.
- Use Child PIP findings to design regular in-service training for nurses and doctors from hospitals and the districts.

Responsibility: Hospital and unit managers.

EDUCATION

- Instil an understanding of the importance of managing paediatric units properly, in medical and nursing students, early in their training.

Responsibility: Medical schools and nursing colleges.

Facilities, equipment and consumables

What Child PIP says

Almost one-third of the administrator-related modifiable factors found in Child PIP data during the three-year period under review were due to lack of access to or inadequate facilities for sick children, especially a lack of high-care beds and resuscitation areas. About 8% percent related to lack of equipment each year and 5-8% to a lack of drugs and IV fluids.

Recommendation

Equipment norms by level of care must be created and implemented at every institution caring for sick children

Action

Develop national norms for facilities, equipment and consumables for each level of paediatric care.

Implementation

POLICY

- Develop and implement national and provincial norms for equipping children's health services at all levels of care.

Responsibility: National and provincial Departments of Health.

ADMINISTRATION

- Ensure that every hospital caring for sick children has a paediatric resuscitation kit in a designated area of the casualty department.

- Increase the number of paediatric high-care and ICU beds and distribute equitably among the provinces.
- Ensure that all paediatric wards, including those in district hospitals, have a designated, appropriately staffed and equipped high-care area.
- Make lodger mother units available in hospitals that offer paediatric inpatient care. These will improve feeding and monitoring of sick children.
- Establish and efficiently administer equipment pools and establish efficient maintenance systems. Consumables must be efficiently stocked and provided.
- Prioritise paediatric resuscitation equipment and consumables.

Responsibility: Institutional and unit managers.

CLINICAL PRACTICE

- Ensure that doctors and nurses have access to the basic equipment norms for each level of healthcare and are responsible for the use and early reporting of any malfunctioning equipment.
- Organise and economically use consumables, without in any way compromising the quality of care given to sick children.

Responsibility: Doctors and nurses in charge of children's wards.

Transport

What Child PIP says

One-third of the deaths occurred during the first 24 hours in hospital. Transport related modifiable factors accounted for approximately 6% of the total administrator modifiable factors and this proportion was constant over the three years, 2005 to 2007.

Recommendation

Transport norms for sick children need to be developed and / or implemented

Action

Assess, manage and monitor sick children properly both before and during transfer from one health facility to another.

Implementation

POLICY

- Develop national norms for pre-transfer assessment, management and monitoring of sick children, as well as for ambulance waiting times and in-transit monitoring and management.

  Responsibility: National and provincial Emergency Medical Rescue Services (EMRS).

ADMINISTRATION

- Ensure that every hospital caring for sick children has the required facilities for stabilising patients prior to transfer, and while awaiting the arrival of the EMRS.

  Responsibility: Institutional managers (hospitals and clinics).

CLINICAL PRACTICE

- Ensure that medical and nursing staff conduct proper pre-transfer assessment, management and monitoring of sick children. Once transport is arranged, the child must continue to be cared for under close supervision. Experienced medical and nursing staff must be involved in the transfer process.

- Improve communication between clinical personnel working for the same catchment population, but at different levels of care. Joint Child PIP meetings and evaluations may be helpful in this regard.

- Institute standardised transfer monitoring forms to be completed on handover of paediatric patients, and by EMRS personnel in transit.

  Responsibility: Medical managers, doctors and nurses in charge of children's wards.

EDUCATION

- Teach undergraduate doctors and nurses about the importance of pre-transfer assessment, in-transit management and monitoring of sick children between health facilities.

  Responsibility: Medical schools and nursing colleges.

Improving paediatric quality of care

Child healthcare data and Child PIP

What Child PIP says

The Child PIP survey of paediatric deaths from 2005 to 2007 has continued to provide robust information about children: their demographics, social and health contexts (i.e., nutrition and HIV and AIDS) and causes of death. It also provided information about the quality of care children received from those entrusted with caring for them. Thus Child PIP describes the experience of children in South African hospitals in detail, and in a way that enables problem identification and therefore problem solving to occur, so that real improvements can be made in the quality of care given to children. Apart from quality of care issues, Child PIP has identified problems with admission data due to poor data collection in ward admission and discharge registers.

Recommendation

Paediatric mortality / quality of care audits should occur in all institutions caring for sick children

Action

Child PIP should be implemented in all hospitals in South Africa.

Implementation

POLICY

- Audit all paediatric deaths occurring in the healthcare system to assess quality of care.
- Institute standardised ward admission and discharge registers to ensure accurate monthly admission data.
- Amalgamate and review district data six-monthly to consolidate insights gained and monitor outcomes.

Responsibility: National and provincial Departments of Health.

ADMINISTRATION

- Encourage structured quarterly paediatric quality of care audits, using the mortality review process as the framework.

Responsibility: Institutional managers.

CLINICAL PRACTICE

- Ensure that nurses and doctors accurately record admission and discharge information about paediatric patients in the ward registers.

- Encourage clinical mortality audits to become part of routine day-to-day clinical practice.

  Responsibility: Paediatric unit managers.

  The mortality review process outlined in Appendix D provides a framework for regular audit meetings.

EDUCATION

- Teach clinical auditing, and especially the ability to reflect on mortality and morbidity in a structured way at undergraduate level at medical schools and nursing colleges. South Africa has three excellent home-grown examples of the structured death audit process which targets, in addition, quality of care. These are the National Committee for Confidential Enquiry into Maternal Deaths (NCCEMD), the Perinatal Problem Identification Programme (PPIP) and Child PIP. All these tools are potentially readily available to undergraduates.

  Responsibility: Heads of medical schools and nursing colleges.

- Publish Child PIP findings annually and present the findings regularly at relevant conferences such as the South African Paediatric Association and Rural Doctors Association of Southern Africa (RuDASA).

  Responsibility: Child PIP national executive committee.

PART TWO
MORBIDITY AND MORTALITY IN SOUTH AFRICA

Chapter 3

Measuring Child Mortality in South Africa

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Introduction

Child mortality is one of the key indicators used to track the health of children. Furthermore, it is one of the eight Millennium Development Goals (MDGs) for reducing poverty and inequality in the world. However, reliable measurement of child mortality remains a challenge for many developing countries, including South Africa.[1]

By looking at global trends in estimates of child mortality, this chapter considers the information that should ideally be collected by countries to inform health policies and programmes. The strengths and weaknesses of alternative data sources are reviewed and the availability of South African data is considered. The chapter also gives an overview of what is known about the trends in child mortality in South Africa.

Indicators of the level of child mortality

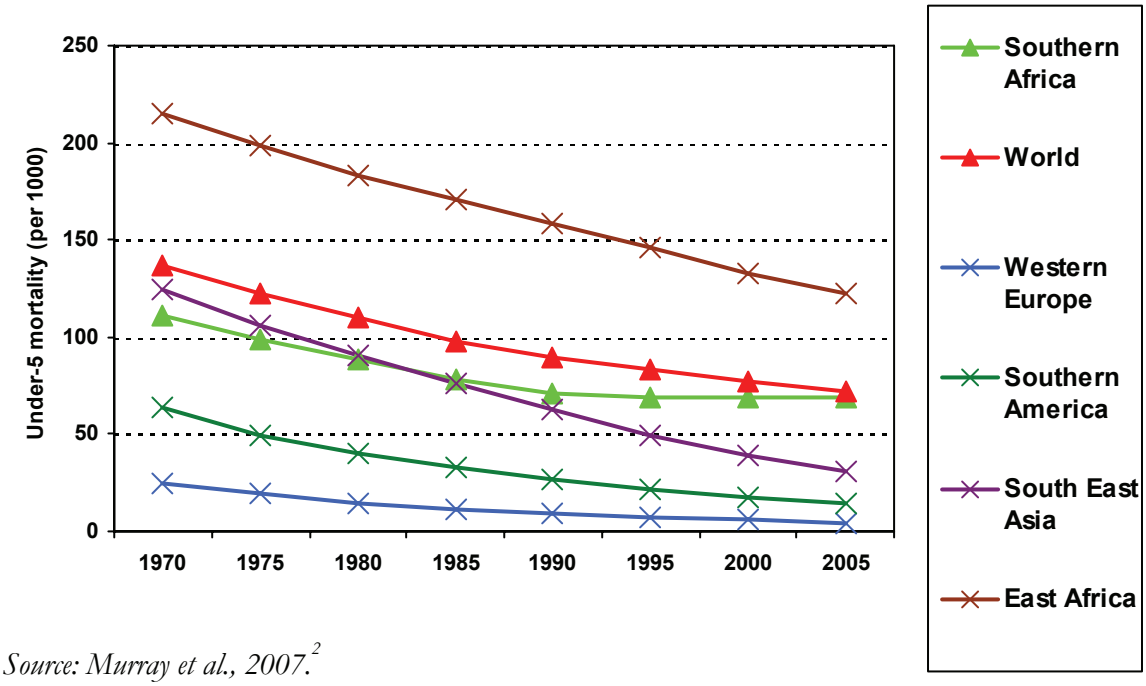
A key indicator of child mortality is the under-5 mortality rate, (i.e., the probability of a child dying before the age of five years). Murray et al.[2] have recently estimated the under-5 mortality rate for different regions of the world for the year 2005. The lowest estimate per 1 000 live births was 4.6 for western Europe and the highest was 219 for central

[1] Bradshaw D, Dorrington RE. 2007. Child mortality in South Africa – we have lost touch. S Afr Med J; 97(8): 582-583.

[2] Murray CJL, Laakso T, Shibuya K, Hill K, Lopez AD. 2007. Can we achieve Millennium Development Goal 4? New analysis of country trends and forecasts of under-5 mortality 2015. Lancet 370: 1040-1054.

Africa. Their estimates show that the global trend has been downward from 172 per 1 000 in 1970 to the current level of 72 per 1 000. This trend has been experienced across all regions, with the exception of the southern African region, which has experienced a slow down or reversal of the trend as a result of HIV and AIDS. Figure 1 shows the trend for selected regions of the world.

Figure 1. Trend in under-5 mortality rates for selected regions of the world



Source: Murray et al., 2007.[2]

Aside from the under-5 mortality rate, there are several other important age specific mortality rates concerning babies and children. The infant mortality rate (IMR), usually calculated from the number of deaths of children under the age of one year divided by the number of live births in that year, approximates the risk of mortality in the first year of life. Although the IMR is a widely used indicator, many demographers suggest that the under-5 mortality rate would be a better indicator to estimate, as it is less subject to error than the IMR.

The IMR can be separated into the neonatal mortality rate (under 28 days) and the post-neonatal mortality rate (1-12 months). The perinatal mortality rate involves the deaths of babies 0-6 days old and is the only rate that includes stillbirths. Thus the perinatal mortality rate is generally presented per 1 000 births and is not restricted to live births. Mortality beyond infancy is often measured as the probability of a one-year old child dying before the age of five years and is known as the

child mortality rate. However, an age specific mortality rate calculated from the number of deaths aged one to four years divided by the number of children aged one to four years can also be used. This would be expressed per 100 000 population.

Constitutionally, children are people under the age of 18 years. Demographically, however, there is a tendency to categorise data into five-year age groups. It is therefore more common for age specific mortality rates to be available for children 5 to 9 years, 10 to 14 years and 15 to 19 years respectively. Given the high levels of mortality of children under the age of five years, the focus of this chapter is on this particular age group.

Cause of death

In order to reduce child mortality, it is important to know the causes of death. Countries collect statistical information on the cause of death from the details provided by doctors about the sequence of diseases or conditions that led to the death on death notification forms. Such data are collected and coded according to the definitions and rules of the International Statistical Classification of Diseases and Related Health Problems (ICD-10).[3] This provides an international medical certificate of cause of death, which is divided into two parts: Part 1, with four lines, captures the cardinal sequence of medical conditions leading to death, and Part 2 is used to show any contributory causes, (i.e., not in the sequence leading to death). From a public health perspective, it is important to distinguish between the *underlying cause of death* and the *immediate cause*.

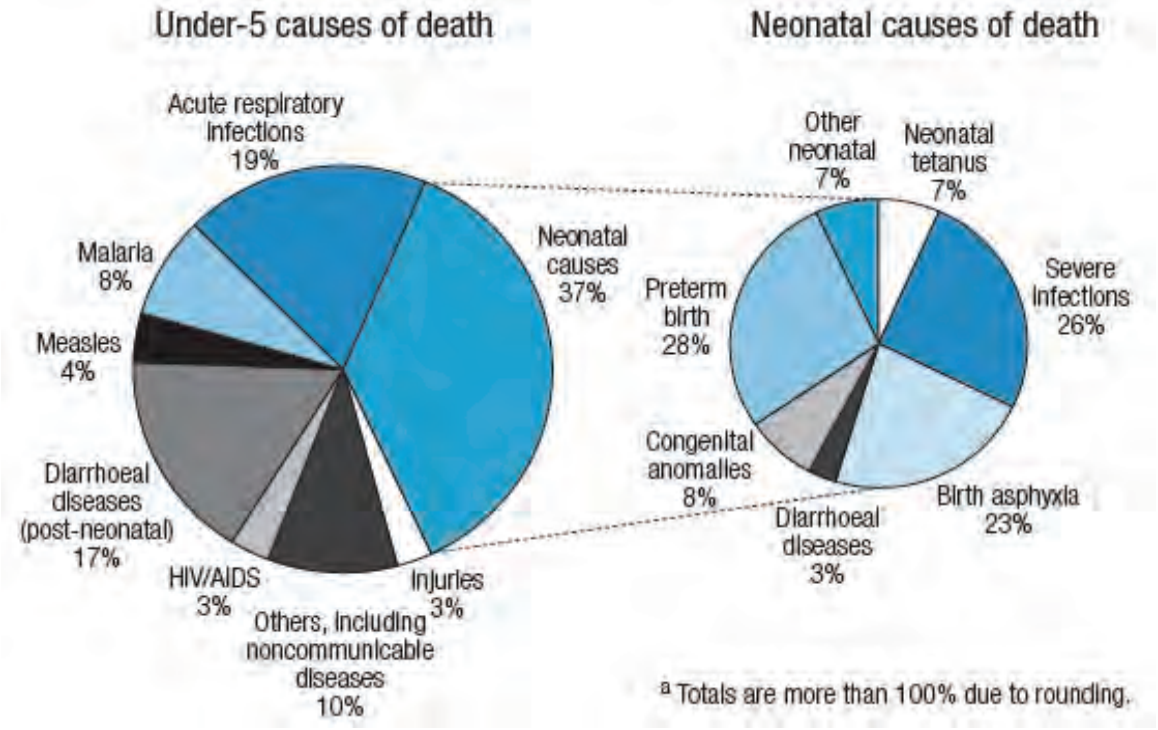
- *Underlying cause of death* is defined as the disease or injury that initiated the chain of events leading to death, or the circumstances of accidents or violence that produced the fatal injury.

[3] World Health Organisation. 1992. International Statistical Classification of Disease and Related Health Problems. Tenth Revision. Volume 2. Geneva: World Health Organisation.

- *Immediate cause of death* is the final complication resulting from the underlying cause of death occurring closest to the time of death and directly causing death.

Figure 2 shows the global estimates of causes of death experienced by children under the age of five years.[4] This shows that the most common causes of death in children under five are neonatal causes, acute respiratory infections and diarrhoeal diseases. These reflect the underlying cause – but it is important to note that many of these causes are associated with malnutrition, which does not show up as an underlying cause. Not all countries have accurate cause of death statistics and modelling has been used to estimate the numbers and causes of death for countries where such data are missing. This includes most developing countries.

Figure 2. Estimated cause of death profile for children under five years, 2005



Source: World Health Report, 2005.[3]

Alternative data sources

Different data sources and approaches to measuring child mortality are available. Each has their own strengths and weaknesses as shown in

[4] World Health Organisation. 2005. World Health Report 2005: Make every mother and child count. Geneva: World Health Organisation.

Table 1. Common problems arise for most approaches related to the numerator, including missing cases, misclassification of causes or misreporting of age. Problems also arise with denominators such as incomplete birth registration.

Table 1: Strengths and weaknesses of alternative methods to measure child mortality

Data sources	Strengths	Weaknesses
Vital registration and cause of death statistics	Routinely collected information	Incomplete registration of deaths Mis-classification of causes Incomplete birth registration
Population based survey and census	Provides information about the whole population (not just those attending health facilities)	Periodic availability Quality needs attention
Demographic and health surveillance sites	Ongoing information of good quality	Limited to selected population Verbal autopsy has limitations in diagnosis
Confidential enquiry/ facility audit	Quality information Provides valuable quality of care information to the actors who can follow-up	Includes only the cases that occur in the facility missing deaths at home Can understate the rate as cases are missed
Modelling	Provides estimates where data are not available	Limited by the amount of information available and the assumptions that are required

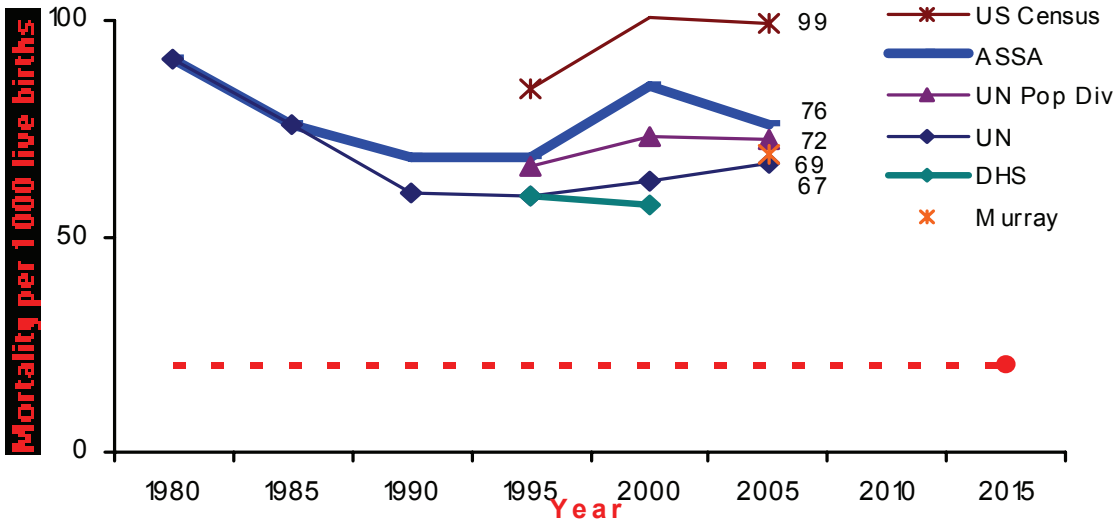
Child mortality in South Africa

Registered deaths of children under five years have increased from 33 000 in 1997 to 62 000 in 2005.[5] However, it is difficult to assess completeness of registration for children and it is not yet possible to distinguish increases in death rates from improved registration. Model-based estimates that draw on the empirical data from national surveys are shown in Figure 3. The models would suggest that the under-5 mortality rate was between 69 to 76 per 1 000 in the year 2005.

[5] Statistics South Africa. 2007. Mortality and causes of death Statistical release in South Africa, 2005. Findings from death notification. P0309.3. Pretoria: Statistics South Africa. 2007. http://www.statssa.gov.za/publications/P03093/P03093.pdf (accessed on 22 June 2007).

Depending on the assumptions based on the impact of HIV and the trend in non-HIV-related causes of death, child mortality may have peaked or may have continued increasing. Further analysis of available data such as the Community Survey conducted in 2007 should be undertaken. However, it is clear that the downward trend prior to 1990 has reversed, and that South Africa is not on track to meet Goal 4 of the MDGs.

Figure 3. Estimates of Under-Five Mortality Rates for South Africa



Source: United Nations Population Division, 2007 [6]
US Census Bureau [7]
ASSA 2003 modelled by RE Dorrington with realistic rollout of PMTCT [8]
Lawn and Kerber, 2006 [9]
Murray et al., 2007 [2]

It is important to know the causes of child deaths. Figure 4 shows the cause of death profile from the registered deaths, by age group. However, it is difficult to interpret the national vital statistics for several

[6] United Nations Population Division. 2007. World Population Prospects: 2006 Revision. CD edition.

[7] US Census Bureau. www.census.gov/ipc/www/idv/

[8] Dorrington R, Bradshaw D, Johnson L, Daniel L. 2006. The Demographic Impact of HIV/AIDS in South Africa: National and Provincial Indicators 2006. Cape Town: Centre for Actuarial Research, South African Medical Research Council, Actuarial Society of South Africa.

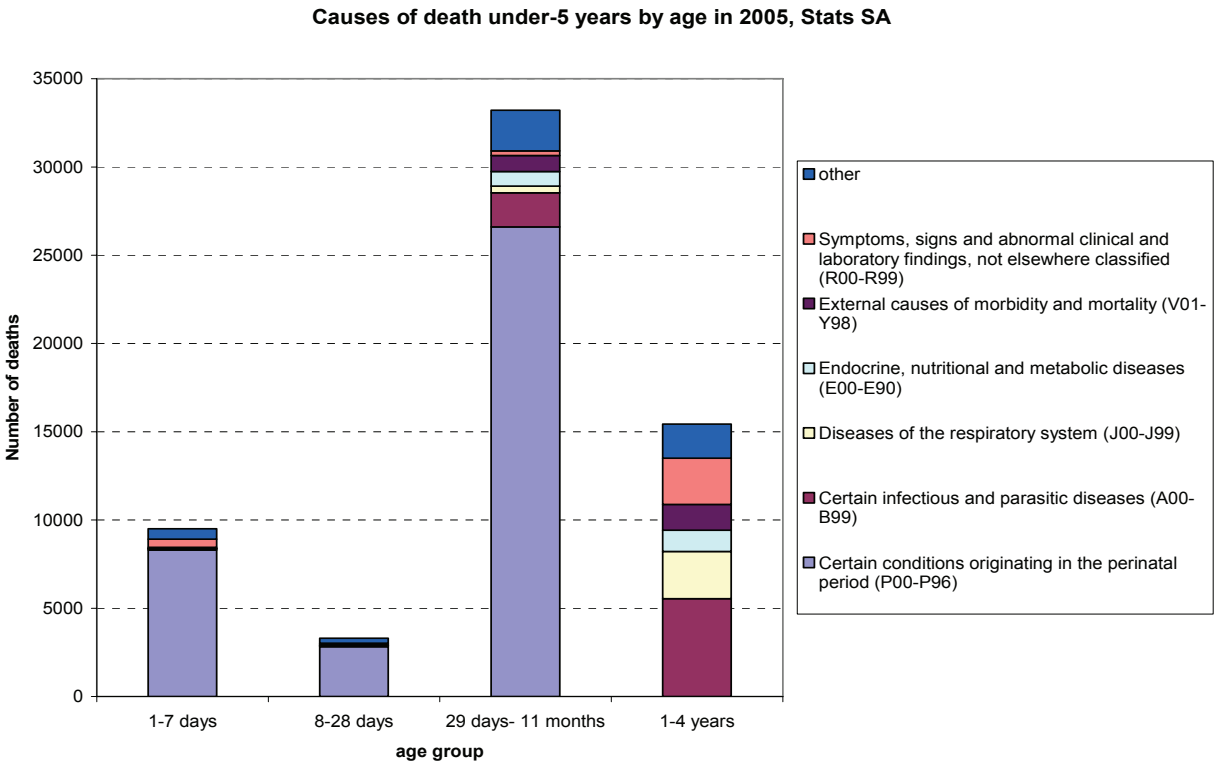
[9] Lawn JE, Kerber K. 2006. Opportunities for Africa's Newborns. PMNCH.

reasons. The extent of under-registration of deaths remains unclear and probably differs across age groups. In addition, there is miscoding of the P codes for infant deaths that occur in older ages.[10]

Figure 4. Causes of death in children under five years, 2005

Source: Own analysis of data from StatsSA

The *South African National Burden of Disease Study, 2000*[11] [12] attempted to overcome the limitations of the available data and through a process of



careful analysis and assessment, derived estimates of the mortality burden in South Africa. Firstly, to estimate of the total number of deaths, the study used the Actuarial Society of South Africa's model

[10] Bradshaw D, Nannan N. 2006. Mortality and morbidity among women and children. In: Ijumba P, Padarath A (Eds). South African Health Review 2006. Durban: Health Systems Trust.

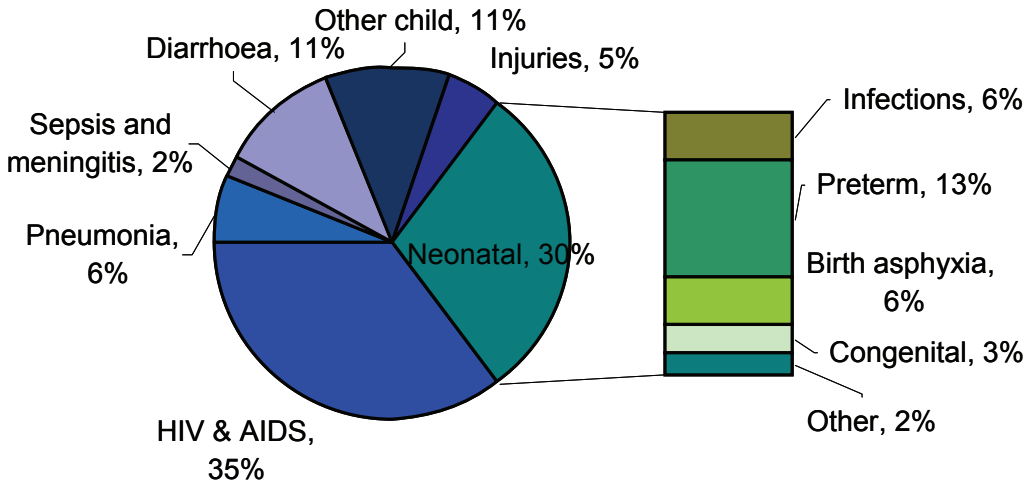
[11] Bradshaw D, Groenewald P, Laubscher R, Nannan N, Nojilana B, Norman R, Pieterse D, Schneider M, Bourne DE, Timaeus IM, Dorrington R, Johnson L. 2003, Initial burden of disease estimates for South Africa, 2000. S Afr Med J ; 93: 682-688.

[12] Norman R, Bradshaw D, Schneider M, Pieterse D, Groenewald P. 2006. Revised Burden of Disease Estimates for the Comparative Risk Factor Assessment, South Africa 2000. Cape Town: Medical Research Council.

calibrated to the trend in under-five mortality from the 1998 *South African Demographic and Health Survey* and the 1996 census with the added impact of AIDS based on epidemiological assumptions, and then extrapolated the proportion of pregnant women who are HIV-positive. Secondly, to estimate of the cause of death profile, the study used the 1996 cause of death data assumed to represent the non-AIDS profile. This was prior to the miscoding of P codes found in data from 1997-2005.

These estimates were reviewed in the *Every Death Counts*[13] report with a regrouping of the diseases in the neonatal period. Figure 5 indicates that approximately a third of child deaths occur in the neonatal period, more than a third result from HIV and the remaining third results from other childhood diseases and conditions. Uncertainty in these estimates must be acknowledged, but are difficult to quantify.

Figure 5. Estimate of the underlying cause of death in children under five years, South Africa 2000



Source: Every Death Counts: Saving the lives of South Africa's mothers, babies and children, 2008

Way forward

South Africa is a middle-income country that has gone through a profound transition to a non-racial democracy. The new government has responded to many requirements including the consolidation of 14 separate provincial and national Departments of Health. Enormous

[13] South Africa Every Death Counts Writing Group. 2008. Every death counts: use of mortality audit data for decision making to save the lives of mothers, babies and children in South Africa. Lancet 2008; 371:1294-304.

improvements have been made in developing an appropriate health information system. Yet, we are still unable to track child mortality reliably. Increased efforts are needed in four areas:

1) Improve vital statistics

Efforts to improve birth and death registration must be continued. At the same time, there is a need to improve the quality of cause of death certification through training medical students as well as practicing doctors. The cause of death in the case of external causes is often not included in the death notification, indicating that there is a need to link the mortuary-based information on external causes into the vital statistics system.

2) Measure child mortality in national household surveys

The *South African Demographic and Health Survey* includes questions to obtain estimates of child mortality. The 2003 survey failed to produce reliable estimates due to data quality concerns. It is imperative that good quality data be collected in the future surveys.

3) Extend facility audits

Several facilities use the Child Healthcare Problem Identification Programme (Child PIP) and the Perinatal Problem Identification Programme (PPIP). Not only does this enable the facility staff to have a better understanding of child mortality in their facility, but the data also contribute to national monitoring. It would therefore be advantageous to extend facility audits. However, this should only be done where there is willingness to participate.

4) Analyse and synthesise available data

We have gone some way to reviewing the data from different sources. However, efforts need to be extended to compare data from different sources, including the demographic surveillance sites, and derive new burden of disease estimates that account for the changes during the past few years.

Acknowledgements

The paper has benefited from my collaboration with the Every Death Counts Working group and the members of the MRC Burden of Disease Research Unit. In particular, discussion with Joy Lawn, Kate Kerber, Nadine Nannan, Ria Laubscher, David Bourne, Linnea Brody and Beatrice Nojilana are acknowledged.

Chapter 4

The Committee on Morbidity and Mortality in Children Under Five Years

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Background

In recognition of the need to reduce maternal mortality and to improve maternal and child health, Dr. M. Tshabalala-Msimang, Minister of Health, established a National Committee on Confidential Enquiries into Maternal Deaths (NCCEMD) in October 1997.

Acknowledging the insights gained from this process, the National Department of Health suggested that the concept be expanded. A long-term vision has subsequently emerged, proposing that additional committees be established to review patterns of mortality in a variety of settings within the health sector. It was proposed that eight national committees be established to review patterns of morbidity and mortality in the following areas:

- Maternal
- Perinatal
- Children
- Medical
- Surgical
- Non-obstetric women
- Trauma
- Peri-operative

In February 2008, when the term of office of the NCCEMD was renewed, two additional committees were launched: the Committee on Morbidity and Mortality in Children Under Five and the National Perinatal Morbidity and Mortality Committee.

Ministerial Committee on Morbidity and Mortality in Children Under Five

The composition of the three committees is similar: each committee comprises 15 members with representation from all nine provinces. Members are based in the public sector, academic institutions and the military, and are representative of both the nursing and medical professions. Each committee has a chairperson and two vice-chairpersons and includes representatives from the National Department of Health, which also provides logistical support to the committees.

The committee has been appointed for a three-year term during which it is required to produce quarterly reports, an annual progress report on the processes of the committee, as well as a definitive triennial report inclusive of the committee's findings, recommendations and its implementation plans.

The terms of reference for all three committees are similar. The Committee on Morbidity and Mortality in Children Under Five Years has five primary tasks:

- Register all deaths of children under five years.
- Identify direct and indirect causes of death.
- Make recommendations to reduce childhood mortality.
- Develop implementation plans for these recommendations.
- Perform additional tasks related to childhood morbidity and mortality as requested by the Minister of Health.

The initial activities of the committee will be focused on three areas:

- The registration and documentation of childhood deaths
    - All child deaths should be recorded, including:
        - Those within the public and private health sector, and
        - Community based deaths outside the health sector.

- This will require the strengthening of existing systems such as vital registration and the District Health Information System or the creation of new parallel death notification systems.

- The interpretation of available data to describe:
  - The extent of childhood mortality, including:
    - Who is dying, (i.e., the demographics of child mortality)
    - Where they dying, (i.e., the geographical distribution of mortality)
    - When they are dying, (i.e., seasonal variations in child mortality)
    - Why they are dying, (i.e., the primary cause of death)
  - The context of childhood deaths, including:
    - Social context
    - Health context
    - Access to health care
  - The cause of death, including:
    - The direct disease process resulting in the death,
    - The indirect contributing or modifiable cause of death that tries to answer the question "why this child?" (i.e., individual characteristics of the child; factors determined by the social context of the child and family, including their access to care; and the quality of the care they were able to access).

- The development of a response to available information, including:
  - Recommendations based on the above data to reduce childhood morbidity and mortality, and
  - An implementation plan to achieve these recommendations.

As the response needs to be evidence based it should be developed progressively in phases:

- In the short term, the recommendations will be limited to addressing direct causes of childhood deaths.
- The medium term response should focus on improving health information systems to improve the quality of information on childhood deaths.
- In the longer term, better quality information should facilitate a more detailed response to address direct and indirect causes of childhood deaths in the community and within the health services.

Child PIP and the Committee

There are a variety of sources for quantitative data on child mortality – vital registration, Demographic and Health Surveys, District Health Information System and sentinel surveillance sites at Agincourt, Hlabisa and Dikgale.

Child PIP is however, the only ongoing programme that looks at quality of care issues relating to childhood deaths. It is therefore essential that the Committee on Morbidity and Mortality in Children Under Five Years and Child PIP develop a partnership to complement each other and to avoid duplication and the unnecessary wastage of scarce resources.

The Committee is an official Ministerial committee with a mandate to make recommendations and to develop implementation plans to reduce childhood mortality. It is therefore in a position of influence.

Child PIP is a voluntary programme, driven by enthusiasts who have developed a credible tool for the objective review of indirect contributing factors to childhood deaths and are achieving extensive coverage of facility-based deaths throughout South Africa.

Collaboration between these two parties is necessary to ensure that they strengthen each other, contribute qualitative data to the review

process and provide a conduit for the implementation of the recommendations arising from both processes.

Conclusion

The launch of the Committee on Morbidity and Mortality in Children Under Five Years represents an extension of the national mortality review process and an attempt to institute an evidence-based plan for the reduction of childhood mortality.

As such, it should contribute towards the development of a culture of clinical governance and provide an opportunity to influence child health services through the development of improved health information systems, a more child friendly health system, infrastructure that is appropriate for children and improved standards of clinical care.

We are all fortunate to be in the right place at this time and you are encouraged to participate in this process through the implementation of the Child PIP and the development of a partnership between Child PIP and the Committee on Morbidity and Mortality in Children Under Five Years.

PART THREE
CHILD PIP:
INFORMATION FOR CHILDREN

Chapter 5

Acute Respiratory Infections: Child PIP 2007

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Introduction

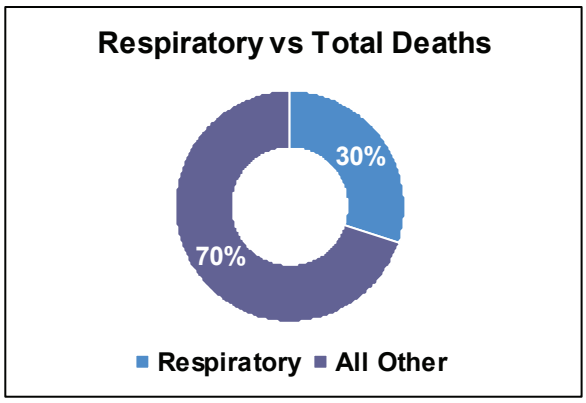
The purpose of this chapter is to review the data from the Child Healthcare Problem Identification Programme (Child PIP) that relate to children who died as a result of acute respiratory infections. The term "acute respiratory infections" (ARIs), for the purpose of this report, refers to *pneumonias* and all acute *lower respiratory tract infections* (LRTIs). Pulmonary tuberculosis, due to its chronic nature, is excluded. Pneumocystis jirovecii pneumonia (PCP), while usually an acute illness, is listed as a separate main cause of death in Child PIP data. Due to the difficulty in confirming clinical PCP, the majority of deaths recorded as being due to PCP were "Suspected PCP". It is useful to look at deaths due to PCP separately because of the close association of PCP and HIV co-infection.

Causes of death

Main Cause of Death by Systems

Deaths due to illness related to the *respiratory system* formed 30% of the total deaths by system. Infections and parasitic diseases were the main causes of death, causing 48% of deaths. These two groups combined caused 78% of all deaths by systems; the individual contribution to cause of death by the other systems was small in comparison, none of them exceeding 3%. The respiratory system, thus, is a crucial area to concentrate on when determining means of reducing child deaths.

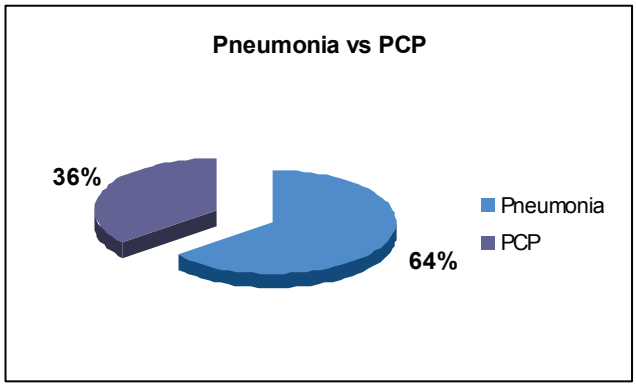
Figure 1. Just under a third of all deaths relate to the respiratory system



Main Cause of Death by Individual Diagnosis

Of the 3 387 deaths captured by Child PIP during 2007, there were 595 deaths due to ARIs. This forms 18% of all child deaths and is the *largest proportion* of deaths by individual diagnosis, although septicaemia follows closely with 17%. Suspected PCP is grouped separately and ranks fourth as a cause of death. A total of 341 deaths were either due to suspected (324) or confirmed (17) PCP. When PCP and ARI deaths are grouped together, they make up 28 % of all deaths. The in-hospital mortality rate for ARIs was 6 per 100 admissions.

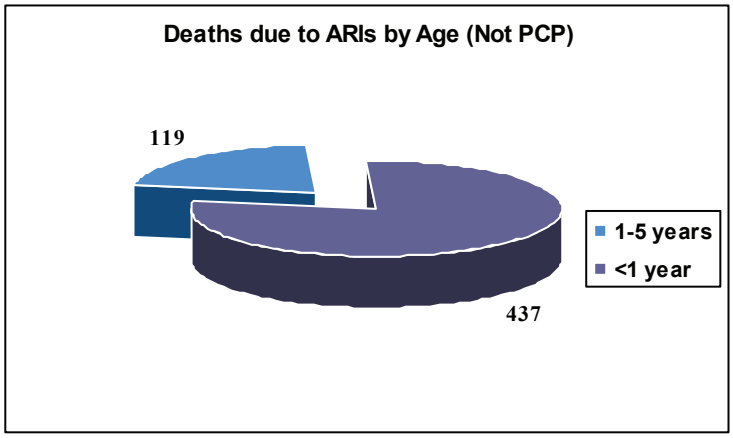
Figure 2. Proportion of ARI deaths related to pneumonia and PCP



Deaths by age

It is clear that infants are at greatest risk of dying from ARIs by a factor of approximately four. Pneumococcal pneumonia is a significant aetiological agent in this age group and the introduction of an effective vaccine to prevent this prevalent disease will reduce child deaths caused by pneumonia.

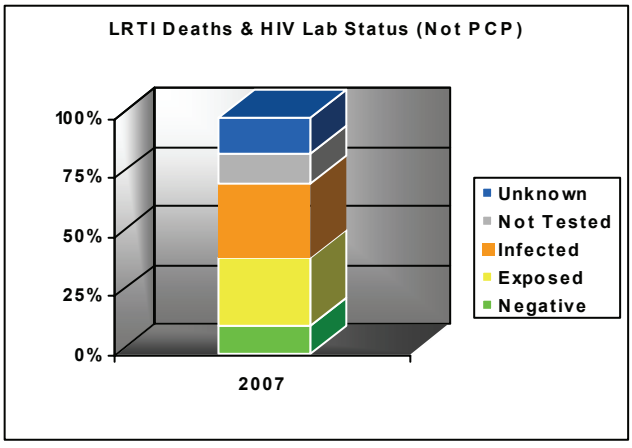
Figure 3. The relationship between age and death from ARIs

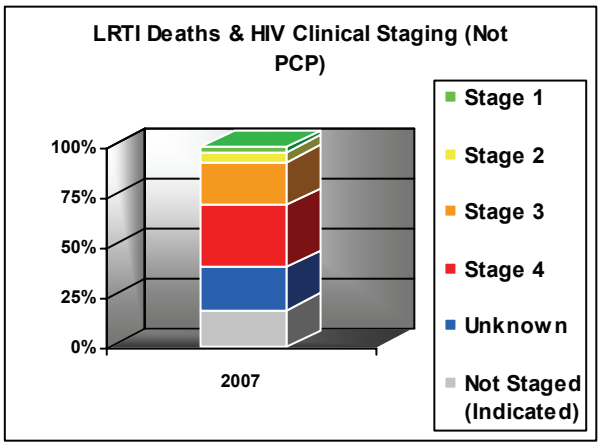


HIV and ARIs

Of the 595 ARI deaths (excluding PCP) recorded by Child PIP, the majority (340) were either HIV-infected or HIV-exposed; only 66 were known to be HIV-negative. One hundred and sixty children were not tested (but should have been) or were of unknown status. Bearing in mind that a considerable proportion of children were not clinically staged (16%) or whose stage was unknown (18%), there is a proportional agreement between the number of children who die from ARIs and clinical staging of HIV, viz. the more advanced the clinical staging, the greater the proportion of deaths due to ARI within that category. A very small number of children with stage I or II HIV disease died from ARIs. In the majority of children who died because of ARIs, the information as to whether they received prevention of mother-to-child transmission (PMTCT) of HIV was unknown. In 14% of these patients, HIV PMTCT prophylaxis was not given, while 19% did receive prophylaxis.

Figures 4 and 5. ARI Deaths by HIV Laboratory Status and HIV Clinical Staging





PCP prophylaxis with cotrimoxazole coverage is similar in 2007 compared to 2006, although the amount of data on this topic has quadrupled. Almost 50% of children who died of PCP were not on cotrimoxazole prophylaxis. It is very worrisome that this fundamental and proven prophylaxis is not being effectively implemented.

Modifiable factors

There was an almost equal number of reported avoidable (175) and non-avoidable (179) deaths due to ARIs. Of the 341 deaths due to PCP (confirmed and suspected), 92 were thought to have been avoidable. Notably, after acute diarrhoea, deaths due to ARIs were thought, by Child PIP users, to be the most avoidable deaths.

Using this information

ARIs are clearly responsible for the deaths of hundreds of children in South Africa each year. Why is this so, and what can be done about it?

Possible reasons …

- PMTCT of HIV and cotrimoxazole prophylaxis is not optimally implemented.
- Overwhelming numbers of very ill patients due to the HIV pandemic.
- Ill-equipped and poorly staffed facilities.
- The rapid rate of progression of ARIs, especially in young children.
- Appropriate medication not given.

Possible practical solutions…

In the Hospital Wards:

- Doctors
    - Should offer HIV testing with informed parental consent to all ill babies on presentation to a health institution, as there is a high risk of a very ill baby with an ARI being HIV-infected.

  - Should suspect PCP in the correct setting and treat promptly.
  - Should give cotrimoxazole prophylaxis to all exposed babies from 6 weeks of age.

- Nurses

  - Must make sure that oxygen therapy is given correctly.
  - Must ensure that medication, especially antibiotic therapy, is administered timeously.

At Departmental Level:

- Identify practical factors that impair care, (e.g., do an equipment audit.).

- Ensure that children with an ARI are transferred to hospital safely *after* stabilization. Provide feedback to referring institutions regarding transfers.

- Strongly encourage early accurate identification of HIV-infected children (4 - 6 weeks of age).

At Hospital Level:

- Policy: PMTCT of HIV must become a priority. Broadening HIV prevention strategies and actually implementing the prescribed prevention for ALL eligible babies must become standard practice.

- Administration/Management: The Child PIP mortality audit tool should be implemented as a quality improvement programme. Preventing ARI deaths among children is a priority. Linking PMTCT and treatment programmes for infected children is crucial.

- Clinical Practice: The focus should be on practical matters, (e.g., identifying critically ill children in need of oxygen therapy and treating hypoxia appropriately). Hospital staff should use high dose cotrimoxazole for suspected PCP and start steroids early, for severe PCP.

- Education: Integrated Management of Childhood Illness (IMCI) danger signs among very sick children and signs of severe disease in children with respiratory infections must become universally known.

Summary

Most ARI deaths occurred among HIV-infected or -exposed infants and children. Preventing mother-to-child transmission is critical, including early and accurate diagnosis of the HIV status of infants and the use of cotrimoxazole prophylaxis for PCP when indicated. Potentially, this could prevent a significant proportion of deaths due to ARIs. If implemented universally at a programmatic level, this goal is attainable.

Infants born to HIV-infected mothers should receive appropriate prophylaxis and have their HIV status determined at 4 to 6 weeks of age (by means of a virological test). Where the mother's HIV status is unknown at delivery, status should be determined before discharge of the neonate. Follow-up of these HIV- exposed or infected infants should be according to the South African PMTCT guidelines. On first contact with the health system, all infants presenting with signs or symptoms of an HIV related illness should be tested with an HIV antibody test and confirmed with a virological method if possible.[1]

In June 2008, WHO revised their guidelines to recommend universal treatment of all HIV-infected infants less than 12 months of age "irrespective of clinical or immunological stage".[2] If recommendations such as these are implemented, which is no small feat, a dramatic reduction in death due to ARIs can be realised.

Of all our efforts to reduce childhood mortality, the Child PIP data suggests that the above concepts will yield the most benefit in the shortest time.

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[1] Clayden, P. Starting infants on antiretroviral therapy. Southern African Journal of HIV Medicine. 2008; 32: 25-32.

[2] World Health Organization. Antiretroviral therapy of HIV infection in infants and children: towards universal access. http://www.who.int/hiv/pub/guidelines/art/en/index.html

Chapter 6

HIV Report: 2005-2007

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Child PIP makes sense of the mortality review process, an opportunity to identify the problems and the missed opportunities systematically during the care of a child in the South African healthcare system. The aim of Child PIP is to identify preventable deaths and to map a way forward to prevent more dying.

Approximately 5.2 million people are living with HIV in South Africa; 184 684 are under the age of 14 years and the national antenatal prevalence rate was 28% in 2007.[1]

HIV in children is one of the diseases that is preventable and it has become a treatable chronic disease.

The purpose of Child PIP is to improve quality of healthcare for children in South Africa through mortality review, and to ask the question, "Was this death avoidable?". When reviewing the final hospital admission of a child, health workers often accept that all necessary care was given to the child and, especially if he or she had AIDS, the death is considered unavoidable. It is vital to reflect more on these deaths: because if HIV infection of a pregnant woman had been prevented, or the transmission of HIV from mother-to-child had been prevented by ensuring that every pregnant woman received effective PMTCT, the child would have been born HIV-negative. If the child had had access to cotrimoxazole prophylaxis and

[1] The national HIV and syphilis prevalence survey 2007, National Department of Health 2008

antiretroviral therapy (ART), the chances of survival beyond childhood would have been good.

Methods

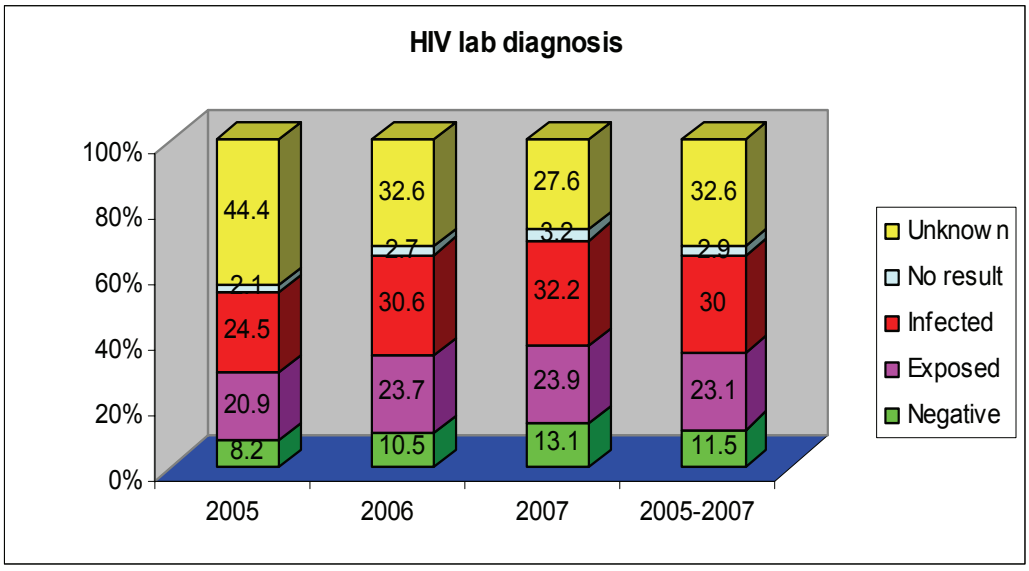
This chapter focuses on the national Child PIP HIV data from 2005 to 2007. Information was collected from 7 847 deaths that occurred in the hospitals and were audited using Child PIP from January 2005 until December 2007. The percentage of deaths among children between one month and one year of age increased from 41% in 2005 to 59% in 2007.

Results

HIV laboratory category

The percentage of children with laboratory-confirmed HIV infection and HIV exposure increased from 2005 to 2007. As a sign of improving quality of care, the percentage of children who died without a known HIV status decreased from 44% to 28%. It is still worrying that in 2007 a third of children died without their HIV status being known.

Figure 1. HIV laboratory diagnosis in Child PIP data from 2005-2007



Survival for children infected with HIV can be improved: on diagnosis a child should be clinically staged to identify those who qualify for antiretroviral treatment (ART) and those who need cotrimoxazole prophylaxis for Pneumocystis jirovecii pneumonia (PCP).

HIV clinical staging

Table 1. Clinical staging as percentage of deaths

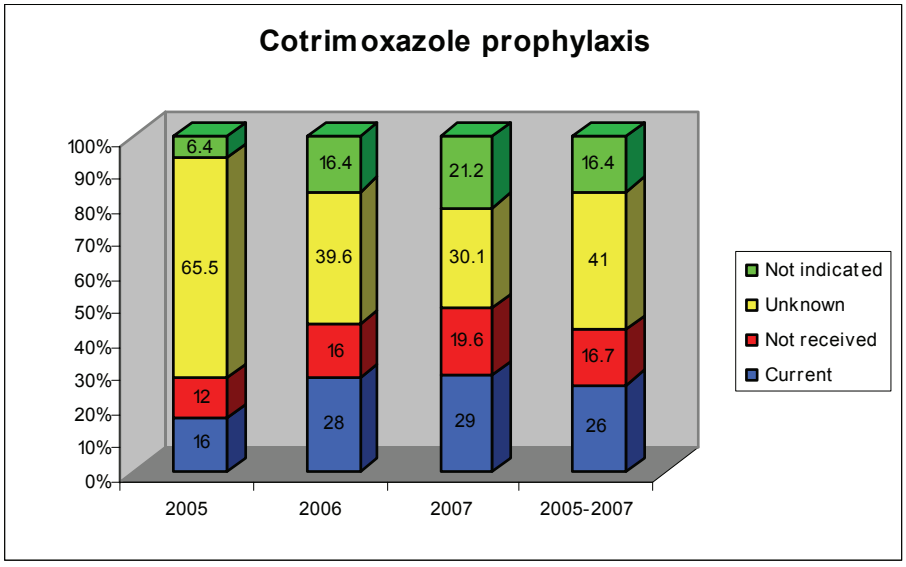
WHO HIV clinical stage	*2005*	*2006*	*2007*	*2005-2007*
Stage I and II	8.3	5.9	4.9	6.0
Stage III and IV	49.3	46.8	45.7	46.6
Unknown	19.9	19.9	17.7	18.9
Staging not indicated	4.4	14.7	19.3	14.5

Forty-five percent of children who died were World Health Organization (WHO) clinical stage III and IV. This implies that they had symptomatic HIV disease and qualified for ART. During 2005-2007, the percentage of those not clinically staged, where it was indicated, remained at about 18%. Just more than 40% of children who died and were eligible to receive ART but did not receive it, although the reasons for this were not always clear. In 2005, 6.5% of children who died were on ART and there were 2.7% deaths in 2007.

PCP prophylaxis

Cotrimoxazole reduces the incidence of PCP and also prevents other bacterial infections. From 2005 to 2007, the number of children who received cotrimoxazole increased from 16% to 29%, those who did not receive it increased from 12% to 20%, and those for whom there was no information decreased from 66% to 30%.

Figure 2. Cotrimoxazole prophylaxis

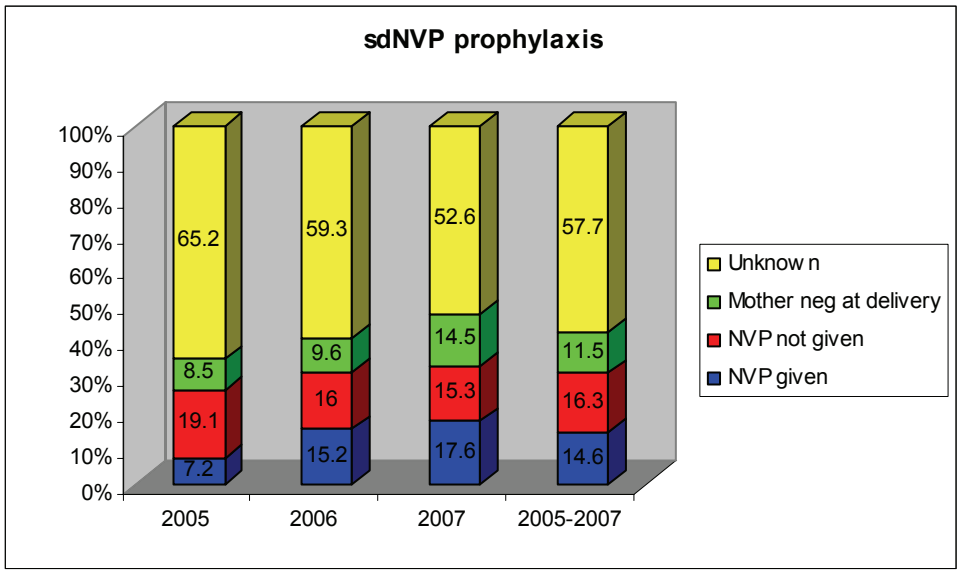


Nevirapine for PMTCT

South Africa started using single dose nevirapine (sdNVP) for prevention of mother-to-child transmission of HIV in 2000. In

February 2008, dual therapy with AZT and 3TC, and sdNVP during labour, was launched. The information on those who received prophylaxis is not easily accessible as it is seldom documented on the Road to Health Chart (RTHC), and as a result, the opportunity to give cotrimoxazole and to diagnose HIV early, is missed. The RTHC is supposed to have the complete health records of a child but because of the concern about confidentiality this information is often not there and healthcare workers depend on mothers to provide information about HIV. In this case, the principle of confidentiality denies proper health care for the child.

Figure 3. PMTCT – single dose nevirapine



HIV-infected children die of the same top causes of death as uninfected children, but there is a greater association with TB and chronic diarrhoea. Children who die of acute diarrhoea and meningitis are likely to die without their HIV status being known.

The proportion of children who died of suspected PCP has not changed over the past three years. Similarly, the proportion of those on cotrimoxazole has not changed much in 2006 and 2007.

Conclusion

In conclusion, 47% of children who die were WHO HIV stage III and IV. Nineteen percent died without being staged clinically and 32% were not tested for HIV. HIV-infected children died of common childhood illnesses with greater association with tuberculosis and

chronic diarrhoea. Provision of nevirapine and cotrimoxazole prophylaxis was significantly deficient.

Recommendations

- More effort must be put into improving PMTCT services through primary prevention of HIV infection of young women, providing ART to pregnant women who need it for their health, and effective ART to prevent mother-to-child transmission among pregnant women who are well. The policy has been developed, but the health system is not efficient. PMTCT should be a routine service at every antenatal care service point and pregnant women must be cared for holistically.

- More children need to access ART. An indicator of how many infants access ART is needed as a marker of functioning ART sites that provide care for children.

- Health-care workers should offer HIV testing to every child admitted to hospital as these children die of the common childhood illnesses. All babies born to HIV-infected mothers should have a PCR done at 6 weeks.

- The RTHC must be used without secrecy as a health record for communication among health-care workers to record the health of the child.

South Africa is one of the countries at risk of not meeting the Millennium Development Goal 4, as the under-five mortality rate is increasing.[2] If HIV is addressed effectively, the number of under-five deaths in the country will be significantly reduced.

[2] The state of the world's children 2008 www.unicef.org/publications

Chapter 7

Malnutrition: Child PIP 2005-2007

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> "I've stood at both the North and South Poles as well as on the world's highest peak. When I look back over my life, though, I have little doubt that the most important projects have been the building and maintaining of schools and medical clinics for my dear friends in the Himalaya."
>
> Sir Edmund Hillary, National Geographic May 2003

(Nepal decreased their under five mortality from 142 to 59/1000 between 1990 and 2006)

Introduction

Malnutrition is a major contributor to childhood mortality in the world. Stunting, wasting and intrauterine growth retardation contribute to 2.2 million deaths and suboptimum breastfeeding to 1.4 million deaths annually at a global level.[1]

In *Saving Children 2005*, 60% of the patients that died were underweight and 33% were severely malnourished.[2] It is therefore very important to analyse the contribution of malnutrition on mortality in the Child PIP database 2005-2007.

[1] Black RE, Allen LH, Bhutta ZA, et al. Maternal and child under nutrition: global and regional exposures and health consequences. The Lancet 2008; 371: 243-260.

[2] Patrick ME, Stephen CR, Saving Children: 2005: 7

Methods

All data entered from January 2005 to December 2007 was analysed using the Child PIP software that is part of the database.

The weights of all under-five children admitted in participating hospitals were entered in the database, using the monthly admission data, as either above or below the third centile or severely malnourished. The total deaths, as well as the in-hospital mortality rates for each category were calculated from the monthly tally sheets.

The nutritional category of the children who died was described using the Wellcome classification and recorded on the individual death data capture sheets. Severe malnutrition was defined as marasmus, kwashiorkor or marasmic-kwashiorkor.

Major causes for mortality were identified and analysed for nutritional status. Clinical staging of HIV was compared with nutritional status.

Nutrition modifiable factors were also identified at caregiver and clinic level.

Results

The database was investigated for trends over the past three years for changes in malnutrition patterns and in-hospital mortality rates. No trends could be detected.

Table 1. Deaths 1 month - 5 years by weight category, Child PIP 2005-2007

Weight category	*1 month - 1 year*	*1 year - 5 years*	*Total*	*%*
Overweight	51	17	68	1.1
Normal	1324	326	1650	26.2
Underweight	1420	468	1888	30.0
Marasmus	924	630	1554	24.7
Kwashiorkor	155	222	377	6.0
Marasmic kwashiorkor	100	181	281	4.4
Unknown	287	197	484	7.6
Total	***4261***	***2041***	***6302***	***100***
% Underweight	33	23		30
% Severely malnourished	28	51		35

Table 2. In-hospital mortality rate (IHMR) by weight, under five years 2005-2007

Weight Category	*Admissions*	*Deaths*	*IHMR (per 100 admissions)*
On or above 3rd centile	42978	1483	3.5
Below 3rd centile	19156	1823	9.5
Severe malnutrition	8830	1443	16.3
Unknown	20401	1068	5.2
Total	***91365***	***5817***	***6.4***

A patient had a nearly three times higher risk of dying if underweight, and four times higher risk if severely malnourished, compared to a patient with normal weight.

The highest risk of mortality associated with malnutrition was in the one to five year age group where one out of every two deaths was severely malnourished. It was not possible to classify patients for stunting or wasting because length or heights were not captured.

Table 3. Major causes for mortality and nutritional status 2005-2007

Main cause of death	*ARIs (incl. PCP)*	*Septicaemia*	*Acute diarrhoea*	*Meningitis bacterial*	*TB (all)*	*Chronic diarrhoea*
Overweight	26	7	8	3	7	3
Normal	724	250	272	143	64	25
Underweight	774	364	309	103	186	65
Severe malnutrition	566	630	358	63	289	156
Unknown	175	70	129	31	42	30
Total	2265	1321	1076	343	588	279
% Normal	32	19	25	42	11	9
% Under-weight	34	28	29	30	32	23
% Severe maln.	25	48	33	18	49	56

Table 4. HIV and nutritional status 2005-2007

Stage / Weight	*Stage I*	*Stage II*	*Stage III*	*Stage IV*	*Un-known*	*Negative*	*Total*	*%*
Overweight	4	1	10	15	28	23	81	1
Normal	94	111	229	313	788	506	2041	26
Underweight	46	108	467	649	748	325	2343	30
Marasmus	3	37	277	1160	343	106	1926	24
Kwashiorkor	2	10	60	141	119	73	405	5
Marasmic kwashiorkor	2	9	44	162	68	34	319	4
Unknown	20	23	90	69	486	78	766	10
Total	171	299	1177	2509	2580	1145	7881	
%	2.2	3.8	14.9	31.8	32.7	14.6		100

Modifiable factors:

Inappropriate nutrition by caregiver was identified in 822 cases (15% of caregiver modifiable factors).

Insufficient assessment for failure to thrive at clinic level was identified in 145 cases (6.4% of clinic modifiable factors).

Delay in referring failure to thrive was identified in 226 cases (9.9% of clinic modifiable factors).

Discussion

It is clear that malnutrition is associated with childhood deaths and addressing it should reduce the numbers dying significantly. Data from the *National Food Consumption Survey* showed that 10% of children between one and nine years in the community were underweight.[3] In this cohort, two out of every three children that died were either underweight or severely malnourished.

One of the solutions suggested to reduce childhood mortality is exclusive breastfeeding for the first six months of life. It is therefore interesting to compare South Africa with other developing countries that achieved significant reductions in their under-five mortality rates. All these countries have exclusive breastfeeding rates of 34% and more compared to South Africa's 11.9% (0-3 months) and 1.5% (4-6 months).[4]

Table 5. Change in mortality and exclusive breastfeeding rates[5]

	1990: Mortality in children < 5yrs/1000	**2006: Mortality in children < 5yrs/1000**	**Change**	**% of children exclusively breastfed < 6 months**
Indonesia	91	34	-63%	40
Egypt	91	35	-62%	38
Nepal	142	59	-58%	68
Bangladesh	149	69	-54%	36
Philippines	62	33	-47%	34
South Africa	60	69	+15%	7

[3] Labadarios D, The National Food Consumption Survey (NFCS) – Children 1-9 years, South Africa, 1999. SA J Clin Nutr 2001 May Vol.14 No. 2

[4] National Department of Health. South African Demographic and Health Survey 2003.

[5] State of the World's Mothers May 2007: Saving the lives of children under 5: 30, www.savethechildren.org

The following strategies are suggested by Bhutta et al. to reduce childhood mortality between birth and 36 months by 25%:[6]

- Promoting breastfeeding.
- Promoting complementary feeding.
- Implementing micronutrient interventions.
- Introducing supportive strategies to improve family and community nutrition.
- Reducing disease burden.
- Managing severe malnutrition according to WHO guidelines.
- Using ready-to-use therapeutic foods to manage severe malnutrition in community settings.

Suggested solutions for South Africa:

- Launch intensive public campaigns through a professional public relations company to convince communities about the benefits of exclusive breastfeeding for the first six months of life and continued breastfeeding up to two years. Maternity leave of six months should be considered to make this possible. Mixed feeding and introduction of solids before six months should be strongly discouraged.

- Remove formula from primary care clinics.

- Establish feeding centres, managed by dieticians or nutritional advisors, which would be exclusive providers of formula, and which would provide ready-to-use therapeutic foods for management of severe malnutrition in the community

- Weigh children under one year monthly and three monthly if between one and three years. This activity does not have to take place in busy primary health-care clinics. Other community settings can be utilized. Failure to thrive or weight loss should be referred for investigation if there is no response to nutritional intervention.

[6] Bhutta ZA, Ahmed T, Black RE, et al, What works? Intervention for maternal and child under nutrition and survival. The Lancet 2008; 371: 417-440

- Provide integrated management of childhood illness (IMCI) training for all primary healthcare workers.
- Ensure that all HIV-infected mothers receive triple antiretroviral therapy during pregnancy and for one year after delivery to ensure safe breastfeeding.

Major political commitment and managerial intervention will be necessary to address malnutrition in children successfully in South Africa.

I want to thank Prof. Dankwart Wittenberg for his constructive criticism of this chapter.

Chapter 8

Child PIP 2005-2007 and Tuberculosis

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Introduction

This chapter presents tuberculosis (TB)-specific data extracted from the national Child Healthcare Problem Identification Programme (Child PIP) mortality audit database from January 2005 to December 2007. Childhood TB, TB prevalence and incidence rates and the emergence of drug resistant strains serve as sentinels for the performance of the National TB Control Programme (NTBCP).

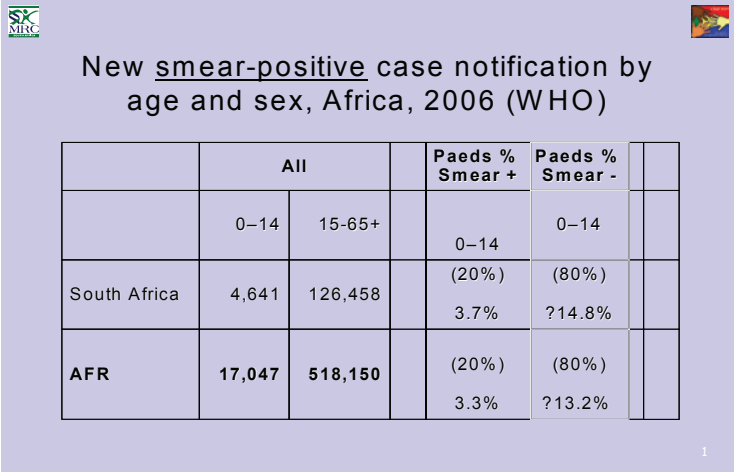
According to the World Health Organisation (WHO) TB report 2008, reporting on data of 2006, the Africa Region[1] (predominantly sub-Saharan Africa) shows the highest TB prevalence rates (>600/100 000 pop) and TB deaths rates (>80/100 000 pop) in the world. More distressing is that these rates are increasing, with major efforts required to attain the Millennium Development Goals.

South Africa ranks second on most indicators for 2006 TB incidence (all forms) at 940/100 000 population and TB prevalence at 998/100 000 population. Among the new smear positive TB cases, children aged 0 to 14 years account for 3.7% of notifications. Smear positive cases account for 20% to 30% of all childhood TB, making the total childhood TB cases approximately 15% of all cases in South Africa

[1] Global tuberculosis control: surveillance, planning, financing: WHO report 2008.

(Figure 1). TB mortality is at 218/100 000 with 45% of new TB cases being HIV co-infected. Drug-resistant TB has emerged in South Africa as a significant contributor to the world's burden, with WHO figures reflecting 95% of the African region burden within this country.[1] This indicates a failure of the national and local TB control programmes.

Figure 1. Adapted by author to include smear negative cases age 0-14 years at 80%



Methods

The national Child PIP database was analysed, using data from January 2005 to December 2007. In Child PIP, the unit of analysis for cause specific rates is the cause of death diagnosis and not each child that dies, (i.e., a single child will have one main cause of death diagnosis and up to four other important diagnoses recorded). Therefore, data referring to individual diagnosis is counting the MAIN cause of death diagnosis alone, while data referring to all diagnoses counts the main as well as the other additional diagnoses.

This report covers data disaggregated to reflect "TB (cause)-specific in-hospital mortality".

Results and Discussion

"What is Child PIP saying about in-hospital childhood TB deaths?"

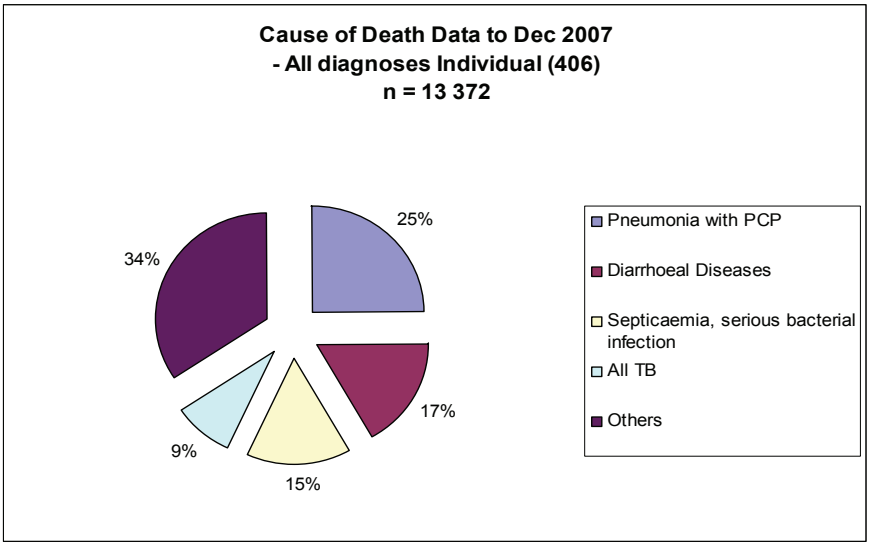
Core data reflects 6 724 deaths from 120 988 admissions, giving an in-hospital mortality rate of 5.6%. A total of 13 989 modifiable factors, at approximately 2 per death, was reported. Annual trends in core data

reflect a progressive decline in all-cause in-hospital mortality rate, starting at 6.5% in 2005, 6.0% in 2006, and 4.9% in 2007.

Characteristics of deaths with respect to TB

Among all-cause mortality data, pulmonary TB was ranked fifth and TB meningitis the eleventh most common cause. This accounts for a total of 1 173 diagnoses of all forms of TB from 13 372 total diagnoses. Thus, TB accounts for 8.8% of all diagnoses recorded. The annual trends for 2005 to 2007 is 8.1%, 9.5% and 8.5% respectively. When TB diagnoses are combined to reflect all types (All TB), it is ranked as the fourth commonest cause of death (COD). (Figure 2)

Figure 2. Cause of Death Data: 2007



Note: This excludes HIV and malnutrition-related causes of death as they are collected as separate categories in Child PIP.)

Child PIP data analysis can utilise only Main COD (as described earlier), which is used for the following data.

TB deaths – about the context

Table 1. The context of TB deaths

Level of care	*%*	*Referral site*	*%*	*Population served*	*%*
Level 1	8.6	Not referred	48.7	Rural, peri-urban, urban	27.8
Level 1,2	8.1	Clinic	26.1	Rural	23.5
Level 1,2,3	6.8	Another hospital	16.2	Rural, peri-urban	20.1
Level 2	5.4	Private sector	8.2	Peri-urban, urban	15.3
Level 2,3	3.8	Unknown	0.9	Peri-urban	9.4
				Urban	3.9

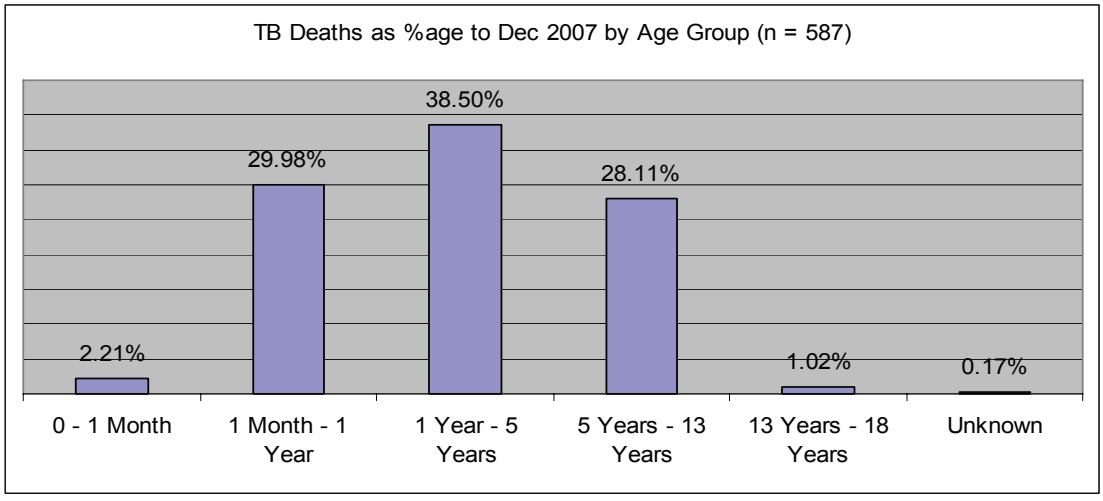
TB deaths occur at all levels of hospitals, with a ranking inverse to the level of care provided at the hospital. The majority of cases were not referred which may reflect poor access to healthcare facilities or late presentation. Rural and peri-urban populations were more affected by TB deaths than urban populations. This seems to follow the socio-economic profile of South Africa, with the poorest, rural populations at highest risk of TB deaths among children. Overcrowding and poor ventilation in rural and peri-urban homes and informal settlement urban dwellers probably contribute to higher risk. Another explanation could be that the diagnosis of TB is interrogated better at higher levels of care and fewer cases are misdiagnosed. In addition, most level two and three facilities are in urban centres.

TB deaths - about the individual

By age

TB of all types affects the most vulnerable age groups most, (i.e., those under five years). The neonatal group may reflect congenital or perinataly acquired TB, with spill over into the infant group. The Perinatal Problem Identification Program (PPIP) should be consulted for further information about this age group. The under-five group represents 70.79% of all TB deaths recorded (Figure 3).

Figure 3. TB deaths by age

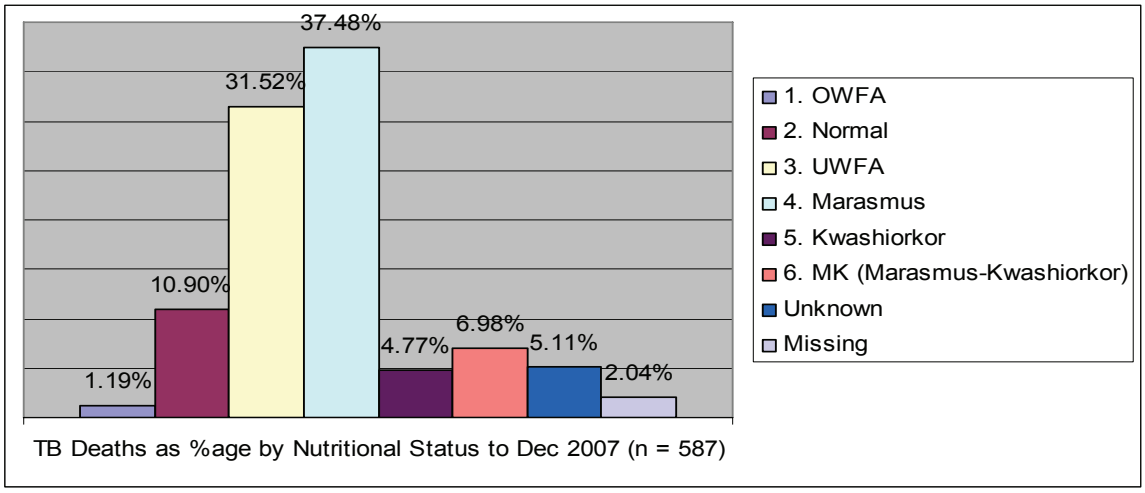


By nutritional status

The association between malnutrition and the risk for TB among children has been well described, and this trend is observed in this Child PIP data. Among those that died in hospital from TB (all-types),

80% were undernourished and 49% were severely malnourished. This is higher than in the all-cause mortality group (Figure 4).

Figure 4. TB deaths by nutritional status



By mothers' well being

In comparison to all-cause mortality by mothers' wellbeing, more mothers were dead (20.1% versus 7.16%) or sick (15.5% versus 9%) in the TB deaths group than compared to all-cause mortality. This may also suggest that their parents were sick or had died of TB. As children with TB are often infected by close loved ones, the unknown percentage of 15.3% is worrisome.

By HIV laboratory category and clinical stage

HIV co-infected children with TB are more likely to die of all forms of the disease. A child with HIV/TB co-infection was (53/10=5.3) five times more likely to die than a child with only TB infection (Figure 5). When compared to all-cause mortality, a child with co-infection (HIV/TB) was 1.75 times more likely to die (Figure 6). Those with more advanced disease based on clinical staging of HIV were also most vulnerable (Figure 7).

Figure 5. TB deaths by HIV laboratory category

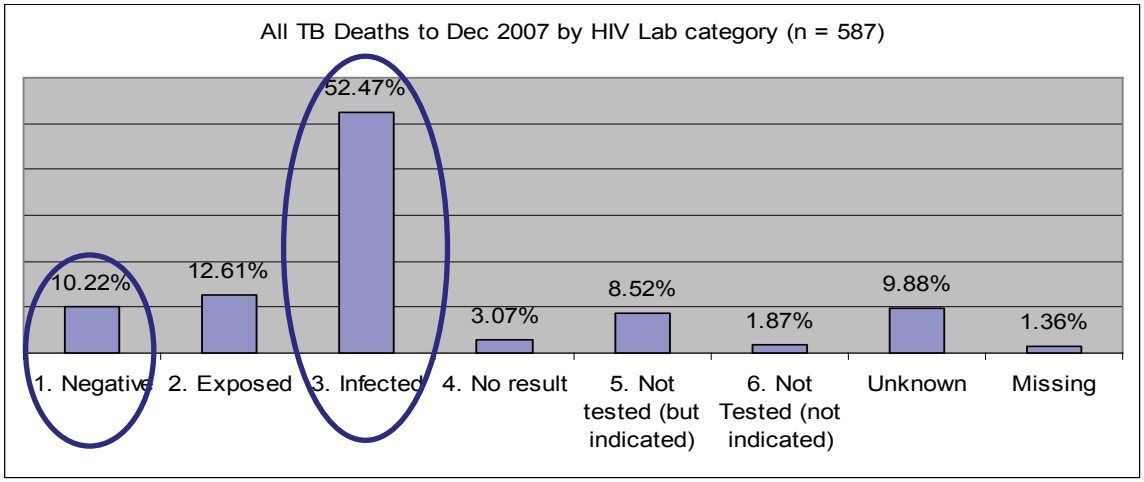


Figure 6. ALL deaths by HIV laboratory category

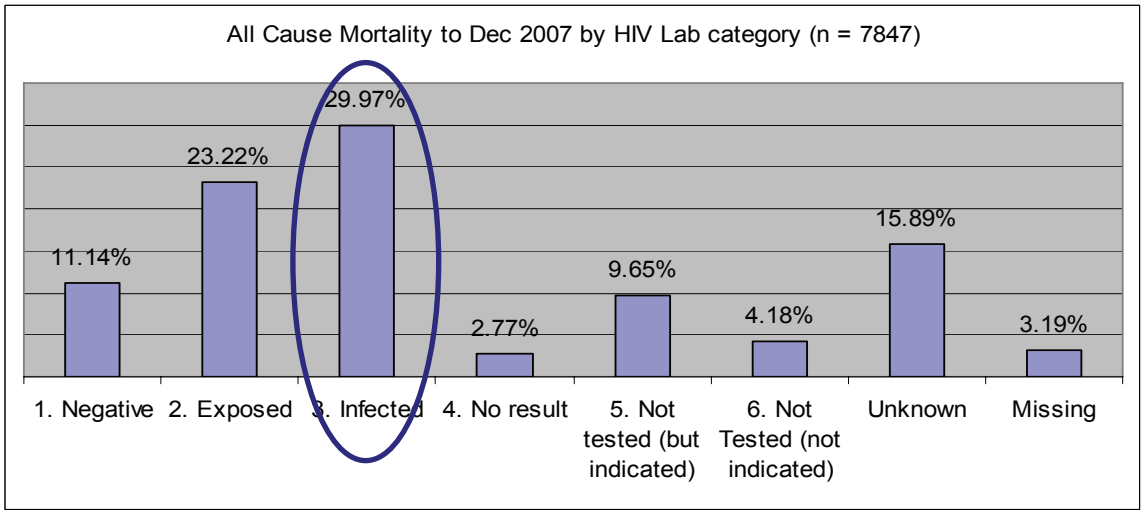
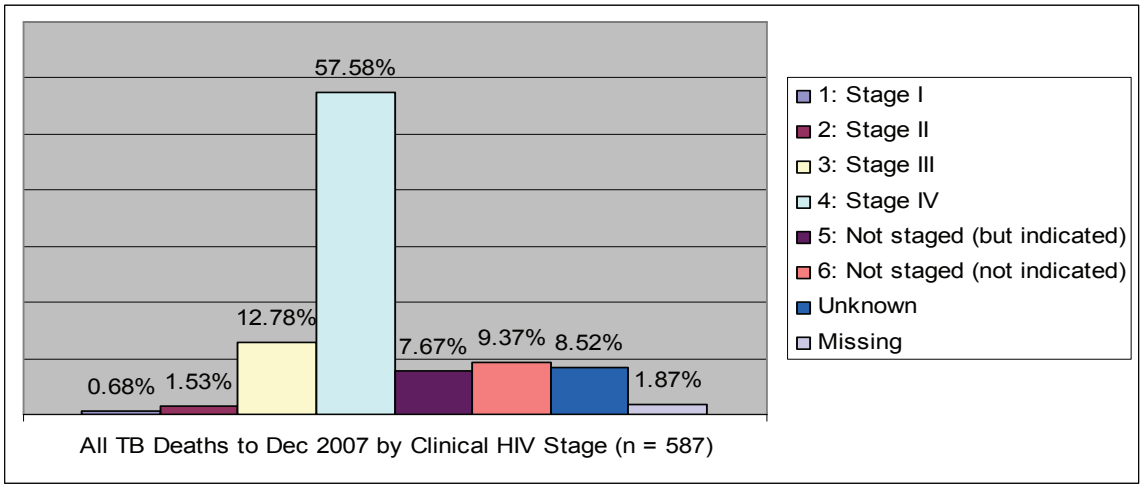


Figure 7. TB deaths by HIV clinical stage



Modifiable factors

The following TB-related modifiable factors (number and percentage) are derived from a total of 16 862 modifiable factors.

TB-related modifiable factors	*Number*	*%*
Declining HIV test	283	1.7
Delay in referring failure to thrive	28	1.3
Appropriate change/addition of antibiotics/TB Rx not prescribed	212	1.3
Insufficient assessment for failure to thrive	145	0.9
No TB contact treatment	88	0.5
LRTI/ARI not responding to treatment, not reassessed	66	0.4
Delay in referring chronic cough	21	0.1

Limitations

- No admission data were available from those that survived (this is an inherent limitation of the Child PIP data) to show in-hospital TB caseload, and thus enable calculation of the TB cause-specific in-hospital mortality rate (IHMR). The TB-specific IHMR can be calculated as a percentage of the all-cause IHMR.

- Data currently in the Child PIP data come from 'enthusiastic' sites, and thus are not representative of all hospitals in South Africa.

- Most of the data represent childhood deaths within regional and tertiary care institutions, and less from district-level hospitals.

Conclusion

Child PIP shows that TB is a key determinant in "all-cause hospital mortality" of children in South Africa. Although not shown in this chapter, clinical experience indicates that there is possibly an increasing TB specific in-hospital mortality in children. Child PIP may be used to describe some aspects of the "circumstances around or natural history" of childhood TB in audited hospitals. There is room for improving data and data analysis, including representivity or validity of data to infer to the entire province or country. At present, this data describes TB deaths in a hospital-based population and the trends and associations of TB deaths with key factors, such as age, nutritional status and HIV status, are in keeping with prior expectations.

Recommendations for the way forward

1) Address the following:

- Implement holistic TB service, integrating with ALL the necessary resources such as nutrition and HIV services.
- Improve coordination among inter- and intra-sectors, including social welfare, home affairs, water sanitation, housing, employment, etc. (inter-sectoral) and (nutrition, HIV, PHC, MCWH, HAST, etc. (intra-sectoral).

2) Direct solutions – "STOP TB" programme (WHO) and NTBCP include:

- Developing a SINGLE, clear national guideline for childhood TB.
- Strengthening appropriate laboratory services.
- Providing fixed drug combinations in appropriate dosages for children.
- Providing accurate performance feedback on TB indicators to all levels.
- Providing accountable monitoring and evaluation.

The author would like to acknowledge all Child PIP users, the KwaZulu-Natal Child PIP Executive Committee (Exco) - Dr Meera Chaggan, Dr Shuaib Kauchali, fellow Child PIP National Technical Task Team and Exco members.

Chapter 9

Diarrhoea and Dehydration at Witbank Hospital: Closing the Audit Loop

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Introduction

Witbank Hospital is a level two and three institution situated in Mpumalanga. It currently serves as the main referral hospital for the province.

Child health-care workers have been involved in the Child Healthcare Problem Identification Programme (Child PIP) since its inception in 2004 and have greatly benefited from the programme in a myriad of ways.

The following is just one example how Child PIP data were used to improve service.

Method

During analysis of the Witbank Child PIP data for 2005, deaths due to acute diarrhoeal disease and dehydration were identified as an area of concern. The process of "closing the audit loop", as described in this chapter, was used to analyse problem areas, to implement changes and to monitor the effect during 2006 and 2007.

Closing the audit loop

Step 1: Identify the problem

Deaths due to acute diarrhoeal disease were identified as a major problem during 2005. There were 461 admissions for acute diarrhoea with 14 deaths, giving an in-hospital mortality rate (IHMR) of 3%.

Step 2: Analyse the problem

Further analysis of the acute diarrhoeal deaths revealed that only 18% had been exclusively breastfed, 55% were severely malnourished and a further 27% were underweight-for-age.

Eighty-two percent of the children dying from acute diarrhoea were HIV-infected or -exposed. More than half (55%) were between one month and one year of age and 45% between one and five years of age.

Of particular concern was the fact that 73% of deaths due to acute diarrhoea occurred within the first 24 hours of admission. In contrast, only 25% of paediatric deaths due to other causes occurred in the first 24 hours at Witbank Hospital. Of further significance was the fact that 82% of acute diarrhoeal deaths occurred during weeknights or weekends as opposed to 67% for all deaths.

A number of modifiable factors were recorded repeatedly in relation to deaths from acute diarrhoea.

In the category "Admission and Emergency" the two most common modifiable factors were:

1) Assessment of shock/dehydration insufficient.
2) Shock not treated appropriately.

In the category "Wards" the most common modifiable factors were:

1) Monitoring of shock insufficient.
2) Too much/too little/incorrect type of intravenous fluids given.

Step 3: Develop a solution

It was clear that the main problems regarding acute diarrhoeal deaths were related to their initial assessment and management in casualty, as well as monitoring during the first 24 hours after admission, especially after-hours, and specific interventions was planned.

Step 4: Test and implement the solution

The following measures were implemented:

- Casualty staff were trained by paediatric staff in how to assess hydration, correct fluid therapy, insertion of intraosseus lines, and when to refer.
- The World Health Organisation (WHO) course, Emergency Triage, Assessment and Treatment (ETAT) was implemented from June 2007.
- Paediatric and intern training focused more on monitoring and recognition of signs of deterioration.
- Every child on intravenous rehydration was seen at least every 4 hours throughout the night, by the doctor on duty (i.e., the protocol was changed).

Step 5: Evaluate and monitor change

Table 1 shows the changes that occurred during 2005-2007, with the in-hospital mortality rate for acute diarrhoea being reduced by one-third from 2005 to 2007.

Table 1. Acute diarrhoea admissions and deaths: 2005-2007

Year	*Admissions*	*Deaths*	*IHMR %*
2005	461	14	3.0
2006	453	6	1.3
2007	540	6	1.1

Conclusion

By using local Child PIP data and endeavouring to close the audit loop, health workers at Witbank Hospital managed to reduce child deaths due to acute gastroenteritis significantly.

PART FOUR
CHILD PIP:
INFORMATION FOR US

Chapter 10

Home and Caregiver-related modifiable factors: Analysis and Implications

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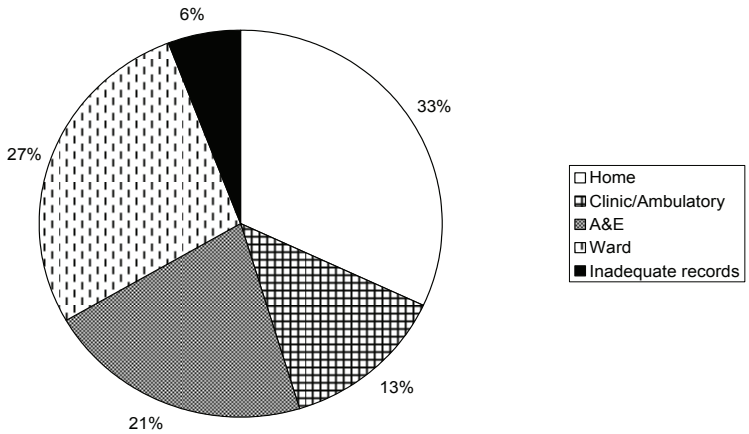
The Child Healthcare Problem Identification Programme (Child PIP) database for the period 2005 to 2007 contains information on 127 714 admissions and 7 150 child deaths. A total of 18 438 modifiable factors for these deaths have been identified, of which 15 285 (82%) were classified as "possible" modifiable factors and 3 153 (17%) were classified as "probable" factors. An average of 2.6 modifiable factors was therefore identified for each death.

Data on the place where modifiable factors occurred are shown below in the Figure 1.

Figure 1. Modifiable factors: place of occurrence



Modifiable factors related to home care provided by caregivers accounted for one third of all modifiable factors. Almost two thirds of modifiable factors therefore occurred within the health system, (i.e., 13% of all modifiable factors were related to care at primary health care facility level, 21% were related to care in casualty (the accident or emergency unit) and 27% occurred in hospital wards).

Caregiver-related modifiable factors

Twelve modifiable factors that relate to care by the family and/or caregiver are included in Child PIP (see Table 1). These are divided into eight categories, namely, timing, recognition, immunisations, nutrition, Road to Health Chart (RTHC), consent/returns, other and insufficient information. Data on insufficient information on the caregiver and family care is not included in this analysis, as it reflects on the failure of the health system to collect relevant information, rather than on the care provided by the family or caregiver.

Table 1. Caregiver-related modifiable factors contained in Child PIP

Category	Modifiable factor
Timing	Delay in seeking care Infrequent clinic attendance
Recognition	Caregiver did not realise severity of illness Home treatment with negative effect on the child e.g. enema Caregiver refusing treatment
Immunisations	Never immunised/behind with immunisations
Nutrition	Inappropriate nutrition
RTHC	RTHC not present/referral letter lost
Consents/Returns	Declining HIV test Did not arrive on day of referral/did not keep appointment
Other	Other modifiable factor concerning caregiver/family (specify)
Insufficient information	Insufficient information/notes on caregiver/family care

The top ten modifiable factors (all categories) are shown in Table 2. Although caregiver-related modifiable factors (shown in italics) account for only a third of all modifiable factors, the top four modifiable factors occur at home or community level. This is largely because there are relatively few caregiver-related modifiable factors, thus the individual factors tend to be broader and less specific than those which relate to events within the formal health system. An average of 0.82 caregiver-related modifiable factors per death were recorded, while the top three modifiable factors, namely delay in seeking care, the caregiver not recognizing the severity of illness and inappropriate nutrition, account for more than 20% of all modifiable factors.

Table 2. All modifiable factors (2005 - 2007 national Child PIP database)

Individual modifiable factors: all	**Number**	**%**
Delay in seeking care	1847	10
Caregiver did not realize severity of illness	983	5.3
Inappropriate nutrition	911	4.9
Inappropriate home care given (e.g., enema)	482	2.6
Insufficient information/notes on caregiver/family care	450	2.4
Lack of professional nurse at hospital	442	2.4
Appropriate antibiotics not prescribed	437	2.4
Insufficient notes	391	2.1
Other modifiable factor concerning caregiver/family (specify)	359	1.9
Physical examination incomplete	358	1.9

The main modifiable factors related to home care and caregivers' actions are shown in the Table 3 below.

Table 3. Caregiver-related modifiable factors (2005-2007 national Child PIP database)

Individual modifiable factors: caregiver-related	**Number**	**%**
Delay in seeking care	1847	31.4
Caregiver did not realise severity of illness	983	16.7
Inappropriate nutrition	911	15.5
Inappropriate home care given (e.g., enema)	482	8.2
Declining HIV test	315	5.3
Infrequent clinic attendance	314	5.3
RTHC not available/referral letter lost	231	3.9
Did not arrive on day of referral/did not keep appointment	207	3.5
Never immunised/behind with immunisations	156	2.6
Caregiver refusing treatment	86	1.5
Other caregiver-related modifiable factors	359	6.1
Total	**5891**	**100**

The caregiver-related modifiable factors can be divided into five main categories as shown in Table 4 on the following page.

Table 4. Caregiver related modifiable factors by category (2005-2007 national ChIP database)

Care-seeking Behaviour	**%**
Delay in seeking care	31.4
Caregiver did not realize severity of illness	16.7
Total	**48.1**
Nutrition and Growth	
Inappropriate nutrition	15.5
Total	**15.5**
Failure to utilize PHC services appropriately	
Infrequent clinic attendance	5.3
RTHC not available/referral letter lost	3.9
Never immunised/behind with immunisations	2.6
Total	**11.8**
Failure to give consent or comply with treatment	
Did not arrive on day of referraldid not keep appointment	3.5
Declining HIV test	5.3
Caregiver refusing treatment	1.5
Total	**10.3**
Treatment of ill children at home	
Inappropriate home care given (e.g., enema)	8.2
Total	**8.2**
Other	6.1
Total	**100**

Caregiver-related modifiable factors as a percentage of all modifiable factors have shown a sustained increase from 22.9% in 2005, to 29.1% in 2006, to 32.1% in 2007.

It is currently not possible to analyse the modifiable factors for deaths due to specific conditions or to look at modifiable factors in sub-groups of children (e.g., children below one year of age). More detailed analysis of modifiable factors will be facilitated by inclusion of this feature in future versions of the Child PIP software.

Discussion

The value of identifying modifiable factors related to childhood deaths lies in their ability to point to areas that need to be addressed. Identifying modifiable factors is not a process of apportioning blame, and it is important that identification and analysis of caregiver-related modifiable factors is not undertaken or interpreted in this light. The Child PIP process is also not specifically designed to provide detailed data on community factors associated with child deaths, and data

therefore need to be interpreted with care. For example, it is difficult to know whether the increase in the percentage of caregiver-related modifiable factors as a percentage of all modifiable factors reflects an increase in awareness among Child PIP users of the role played by caregiver and community factors in child deaths, an increased tendency to blame caregivers or actual changes in the behaviours and practices of caregivers.

However, while caution should be observed, analysis of caregiver-related modifiable factors can provide valuable insights into issues that affect child health and mortality at household and community levels. The process can also play an important role in assessing and informing the appropriateness and effectiveness of current maternal, newborn and child community-based interventions.

The caregiver-related modifiable factors can be broadly divided into five main categories, namely, factors related to care-seeking behaviours, factors related to inadequate or inappropriate nutrition, factors relating to failure to give consent or comply with recommended treatment, factors related to home care of children during illness and factors related to routine utilization of preventive health services.

The Integrated Management of Childhood Illness (IMCI) strategy has been identified as the key strategy for reducing child mortality in South Africa. The strategy has three components - the first two focus on improving the care which children receive at primary health-care facilities through improving both the case management of ill children and strengthening the ability of the health system to support high quality care for children. The third or Household and Community Component (HHCC) aims to empower households and communities to practice behaviours that promote the growth and development of children. The HHCC of IMCI is based on 16 key family practices, which are shown in Figure 2. They focus on four main areas, namely, promotion of growth and development, preventing disease, promoting appropriate home care of children during illness, and care-seeking and compliance with treatment during illness. Although a number of successful HHCC IMCI projects have been implemented in South Africa, sustainable models for implementing the component on a large scale have been lacking. As a result, although many districts are

implementing HHCC IMCI projects, coverage at household level remains low.

Figure 2. Household and Community Component of IMCI: 16 Key Messages

HOUSEHOLD AND COMMUNITY COMPONENT OF IMCI
16 KEY MESSAGES

PROMOTION OF GROWTH AND DEVELOPMENT

These are behaviours that help the child grow and develop physically and mentally.

1. Breastfeed infants for six months (It should be acceptable, feasible, affordable, sustainable and safe (AFASS))
2. Introduce energy-dense complementary feeds at six months
3. Ensure adequate intake of micronutrients
4. Promote social and mental development through interaction and play

DISEASE PREVENTION

Practices in the household before the onset of a disease that provide protection against disease

5. Immunize all children
6. Ensure safe disposal of faeces and hand washing with soap
7. Prevent malaria through house-spraying or use of insecticide-impregnated bed nets in malaria areas
8. Prevent HIV infection and provide care for HIV affected children and orphans

APPROPRIATE HOME CARE OF CHILDREN

Practices that take place in the home to help a child once it is realised that the child is sick

9. Continue to feed an ill child and offer more fluids
10. Give sick children appropriate home treatments
11. Prevent and manage accidents and injuries
12. Prevent child abuse and neglect, and take appropriate action where it occurs
13. Ensure that men participate actively in child care

CARE AND COMPLIANCE WITH TREATMENT OUTSIDE OF THE HOME

Practices that involve going outside home to seek health care

14. Caregivers should know when the sick child needs treatment outside the home, and seek appropriate care
15. Follow the health workers' advice regarding treatment, follow-up and referral
16. Provide adequate antenatal care for mothers

It is encouraging to note that there is excellent congruency between the most common modifiable factors and the HHCC IMCI messages. This suggests that the HHCC content or messages are appropriate, but that there is much work to be done in terms of scaling up the intervention and reaching a higher proportion of households.

The data highlight the important role of care-seeking behaviour. Problems related to care-seeking account for almost half of the caregiver-related modifiable factors. Although inappropriate care-seeking has been implicated as an important contributor to child deaths in most settings,[1] issues related to care-seeking (and barriers to effective care-seeking) during childhood illness have received relatively little attention, both internationally and in South Africa. The World Health Organisation suggests that additional research to improve our understanding of caregivers' specific patterns of accessing care will promote our ability to develop appropriate programmatic responses to preventing child morbidity and mortality, particularly at local levels.[2]

Care-seeking involves a number of important steps. Recognition that the child needs care outside of the home is a necessary first step. Whether recognition of the need results in care-seeking is influenced by many factors, many of which are poorly understood.

One approach to classifying these is to look at structural factors (including household financial resources, women's autonomy in decision-making, and caregivers' personal health), health system factors (especially access to and perceived quality of the services), and caregivers' explanatory models, including their assessment of the severity of the child's illness and cultural beliefs regarding the causality and required treatment for illness in general and specific illnesses contribute to the process of care-seeking.[3]

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[1] Hill Z, Kirkwood B and Edmond K (2004) Family and community practices that promote child survival, growth and development: a review of evidence. WHO, Geneva.

[2] WHO 2002

[3] Sharkey AB (2008) The health and social context of infant death: reflections from South Africa. Unpublished thesis. Johns Hopkins University.

Summary and recommendations

Caregiver-related factors play an important role in many childhood deaths. Child PIP can assist in identifying these factors, although care needs to be taken that this is not seen as an exercise in apportioning blame.

Many of the common modifiable factors are addressed through the HHCC of IMCI. This suggests that the content of the HHCC IMCI messages is appropriate, although more effort and resources need to be given to implementation of the strategy as part of strengthening of community-based maternal, newborn and child health and nutrition services.

Issues related to care-seeking behaviour accounted for the largest proportion of caregiver-related modifiable factors. Care-seeking behaviour is known to be influenced by a range of structural, health system and individual caregiver factors. There is a need to better understand these behaviours. While Child PIP data can provide some data, studies that specifically focus on understanding care-seeking and barriers to effective care-seeking also need to be undertaken. Efforts to improve care-seeking behaviours are likely to include interventions that aim to improve caregivers' recognition of illness and danger signs in children, and interventions to address the many structural and health system barriers that impede timely access to good quality health services.

It is recommended that Child PIP adapt the way in which caregiver-related modifiable factors are classified, and that the classification shown in Table 4 is adopted. This classification is more logical, and because it is more compatible with the IMCI HHCC 16 key family practices, it makes the linkages between the modifiable factors and key interventions that aim to address them more explicit.

Finally, it is recommended that further analysis that looks at modifiable factors in sub-groups of child deaths is conducted, (e.g., all deaths from a specific cause), of all deaths in children less than one year of age. This will provide valuable insight into the role of specific interventions in reducing deaths from particular conditions, and help in adapting and targeting community messages.

Chapter 11

Modifiable Factors at PHC and Ambulatory Care: What can be learned from Child PIP 2007?

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This chapter reports on modifiable factors at primary health-care clinics that may have contributed to in-hospital infant and child deaths as reported in national Child Healthcare Problem Identification Programme (Child PIP) database in 2007. The process and methods of collecting data for the Child PIP programme have been discussed in Chapter 1.

The total number of deaths reported for all the facilities in this period was 2 871. These deaths were from 53 384 admissions during the same time period. This amounts to a crude in-hospital mortality rate of 5.4 per 100 for all the admissions in these facilities.

The facilities reported these deaths voluntarily and analysed the cause of death in each case and attempted to describe any modifiable factors that may have influenced the outcome of this death.

It is of note that 60.7% of the 2 871 deaths occurred in children under the age of one year and 5.7% of deaths in neonates. Although the neonatal mortality data in Child PIP is not complete, these figures emphasise that the infants in this country are certainly at risk.

Only 28.5% of the 2 515 children less than five years were of normal weight at the time of death and the rest were all underweight-for-age.

Regarding parental wellbeing, the trend was becoming clearer. Maternal wellbeing was documented better than that of the fathers. Comparing what the data showed with respect to parental wellbeing during the three years of reporting from 2005 to 2007, the number of mothers for whom information was recorded has increased and the number of mothers known to be well has increased. However, the number of mothers that were documented to be dead at the time of the child's death has also increased over this period and for 2007 stood at 8.4%.

Table 1: Parental wellbeing documented at the time of the child's death

Deaths recorded	Alive	Sick	Dead	Unknown
Mothers	64%	9%	8.4%	20%
Fathers	29%	2%	5%	64%

The knowledge about the fathers' wellbeing was less well documented. In 64% of child deaths no information about the father was recorded, approximately 30% were known to be alive and well, and 5% were documented to have been dead, at the time of the child's death. This is important to note, because a great proportion of modifiable factors are related to the care of the child at home, and may well be a function of the trend that more and more children do not have adequate parental supervision and care. Not having a healthy mother places children at greater risk of presenting at a late stage to the health facility when death is no longer preventable.

Modifiable factors were recorded with respect to each death. The group assessing the death determine and categorise these factors. Child PIP categorises them according to where the modifiable factor occurred. There could be many modifiable factors documented for a single death. This chapter is concerned with those modifiable factors occurring at the time of care in the clinics and during referral to the hospitals. It must be noted that these factors were determined retrospectively and only accounted for those children who died. Therefore this does not necessary reflect a full picture of where the modifiable factors in general might occur.

Table 2. Modifiable Factors noted in the Child PIP data for 2007

Deaths recorded	2 871
Modifiable factors recorded	16 065
Modifiable factors concerning the clinic/ambulatory management only	2 216

The group assessing the deaths was also requested to give an opinion as to whether the modifiable factor identified was a "possible: contributing factor to the death, or a "probable" factor. A probable factor is regarded as one that, if corrected, may have prevented the death from occurring. Of those modifiable factors concerning ambulatory care, 85% were thought to be "possible" and only 15% were classified as "probable" modifiable factors.

When determining a modifiable factor after a death, there can be much variability between assessors with respect to the acceptance of a modifiable factor. There may also be an element of blaming health workers from a different institution for the frustrations experienced. The lack of standardisation of the modifiable factors by the different groups needs to be considered in the interpretation of the modifiable factors.

During 2007, the modifiable factors occurring at the clinic and ambulatory level of care were listed as shown in Table 3, ranked in order of occurrence.

Table 3. Modifiable factors for the clinic and ambulatory care

Modifiable factor	**%**
Insufficient management	29.2
Inappropriate care by GP	23.5
Assessment insufficient	22
Insufficient monitoring	4.2
Lack of transport	4.2
Access/barriers	3.8
Drugs and IV equipment	2.9
Communication	2.8
Equipment; Laboratory; Personnel; Policy	Less than 1% each

The percentage reflects the percentage of all the modifiable factors noted for this category.

It is clear that more than half of the modifiable factors were due to insufficient management of the condition of the child, whether the child was referred from the public or the private sector.

Insufficient assessment also played a major role when assessing modifiable factors.

In addition, further down the referral line, insufficient monitoring and transport also played important roles as preventable factors.

It is of interest to note that the much mentioned current frustration of health workers of disposable items being out of stock did not feature much when it came to modifiable factor concerning the deaths of these children.

Issues that call for correction resulting from recognition of modifiable factors at clinic/ambulatory level are the following:

- IMCI policy not followed.
- "Failure to thrive" not recognized.
- Insufficient case assessment.
- Insufficient case management.

This means that "preventive" thinking and action is needed at clinic level. These factors need to be corrected through making health-care workers aware and providing training on these issues at appropriate continuing development forums.

When looking at the clinic-related modifiable factors for the previous periods, (i.e., for 2005, 2006 and 2007) the ranking of these is very similar with respect to the top six modifiable factors.

Additions from previous periods include:

- Lack of high-care beds/resuscitation area.
- No appropriate 'stat' antibiotics/antibiotics for acute infection.
- No TB contact treatment.
- Insufficient investigations done.

It is clear that the implementation of the IMCI policies must be emphasised, and "failure to thrive" needs to be recognised earlier Proper assessment and management of the correct findings during examination of the children at the clinics and in ambulatory care needs to be enforced, which could be achieved by insisting on complete documentation with referral.

When analysing the "gut feelings" of the assessors of the deaths as to whether they would regard this child's death as avoidable or not, it can be seen in Table 4 that answers were almost equally divided into a third each - positive, negative and doubtful. This measurement is, however, a very subjective one and not well standardised within Child PIP.

Table 4. Overall assessment as to whether the death was avoidable

"If the process of caring had been different, would this death have been avoidable?"	
Not sure	30%
No	29%
Yes	29%
Unknown	6%
Total	**100% (n=3124)**

Summary

Implementation of the IMCI policies during assessment and management of sick children remains an important cornerstone in the ambulatory and primary care of children in South Africa.

Chapter 12

Admission and Emergency Modifiable Factors: What do they tell us?

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Introduction

The Child Healthcare Problem Identification Programme (Child PIP) compels its users to identify substandard care and missed opportunities for intervention, if present, during each death audit. These are called modifiable factors, and can be used by each Child PIP site, by means of locally achievable interventions, to improve the quality of service to children in hospital.

It stands to reason that each site, due to differences in resources and circumstances, will have its own unique set of modifiable factors on which to concentrate.

It is, however, also true that many of the modifiable factors identified by Child PIP users, appear regularly across most of the sites, regardless of level of care or other differences.

Methods

There are four sub-headings under which modifiable factors can be identified in Child PIP.

This chapter will look at modifiable factors occurring during "Admission and Emergency". It therefore focuses on the assessment,

management and monitoring during the initial presentation of a sick child, most often in a casualty or emergency department setting.

Data encompassing the period, 2005- 2007 were retrieved and analysed from the national Child PIP database. An attempt was also made to determine whether there were any differences among the levels of hospital.

Results

Basic data

- Total admissions 109 178
- Total deaths 6 502
- Modifiable factors 13 394
- Admission and Emergency 2 900 (21.1%)

Top five causes of death

1. Pneumonia/ARI 18.2%
2. Septicaemia 17.2%
3. Acute diarrhoea 13.8%
4. PCP 9.4%
5. Meningitis (bacterial) 4.4%

Percentage of deaths occurring in first 24 hours

- All Child PIP sites 33.2%
- Level 1 sites 35.0%
- Level 2 sites 31.4%
- Level 3 sites 33.1%

Percentage of deaths occurring after hours

- All Child PIP sites 62.2%
- Level 1 sites 63.8%
- Level 2 sites 64.0%
- Level 3 sites 59.0%

Top ten modifiable factors in admission and emergency

1. Appropriate antibiotics not prescribed	12.3%
2. History taking incomplete	8.7%
3. Appropriate investigations not done	8.6%
4. Assessment of shock/dehydration insufficient	5.2%
5. Other insufficient case management	4.7%
6. Shock not treated appropriately	4.3%
7. Lack of infant/paediatric ICU facilities	3.8%
8. Lack of hospital beds/overcrowded	3.8%
9. Lack of senior doctors (post-community service)	3.7%
10. Insufficient monitoring of O_2 saturation	3.4%

Discussion

Modifiable factors in admission and emergency account for 21% of all identified modifiable factors. The top 10 factors accounted for more than 60% of the total, while the remaining 36 factors accounted for less than 40%.

The factors relating to case management and case assessment dominated, while administrative factors were much further down the list. There was no significant difference between the different levels of hospitals regarding admission and emergency modifiable factors.

Considering the top five causes of death mentioned above, it becomes clear that the common modifiable factors play a big role in the unsuccessful outcome for those patients.

The most common factor identified, "Appropriate antibiotics not prescribed", is likely to contribute to the high number of deaths due to pneumonia, septicaemia and bacterial meningitis. "Insufficient assessment", as well as "Inappropriate treatment of shock/severe dehydration", which were commonly identified, very likely contributed to the deaths due to acute diarrhoea and septicaemia.

It is also clear that many sites are challenged due to a lack of senior doctors or doctors experienced enough in paediatrics to give guidance to their junior colleagues.

Suggested solutions

Each site must find their own solutions to their most pressing problems. It is clear, however, that many of the problems are widespread and some generic solutions might be helpful.

The focus should be on improving case assessment and management. All medical personnel working in a casualty setting should be properly trained in management of paediatric emergencies.

Using the WHO Emergency Triage, Assessment and Treatment (ETAT) training programme would assist greatly in addressing these problems. If such complete training is not possible, a senior doctor at the site should train casualty staff in at least the following:

- Recognition and initial fluid management of shock (hypovolaemic and septic), and
- Antibiotic treatment for bacterial infection (i.e., sepsis, ARI and meningitis), specifically,
    - What to give,
    - How much, and
    - The importance of giving treatment immediately in casualty

Case management protocols must be available and clearly visible in casualty at least for the big five diseases.

Junior doctors should have easy telephonic access to senior doctors for advice and referral hospitals can play a big role in this regard.

Lastly, of all the categories of modifiable factors, those in admission and emergency are probably the easiest in which to effect change and the most likely to yield quick improvements in child care. We therefore owe it to our children to do our utmost to improve our practices.

Chapter 13

Ward Modifiable Factors: Child PIP 2005-2007

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The growth of Child Healthcare Problem Identification Programme (Child PIP) has been most remarkable during the last three years and the database has swelled with data as all nine provinces from South Africa are represented. The next important step is to extract useful information from the database and make recommendations, which, if followed, will improve the quality of health care that children receive in the South African health system.

Aim

The purpose of this chapter is to look at the national Child PIP database with specific emphasis on "Ward Modifiable Factors", to analyse these and to determine where, within the ward setting, the health-care system is failing our children. Lastly, solutions to the identified problems will be suggested.

Method

Data from the national Child PIP database were analysed using the Child PIP software, from January 2005 to December 2007. Patients that arrived at the institution "Dead on Arrival" were excluded from the analysis.

Results

Nineteen hospitals contributed to the Child PIP database in 2005. This had increased to 49 hospitals in 2007. All nine provinces were

represented in the period, 2005 to 2007. The baseline Child PIP data from 2005-2007 is shown in Table 1.

Table 1. Child PIP baseline data: 2005-2007

	2005	2006	2007	2005-2007
Total admissions	23687	38104	59197	120988
Total deaths	1528	2276	2920	6724
In-hospital mortality rate (no. of deaths/ 100 admissions)	6.5	6.0	4.9	5.6
Total modifiable factors	3566	4676	5747	13989
Modifiable factors rate (no. MFs /100 deaths)	233.4	205.4	196.8	208.0

Quality of data

The quality of the data is satisfactory. An encouraging sign is that the quality of record keeping has improved from 2005 to 2007. In 2005, only 41.9% of folders were "present and OK" while this had improved to 61.2% in 2007. This may be due to improved record keeping as a result of regular auditing encouraged by Child PIP.

Table 2. Quality of records: Child PIP data 2005-2007

Quality Of Records	2005 (%)	2006 (%)	2007 (%)	2005-07 (%)
Folder present, records and notes OK	41.9	51.7	61.2	53.7
Folder present, records incomplete (e.g., no RTHC)	29.6	21	22.2	23.4
Folder present, records incomplete AND notes inadequate	4.1	11.3	5.1	7.1
Folder present, notes inadequate	4.9	8.1	4.2	5.7
Folder not available	7.7	5.1	3.6	5
Missing	10.1	1.4	0.9	3.1
Unknown	1.7	1.3	2.7	2
Total	**100**	**100**	**100**	**100**

Ward modifiable factors

Frequency

Circumstances within the hospital ward account for a significant proportion of all modifiable factors as shown by the data below.

Table 3. Modifiable factors: Child PIP data 2005-2007

Modifiable factor: Place	2005	2005	2006	2006	2007	2007	2005-07	2005-07
	No.	%	No.	%	No.	%	No.	%
Home	894	22.4	1845	33.2	2472	35.5	5211	31.6
Ward	**1017**	**25.5**	**1561**	**28.1**	**1968**	**28.3**	**4546**	**27.5**
A&E	1065	26.7	1212	21.8	1246	17.9	3523	21.3
Clinic/Ambulatory	563	14.1	693	12.5	950	13.6	2206	13.4
Records	450	11.3	248	4.5	324	4.7	1022	6.2
Missing	4	0.1	0	0	0	0	4	0
Total	3993	100	5559	100	6960	100	16512	100

Ward modifiable factors accounted for 27.5% of all modifiable factors for the period 2005-2007. This is second largest contributor to modifiable factors. The most prevalent was "Home" modifiable factors which accounted for 31.6% of all modifiable factors.

Top 20 ward modifiable factors

The top 20 ward modifiable factors are shown in Table 4.

Table 4. Top 20 modifiable factors: Child PIP data 2005-2007

Year	**2005**	**2006**	**2007**	**2005-07**	**2005-07**
Description of modifiable factor	**%**	**%**	**%**	**%**	**No.**
Lack of professional nurse at hospital	11.7	5.6	11	9.3	424
Lack of senior doctors (post-community service)	0.8	8.2	4.7	5	228
Appropriate change/addition of antibiotics/TB Rx not prescribed	6	5.3	3.5	4.6	211
Blood glucose	8.6	2.7	3.7	4.4	202
Insufficient case assessment/management at previous admission/OPD visit	4	3.9	4.9	4.4	199
Too much/too little/incorrect type of IV fluids prescribed/given	6.3	4.4	3.3	4.4	198
Lack of hospital beds/ward overcrowded	1.2	6.8	3.8	4.2	193
Appropriate investigations not done	4.4	4.5	3.9	4.2	193
Lack of high care beds/resuscitation area	0.6	3.2	5.6	3.7	166
Respiratory rate/oxygen saturation	3	4.9	3	3.7	166
Lack of infant/paediatric ICU facilities	1.8	2.9	4	3.1	142
Shock	0.9	3.7	2.9	2.7	124
Results of investigations not traced/not noted (including x-rays)	2.7	2.4	2.6	2.5	115
Physical examination incomplete	2.4	2.6	2.3	2.4	110
Other modifiable factor	1.8	1.7	3	2.3	103
Electrolytes	2.3	3	1.6	2.2	102
IV fluids not monitored/not recorded appropriately	2.2	2.5	1.7	2.1	94
Doctor not called for critically ill child	2.2	2.1	1.7	1.9	88
Other appropriate treatment not prescribed	2.2	1.9	1.8	1.9	86
Other insufficient monitoring	2.7	1.1	2	1.8	83

The ten most prevalent ward modifiable factors will be discussed in detail.

1) Lack of professional nurses

The most prevalent ward modifiable identified from 2005-2007 was "Lack of a professional nurse". This accounted for 9.3% of all ward modifiable factors. Lack of nursing staff is a major obstacle facing health care in South Africa. This is also a global phenomenon with developing and third world countries particularly affected. Solving

this problem will need a multi-faceted approach. Interventions should include:

- Staff training: Nursing colleges need to be strengthened so that more nurses can be trained.

- Staff retention: The exodus of skilled, trained nurses from the public sector to the private sector and foreign countries needs to be addressed. Working conditions such as remuneration, working hours, work environment and inadequate career pathing need to be improved.

- Staff recruitment: Skilled nurses that have left the public sector need to be actively recruited back into the South African health-care system.

These interventions will need cooperation from national, provincial and local government departments, as well as nursing colleges.

2) Lack of senior doctors

Shortage of skilled doctors is also a major contributing factor toward childhood mortality in South Africa. Of all ward modifiable factors, 5% were due to a lack of a skilled post-community service doctors. One of the major challenges facing not only South Africa, but also the rest of the African continent is a severe lack of skills. There are a number of factors implicated:

- Too few doctors being trained.
- Loss of skilled doctors to first world countries.
- Loss of skilled doctors to the private sector.
- Chronic shortage of skilled doctors in rural areas.

Solving this problem requires cooperation from many organisations and government institutions. Universities need to be strengthened so that more medical personnel can be trained. Once trained, the next challenge is retention of staff and the ability of rural hospitals to attract skilled staff. Possible solutions include:

- Enhancing training: Universities and nursing colleges need to increase their number of graduates, either by increasing the number of institutions or class sizes.

- Retaining staff: Retaining adequately trained staff is a global problem. Working conditions need to be improved in a number of areas namely, better remuneration; fewer working hours; decisive career pathing; job satisfaction; and rural allowances.

3) Appropriate change/addition of antibiotics/TB treatment not prescribed

Inappropriate antibiotic or anti-TB therapy accounted for 4.6% of all ward modifiable factors. This could be attributed to a number of factors such as:

- Shortage of senior doctors.
- Inadequate training.
- Lack of adherence to treatment guidelines.

Possible solutions include:

- Recruit appropriate senior staff to train and to supervise junior doctors.
- Enforce adherence to existing guidelines such as Hospital level Essential Drug List and national TB guidelines.
- Train doctors to implement these guidelines

4) Insufficient case assessment/management at previous admission or out-patient visit

This accounted for 4.4% of ward modifiable factors. Again, this can be attributed to a lack of adequately trained staff in hospitals. The solution requires more trained medical staff. Current treatment guidelines need to be available and followed appropriately.

5) Blood glucose

Inappropriate monitoring of blood glucose in the wards was responsible for 4.4% of ward modifiable factors. This is an alarming statistic as glucose monitoring is non-invasive, inexpensive and requires fairly basic training. The management of an abnormal glucose result is

also fairly simple in most cases if treatment protocols are followed. The following factors need to be addressed to solve this problem.

- Equipment: Glucometers and test strips need to be readily available in the wards.
- Staff: Sufficient nursing staff are required to monitor blood glucose.
- Training: Doctors and nurses must be adequately trained to interpret blood glucose results and to adequately manage abnormalities.
- Guidelines: These should be readily available in the wards for easy reference, and adherence to these should be enforced.

6) Too much/too little/incorrect type of IV fluids prescribed/given

This accounted of 4.4% of ward modifiable factors. Much of this problem stems from inadequate training and a lack of senior doctors. Again, as with the modifiable factors discussed previously, the solution would require action in the areas of staffing, training, clinical guidelines and equipment.

7) Lack of hospital beds/ward overcrowded

This modifiable factor was responsible for 4.2% of all ward modifiable factors. The inability of hospital facilities to adequately cope with the needs of the population is a cause for concern. There are a number of suggested solutions:

- Funding: More funding from national and provincial government will increase capacity. New hospitals need to built and capacity increased at existing institutions.
- Increased efficiency of institutions: Staff at hospitals must efficiently investigate and treat patients so that the length of the hospital stay can be shortened. An efficient down-referral system will also help to alleviate overcrowding.
- Primary health care: An adequate primary health-care system is needed so that ambulant patients are managed at home and

not by hospitals. Patients can also be managed early at clinics before they develop severe complications which require admission.

8) Appropriate investigations not done

This modifiable factor accounted for 4.2% of all ward modifiable factors. Appropriate investigations include laboratory tests as well as diagnostic tests ranging from x-rays to magnetic resonance imaging scans. In order for patients to be investigated appropriately, staff must be adequately trained to recognize which investigations need to be performed on their patients. Doctors also require the adequate resources to investigate their patients. This includes time, consumables, laboratory facilities, equipment and adequately trained staff to perform a diagnostic procedure.

Possible solutions include having sufficient and adequately trained doctors; establishing guidelines regarding investigations of patients; ensuring adequate funding and availability of infrastructure; and designing efficient referral systems if the appropriate investigations cannot be done at an institution.

9) Lack of high care beds/resuscitation area

The lack of high care beds or lack of a resuscitation area was responsible for 3.7% of ward modifiable factors. A designated and well-equipped resuscitation area to cater for paediatric patients is vital at every institution looking after children. A lack of high care beds for critically ill patients is a challenge occurring in many South African institutions.

Possible solutions include:

- Adequately trained and sufficient numbers of staff to operate a high care area,
- Adequate resuscitation and monitoring equipment for a high care area,
- Designated areas for resuscitation and high care areas,
- Adequate funding for equipment and staff,

- Guidelines for staffing and equipment norms for high care and resuscitation areas, and
- Legislation making it mandatory that all institutions looking after children have adequate resuscitation facilities.

10) Respiratory rate/O_2 saturation

Inadequate monitoring of respiratory rate or oxygen saturation was responsible for 3.7% of all ward modifiable factors. While it may seem that monitoring these parameters is easy and non-invasive, adequate numbers of trained staff and appropriate equipment in the form of saturation monitors are needed.

Again, solutions include ensuring adequate staffing; sufficient equipment, (i.e., saturation monitors) and that appropriate interventions are performed once abnormal results are identified.

Conclusion

By looking at the top ten ward modifiable factors, a clear pattern is evident reflecting fundamental shortcomings in the health care system. The largest challenge is the dire shortage of both trained nurses as well as junior and senior doctors. Solving staff shortages will require a concerted effort from many organisations and institutions. There needs to be direction from national and provincial government agencies, as well as from nursing colleges and medical schools. New staff need to be urgently trained, while existing staff need to be retained within the public health-care system. Existing skilled health-care professionals need to be actively recruited to rejoin the provincial health-care sectors.

Apart from skills shortages, chronic under-funding of health-care institutions is another cause for concern. Patient capacity needs to be increased to alleviate overcrowding in the wards. Hospitals need to be adequately equipped with essential resuscitation, monitoring, diagnostic and therapeutic equipment. Staff must be adequately trained to operate this equipment.

Treatment and management guidelines need to be readily available. These have already been formulated in the form of integrated

management of childhood illness (IMCI) guidelines at clinic level and National Essential Drug List guidelines at hospital level. In addition, useful resources such as the *WHO Pocket Book of Hospital Care for Children* can be utilised. These guidelines should be readily available at institutions looking after children and health-care workers should utilise them.

Individual institutions should also take responsibility for their own shortcomings. Problem areas need to be identified and solutions sought. The interventions to overcome them need to be implemented and their impact on mortality assessed. Child PIP can be a very useful tool in this regard.

PART FIVE: PROVINCIAL REPORTS

Part Five of Saving Children 2005-2007 contains provincial summaries of the Child Healthcare Problem Identification Programme (Child PIP) data from each of the nine provinces in South Africa during this period. Some provinces have comparative data over the full period and some have only for one or two years, yet all contributions were included and considered valuable. Together these provincial reports provide a comprehensive picture of the children who died in South African hospitals over the past three years and the quality of care they received. Abstracts from most of the participating sites can be viewed on the Child PIP website (www.childpip.org.za).

Gauteng

Introduction

Gauteng is the smallest of the country's nine provinces. It covers just more than 17 000 square kilometres, approximately 1.4% of the total land surface of South Africa. It may be the smallest of the nine provinces but it is also the wealthiest and most densely populated province in the country. The provincial boundaries include most of the towns strung east to west along the gold reef, from Springs in the far East Rand to Randfontein in the west. It runs down to the Vaal River in the South, and just beyond South Africa's capital, Pretoria, in the north.

Despite being the richest province, millions of its inhabitants live in poverty. The unemployment rate is estimated to be 29.5% and 25% of its households are in informal settlements. The province is home to some of the largest informal settlements in the country, including Diepsloot, Alexandra and Honeydew. These circumstances provide the health-care system with numerous challenges. Malnutrition, diarrhoeal disease, pneumonia, tuberculosis and HIV are rife.

Methods

Two hospitals in Gauteng province contributed Child PIP data in 2007, namely Coronation Hospital and Kalafong Hospital. A complete

set of data were available from both hospitals, (i.e. 12 months' mortality audits, from January 2007 to December 2007 as well as admission data from the corresponding period).

These hospitals are quite similar in that they are both regional, academic hospitals. They both provide primary and secondary level care and offer some tertiary level care. The patient demographics of both institutions are also quite similar. They both serve patients in the low-income bracket with many patients residing in informal settlements. Coronation Hospital is situated in Newclare, a suburb of Johannesburg, to the west of Johannesburg's city centre. It is affiliated to the University of the Witwatersrand. Kalafong Hospital on the other hand, is situated in Atteridgeville, a township to the west of Pretoria. It is affiliated to the University of Pretoria.

The 2006 data was provided primarily by Coronation Hospital while some data was provided by Tembisa Hospital. The 2006 Gauteng provincial data has been previously published in the *Saving Children 2006* and is tabulated for comparative purposes.

Results

Baseline data

Gauteng	*2006 (Coronation only)*	*2007 (Coronation and Kalafong)*
Total admissions	3797	6714
Total deaths	193	220
In-hospital mortality rate (%)	5.1	3.3
Total modifiable factors	262	318
Modifiable factor rate (per death)	1.4	1.4

Information about children who died

Demographics

The table below lists the percentage of all deaths, in each age category.

Age	*2006 (% of deaths) n=235 (Coronation and Tembisa)*	*2007 (% of deaths) n=220 (Coronation and Kalafong)*
0-1 month	7	9
1 month-1 year	65	56
1-5 years	19	21
5-13 years	8	13
13-18 years	0.5	1
Unknown	0.5	0
Total	100	100

Health context

NUTRITION

Nutrition data are represented in the table below.

Nutritional category	*2006 (% of deaths)*	*2007 (% of deaths)*
OWFA	2	1
Normal	30	21
UWFA	31	36
Kwashiorkor	4	5
Marasmus	25	22
Marasmic Kwashiorkor	5	4
Unknown	3	11
Total	100	100

HIV&AIDS

The tables below show data with regard to HIV, namely the prevention of mother-to-child transmission (PMTCT), feeding practices, *Pneumocystis carinii* pneumonia (PCP) prophylaxis, and antiretroviral treatment (ART).

Laboratory category	*2006 (% of deaths)*	*2007 (% of deaths)*
Negative	23	27
Exposed	14	9
Infected	46	54
Not tested (but indicated)	11	3
Not tested (not indicated)	2	1
Unknown	4	6
Total	100	100
Clinical HIV staging	*2006 (% of deaths)*	*2007 (% of deaths)*
Stage I	1	1
Stage II	5	0
Stage III	11	6
Stage IV	40	46
Not staged (but indicated)	14	6
Not staged (not indicated)	23	35
Unknown	6	6
Total	100	100

PMTCT

Nevirapine prophylaxis	*2006 (% of deaths)*	*2007 (% of deaths)*
Given	14	21
Not given	25	25
Mother negative	24	29
Unknown	37	25
Total	100	100

FEEDING PRACTICE

Infant feeding	*2006 (% of deaths)*	*2007 (% of deaths)*
Exclusive breast	14	9
No breast, ever	23	26
Mixed	26	34
Unknown	37	31
Total	100	100

PCP PROPHYLAXIS

Cotrimoxazole	*2006 (% of deaths)*	*2007 (% of deaths)*
Current	35	32
Ever	2	3
Never (but indicated)	19	23
Never (not indicated)	26	32
Unknown	18	10
Total	100	100

ART (CHILD DEATHS)

ART – child deaths	*2006 (% of deaths)*	*2007 (% of deaths)*
Current	9	11
Ever	3	1
Never (but indicated)	39	44
Never (not indicated)	34	39
Unknown	15	5
Total	100	100

Causes of child deaths

The table below shows the top five causes of death in Gauteng.

All diagnoses: top 5	*2006 (% of deaths)*	*2007 (% of deaths)*
Pneumonia, ARI	19.1	14.7
Acute diarrhoea, hypovolaemic shock	18.3	9.1
Septicaemia, possible serious bacterial infection	16.3	13.7
PCP (suspected)	8.0	8.1
TB: Pulmonary	4.9	3.7

Information about quality of child healthcare

RECORDS

Records	*2006 (% of deaths)*	*2007 (% of deaths)*
Folder not available	5	12
Folder available: records incomplete	13	8
Folder available: notes inadequate	9	1
Folder available: incomplete AND inadequate	1	3
Folder available: OK	72	74
Unknown	0	2
Total	100	100

MODIFIABLE FACTORS

The following tables describe where modifiable factors were identified, and who were responsible for them.

Modifiable factors: where?	*2006 (% of MFs)*	*2007 (% of MFs)*
Home	67	61
Primary health clinic	6	9
Admission & Emergency care	4	4
Ward	23	26
Total	100	100
Modifiable factors: who?	***2006 (% of MFs)***	***2007 (% of MFs)***
Caregiver and family	67	60
Administrator	7	8
Clinical personnel	26	32
Total	100	100

Discussion

Baseline information in 2006 was obtained only from Coronation Hospital, as admission data was not available from Tembisa Hospital. In 2007, a complete set of 12 months' data were available from Coronation and Kalafong Hospitals and all 2007 analyses included data from both sites. An encouraging statistic is that in-hospital mortality rate dropped from 5.1% in 2006 to 3.1% in 2007.

About children who died

DEMOGRAPHICS

Mortality remains highest in infants. Of all children who died, 72% were under one year of age in 2006 while 67% were under one year in 2007. Future interventions need to be targeted at this age group.

HEALTH CONTEXT

Malnutrition remains a major co-morbidity. Thirty-six percent of children who died were underweight for age in 2007 as opposed to 31% in 2006. A further 31% of children that died were severely malnourished (kwashiorkor, marasmic-kwashiorkor or marasmus) in 2007 compared to 34% in 2006.

HIV remains a major obstacle. Fifty-four percent of children who died in 2007 were confirmed HIV-infected with a further 9% of children being HIV-exposed. This was slightly more than 2006 where 46% of children who died were HIV-infected and 14% HIV-exposed. This may be attributed to the fact that there were fewer children who were not tested for HIV in 2007 hence fewer unknowns. Eleven percent of children who died were not tested for HIV in 2006 compared to 3% in 2007.

In 2006 and 2007, the majority of children who died of HIV-related illness had advanced HIV infection. Of all children that died in 2007, 52% were either HIV WHO stage III or IV while this was 51% in 2006. Relatively few children who died were HIV WHO stage I or II (1% in 2007 and 6% in 2006).

PMTCT coverage was still suboptimal and current PMTCT programmes need to be strengthened. In both 2006 and 2007, 25% of children that died were not given PMTCT when it was indicated. This figure is still too high. Interventions need to be targeted at antenatal clinics so that all pregnant mothers can be counselled and offered HIV

testing. HIV-infected mothers should be offered PMTCT and their babies given appropriate PMTCT at birth. The PMTCT status was unknown in 25% of cases in 2007 as opposed to 37% in 2006. While there is some improvement, the percentage is still too high.

Relatively few mothers chose to exclusively breast feed. Only 9% of children were exclusively breast fed in 2007. Also of concern is the large proportion of children that received mixed feeds (34% in 2007 and 26% in 2006). Whilst the analysis looks at feeding practices in both HIV-infected and HIV-uninfected children, feeding practices remained sub-optimal regardless of HIV status. Children who are HIV-exposed should be either exclusively breast or formula fed based on an informed decision that the mother has made. Factors such as access to clean water, availability of formula, ability to sterilise bottles and the possible risk of transmission of HIV via breast milk must have been taken into consideration. Mothers need to be better educated as to the most appropriate method of feeding their children.

PCP prophylaxis is still inadequate. Twenty-three percent of children who died in 2007 did not receive PCP prophylaxis when it was indicated. This compares to 19% in 2006.

Universal access to antiretroviral treatment remains a challenge. There were still too many children dying of HIV-related illness who had not accessed ART when it was indicated. Forty-four percent of children that died in 2007 were not receiving ART when it was indicated. This compares to 39% in 2006. A concerted effort needs to be made to identify eligible children and to starting them on ART.

CAUSES OF DEATH

Pneumonia (14.7%), septicaemia (13.7%) and acute diarrhoeal disease (9.1%) were the leading causes of death. Data between 2006 and 2007 were comparable. The largest difference was the reduction in deaths caused by acute diarrhoea. This was 9.1 % in 2007 as opposed to 18.3% in 2006.

About quality of child healthcare

Record keeping improved from 2006 to 2007. Record keeping was satisfactory, with 74% of folders deemed to complete, appropriate and available. Records were "incomplete and inadequate" in only 3% of cases. The quality of records was comparable from 2006 to 2007.

MODIFIABLE FACTORS

Home modifiable factors accounted for 61% of all modifiable factors in 2007. The next most prominent area was hospital wards, which accounted for 26% of modifiable factors. In 2007, delay in seeking care was the commonest modifiable factor (16%). Within the wards, appropriate change/addition of antibiotics/TB treatment not prescribed accounted for 4.4% and inappropriate management of shock accounted for 3.5% of all modifiable factors.

Recommendations

- Prevention of HIV through universal access to PMTCT and strengthening of current PMTCT regimens has been addressed to some extent by the introduction of the new PMTCT guidelines using dual therapy of nevirapine and AZT. Much work still needs to be done to ensure that mothers and children that qualify for PMTCT have access to the programme.
- Better coverage of ART is required. There are still too many children not having adequate access to ART. More children requiring ART need to be identified and started on treatment.
- Stronger integrated management of childhood illness (IMCI) programmes should be implemented at local clinics.
- Community education campaigns with emphasis on infant nutrition, HIV, diarrhoeal disease and oral rehydration should be launched.
- The nationwide rollout of pneumococcal and rotavirus vaccines in 2009 remains an exciting prospect.
- Implementation of standard treatment guidelines by junior staff will ensure appropriate management of patients.

Limitations

Only two sites contributed to Child PIP data in Gauteng. These are two very similar hospitals with similar staffing and patient demographics. The data analysed may thus not be representative of the entire province. Getting data from more sites with different levels

of care, staffing levels and patient demographics will make the data for future reports more representative.

Conclusion

The 2007 data has showed some encouraging signs with the reduction of inpatient mortality from 5.1% in 2006 to 3.3% in 2007. However, the data are not representative of the entire province as only two hospitals provided data. Much work needs to be done to ensure the expansion of Child PIP across the entire province.

The advent of policy changes such as dual therapy PMTCT and the rollout of pneumococcal and rotavirus vaccines across the country remain an exciting prospect. The impact of these interventions will be closely monitored by Child PIP.

Mpumalanga

Introduction

Mpumalanga is situated in the north-eastern corner of South Africa. It covers 80 000 square kilometres and has 3.5 million inhabitants. It varies from deeply rural areas to fully urbanised, big industrial cities. The economy centres on mining, agriculture and tourism.

There are 28 provincial hospitals in the province with only six full-time paediatricians working in these hospitals. Most hospitals are experiencing a severe shortage of doctors, due to the absence of community service doctors. There are 60 000 deliveries annually, with a perinatal mortality rate of 35/1000 and a neonatal mortality rate of 13.5/1000.

Witbank Hospital is a level one, two and three institution, while the rest of the hospitals provide level one care. Mortality meetings occur weekly to monthly, depending on the size of each hospital.

Child PIP has grown tremendously in Mpumalanga, and by mid-2008 more than 20 hospitals were using the programme, although most still on the paper version only. The first provincial workshop was held in October 2008.

Methods

The data for 2006 only reflects that collected from Witbank and Barberton Hospitals, which were the only sites actively functioning and with complete data for 2006. Data for 2007 includes Witbank, Barberton, Middelburg, Standerton, KwaMhlanga, Belfast and Waterval Boven Hospitals. This makes comparisons between the years difficult.

Results

Baseline data

Mpumalanga	*2006*	*2007*
Total admissions	3589	5356
Total deaths	168	289
In-hospital mortality rate (%)	4.7	5.4
Total modifiable factors	276	577
Modifiable factor rate (per death)	1.6	2.0

Information about children who died

Demographics

The table below lists the percentage of all deaths, in each age category.

Age	*2006 (% of deaths)*	*2007 (% of deaths)*
0-1 month	6	4.8
1 month-1 year	55.7	67.3
1-5 years	25.1	21.8
5-13 years	10.8	6.1
13-18 years	2.4	0
Unknown	100	100
Total	6	4.8

Health context

NUTRITION

Nutrition data are represented in the table below.

Nutritional category	*2006 (% of deaths)*	*2007 (% of deaths)*
OWFA	1.2	0.7
Normal	24.6	29.3
UWFA	29.3	33.7
Kwashiorkor	1.8	4.8
Marasmus	32.9	21.4
Marasmic Kwashiorkor	8.4	3.4
Total	100	100

HIV&AIDS

The tables below show the data with regard to HIV, namely prevention of mother-to-chid transmission (PMTCT), feeding practices, *Pneumocystis carinii* pneumonia (PCP) prophylaxis and antiretroviral treatment (ART).

Laboratory category	*2006 (% of deaths)*	*2007 (% of deaths)*
Negative	5.4	10.9
Exposed	26.3	23.8
Infected	51.5	33.7
Unknown	16.8	31.6
Total	100	100
Clinical HIV staging	*2006 (% of deaths)*	*2007 (% of deaths)*
Stage I	3.6	0.7
Stage II	8.4	4.8
Stage III	15.0	23.8
Stage IV	40.1	19.0
Not staged	31.2	37.4
Unknown	1.8	14.3
Total	100	100

PMTCT

Nevirapine prophylaxis	*2006 (% of deaths)*	*2007 (% of deaths)*
Given	10.8	13.6
Not given	45.5	31.6
Mother negative	6.0	13.3
Unknown	37.7	41.5
Total	100	100

FEEDING PRACTICE

Infant feeding	*2006 (% of deaths)*	*2007 (% of deaths)*
Exclusive breast	8.4	11.6
No breast, ever	18.0	13.3
Mixed	47.3	33.6
Unknown	36.3	41.5
Total	100	100

PCP PROPHYLAXIS

Cotrimoxazole	*2006 (% of deaths)*	*2007 (% of deaths)*
Current	49.1	36.4
Ever	2.4	1.4
Never (but indicated)	25.7	24.1
Never (not indicated)	15.6	23.5
Unknown	7.2	14.6
Total	100	100

ART (CHILD DEATHS)

ART – child deaths	*2006 (% of deaths)*	*2007 (% of deaths)*
Current	6.6	5.1
Ever	0.6	1.7
Never (but indicated)	57.5	38.8
Never (not indicated)	24.0	33.7
Unknown	11.4	20.7
Total	100	100

Causes of child deaths

The table below shows the top five causes of death in Mpumalanga.

All diagnoses: top 5	*2006 (% of deaths)*	*2007 (% of deaths)*
PCP (suspected)	13.0	17.7
Pneumonia, ARI	12.2	14.9
TB: Pulmonary	11.5	3.4
Septicaemia, possible serious bacterial infection	10.3	11.5
Acute diarrhoea, hypovolaemic shock	7.6	12.7

Information about quality of child healthcare

RECORDS

Records	*2006 (% of deaths)*	*2007 (% of deaths)*
Folder not available	0	1.0
Folder available: incomplete AND inadequate	39.5	59.9
Folder available: OK	60.5	39.1
Total	100	100

MODIFIABLE FACTORS

The following tables describe where modifiable factors were identified, and who were responsible for them.

Modifiable factors: where?	*2006 (% of MFs)*	*2007 (% of MFs)*
Home	49.3	33.4
Primary health clinic	9.9	11.1
Admission & Emergency care	13.5	27.5
Ward	25.5	25.4
Total	98.2	97.4

Modifiable factors: who?	*2006 (rate per death)*	*2007 (rate per death)*
Caregiver and family	5.0	3.5
Administrator	2.0	1.9
Clinical personnel	8.1	8.1
Total	1.6	2.0

The most common modifiable factors by place were:

- Home: Delay in seeking care.
- Admissions and Emergency: Appropriate antibiotics were not prescribed.
- Ward: Appropriate investigations were not done.

Discussion

About children who died

DEMOGRAPHICS

Infants (1-12 months) accounted for 67% of all child deaths. Neonates admitted to general paediatric wards made up 4.8% of all deaths, which again raised questions as to the advisability of admitting neonates to these wards.

HEALTH CONTEXT

Malnutrition remained a massive problem with only 29.3% of all deaths occurring in normal weight children, while 30% occurred in the severely malnourished category.

HIV and AIDS remained the biggest challenge in paediatric healthcare in Mpumalanga. Where the HIV status of children is known, 84% of all deaths occurred in HIV-infected or -exposed children. With new sites reporting the HIV status was unknown overall in a greater percentage of deaths.

The PMTCT programme is still not functioning optimally with a very high percentage of deaths occurring in children not receiving nevirapine prophylaxis. The situation is improving dramatically with some new initiatives in 2008, which should start reflecting in data for 2009.

CAUSES OF DEATH

PCP, pneumonia, septicaemia and acute diarrhoeal disease were again the most common causes of death.

About quality of child healthcare

There was a significant increase in modifiable factors relating to admission and emergency, as well as a relative decrease in home-based modifiable factors. Initial assessment and case management in a casualty or emergency setting as well as insufficient monitoring in the paediatric ward after hours were identified as important factors relating to clinical personnel. Administrative modifiable factors decreased in 2007.

With all the new sites reporting, a significant decrease in the quality of record keeping was noted. This will be addressed.

Recommendations

The following measures are implemented in Mpumalanga:

1) All hospitals in the province, with the exception of three, are using the Child PIP paediatric mortality review (paper version at least). This was greatly facilitated by the provincial Department of Health's decision to create a post exclusively for the support of Perinatal Problem Identification Programme (PPIP) and Child PIP.
2) The Child Health Resource Package (CHeRP) CD as well as other guidelines were distributed to all hospitals in Mpumalanga.
3) A new initiative, the Mother and Child Health project was established by the provincial Department of Health, the Medical Research Council and the Department of Family Medicine at the University of Pretoria. This initiative aims is to create teams at each site to coordinate all aspects of maternal and child care. Training on Basic Antenatal Care, PMTCT, Emergency Triage Assessment and Treatment and neonatal care has started at all sites. Child PIP data will be used to monitor change.
4) The first Child PIP provincial workshop was held in October 2008, with more than 90% of all hospitals sending delegates.
5) The annual district and provincial PPIP meeting will now become a combined PPIP and Child PIP meeting.

Conclusion

We believe that Child PIP is an important tool in improving paediatric care in Mpumalanga and we look forward to expanding throughout the province and increasing participation in this wonderful initiative.

Limpopo

Introduction

The most northerly of South African provinces, Limpopo is a land of contrasts. It is a vast province of more than 123 000 square kilometres, making up 10% of South Africa's land area where the extreme poverty of local inhabitants is contrasted starkly by world famous game lodges where tourists and visitors enjoy the rugged landscape in fantastic luxury. Limpopo has a population of 5,8 million, 13% of the country's population. It is predominantly rural (86%) and with an unemployment rate of 46% and poverty rate of 65%, is one of the poorest areas in country.[1]

Limpopo has 43 hospitals and 477 clinics. There are 35 level one hospitals, 7 level two hospitals and 1 level three hospital, namely, the Polokwane-Mankweng Complex.[2]

Only one hospital used Child PIP in 2007, namely Bela-Bela Hospital, which started using the programme in 2005. However, Child PIP is growing in Limpopo as F H Odendaal Hospital started using the programme in the middle of 2008 and four other hospitals started using Child PIP (mostly the paper version only) by the end of 2008. The first provincial Child PIP training workshop was held in October 2008, attended by participants from ten hospitals.

Bela-Bela Hospital is a level one and two rural hospital situated in the Waterberg district which serves a population of 63 000. Bela-Bela Hospital receives patients from three hospitals and four clinics, as well as from North West and Mpumalanga provinces. Bela-Bela Hospital has 106 beds and 24 are dedicated to paediatric patients. There is one full-time paediatrician and either a community service doctor or an intern rotates monthly through the paediatric ward, which is a mixed medical and surgical ward.

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[1] Thom, A. Limpopo- Limping behind in health care. Centre for the Study of AIDS. Pretoria: University of Pretoria, 2004, pages 1-5.

[2] Fuentes. Limpopo Province. In Pattinson RC ed. Saving Babies 2003-2005: Fifth perinatal care survey of South Africa. Pretoria: University of Pretoria, MRC, CDC; 2007, pages 129-133.

Methods

In 2007, the number of hospitals in Limpopo using Child PIP decreased from two to one, as Letaba Hospital no longer collected data. The data presented below represents Bela-Bela and Letaba Hospitals for 2006 but only Bela-Bela Hospital for 2007.

Results

Baseline data

Limpopo	*2006 (Bela-Bela and Letaba)*	*2007 (Bela-Bela only)*
Total admissions	1730	955
Total deaths	113	48
In-hospital mortality rate (%)	6.5	5
Total modifiable factors	286	129
Modifiable factor rate (per death)	2.5	2.7

Information about children who died

Demographics

The table below lists the percentage of all deaths, in each age category.

Age	*2006 (% of deaths)*	*2007 (% of deaths)*
0-1 month	0	0
1 month-1 year	58.5	64.6
1-5 years	30.7	27.1
5-13 years	10.8	8.3
Total	100	100

Health context

NUTRITION

Nutrition data are represented in the table below.

Nutritional category	*2006 (% of deaths)*	*2007 (% of deaths)*
OWFA	1.4	4.2
Normal	20.3	18.8
UWFA	29.2	16.7
Kwashiorkor	3.4	4.2
Marasmus	39.2	45.8
Marasmic Kwashiorkor	5.8	6.3
Unknown	0.7	4.0
Total	100	100

HIV&AIDS

The tables below show data with regard to HIV, namely PMTCT, feeding practices, *Pneumocystis carinii* pneumonia (PCP) prophylaxis and ART.

Laboratory category	*2006 (% of deaths)*	*2007 (% of deaths)*
Negative	6.4	0
Exposed	25.3	39.6
Infected	31.1	35.4
Not tested	27.7	18.7
Unknown	9.5	6.3
Total	100	100
Clinical HIV staging	*2006 (% of deaths)*	*2007 (% of deaths)*
Stage I	0.9	0
Stage II	5.6	6.3
Stage III	4.8	8.3
Stage IV	40.0	35.4
Not staged	32.3	45.8
Unknown	16.4	4.2
Total	100	100

PMTCT

Nevirapine prophylaxis	*2006 (% of deaths)*	*2007 (% of deaths)*
Given	8.3	27.1
Not given	10.9	16.7
Mother negative	2.9	0
Unknown	77.9	56.2
Total	100	100

FEEDING PRACTICE

Infant feeding	*2006 (% of deaths)*	*2007 (% of deaths)*
Exclusive breast	16.3	39.5
No breast, ever	25.8	27.1
Mixed	23.7	2.1
Unknown	34.2	31.3
Total	100	100

PCP PROPHYLAXIS

Cotrimoxazole	*2006 (% of deaths)*	*2007 (% of deaths)*
Current	47.4	56.2
Ever	8.8	10.4
Never (but indicated)	4.6	12.5
Never (not indicated)	6.3	0
Unknown	32.9	20.9
Total	100	100

ART (CHILD DEATHS)

ART – child deaths	*2006 (% of deaths)*	*2007 (% of deaths)*
Current	4.6	2.1
Ever	2.1	2.1
Never (but indicated)	42.1	68.7
Never (not indicated)	17.1	4.2
Unknown	34.1	22.9
Total	100	100

Causes of child deaths

The table below shows the top five causes of death in Limpopo.

All diagnoses: top 5	*2006 (% of deaths)*	*2007 (% of deaths)*
Pneumonia, ARI	25.1	47.9
Acute diarrhoea, hypovolaemic shock	10.3	18.8
TB: Pulmonary	9.1	10.5
Chronic diarrhoea	4.2	2.1
PCP (suspected)	13.9	2.1

Information about quality of child healthcare

RECORDS

Records	*2006 (% of deaths)*	*2007 (% of deaths)*
Folder available: incomplete and/or inadequate	49.0	22.960.4
Folder available: OK	50.1	39.6
Total	100	100

MODIFIABLE FACTORS

The following tables describe where modifiable factors were identified, and who were responsible for them.

Modifiable factors: where?	*2006 (% of MFs)*	*2007 (% of MFs)*
Home	45.8	38.0
Primary health clinic	9.4	5.4
Admission & Emergency care	27.9	22.5
Ward	16.0	27.9
Total	99.1	93.8
Modifiable factors: who?	***2006 (% of MFs)***	***2007 (% of MFs)***
Caregiver and family	49.7	38.0
Administrator	9.8	17.8
Clinical personnel	40.5	44.2
Total	100	100

The most common modifiable factors by place were:

- Home: Inappropriate nutrition.
- Admissions and Emergency: Appropriate investigations not done.
- Ward: Too much, too little, or incorrect type of IV fluids prescribed or given.

Discussion

Only one hospital in Limpopo, Bela-Bela Hospital, was using Child PIP during 2007. The data from Bela-Bela Hospital alone cannot reflect the complete situation in Limpopo and it is thus very important to expand Child PIP to other hospitals.

The in-hospital mortality rate (all ages) at Bela-Bela Hospital decreased from 6.5% in 2006 to 5.0% in 2007. This can be seen as a reflection of the positive impact of Child PIP at Bela-Bela Hospital.

About children who died

Bela-Bela Hospital serves a community where poverty due to high unemployment, lack of education and skills, traditional beliefs with negative effects, and the HIV pandemic are present.

DEMOGRAPHICS

More than 90% of child deaths occurred in children under five years of age, and 65% occurred in infants (1-12 months). Neonates were not admitted to paediatric wards as advised by the Limpopo Initiative for Neonatal Care (LINC) because paediatric wards are not a good environment for them and it is best for neonates to be admitted and treated in nurseries.

HEALTH CONTEXT

The nutritional status of children who died during 2007 deteriorated due to severe malnutrition. This reflects poverty and poor nutritional education, and forms part of the HIV clinical picture. Only one fifth of the dead children were over the 3rd weight percentile. More than half of the children who died during the period had severe malnutrition.

HIV and AIDS remained the biggest challenge in paediatric health care in Limpopo. Three-quarters of all deaths occurred in HIV-infected or -exposed children. There was an increase in children who had been HIV-infected or -exposed. In contrast, there were fewer children with unknown HIV status, reflecting an improvement in this area.

The PMTCT programme was still not functioning optimally with a very high percentage of deaths occurring in children not receiving nevirapine prophylaxis in spite of the number increasing, in contrast to 2006. A PMTCT clinic was opened at Bela-Bela Hospital where all babies exposed perinataly to HIV were treated according to PMTCT protocols with the addition of AZT to the prophylaxis.

Mixed feeding, a deleterious practice had decreased almost ten times from 2006, a very positive change. Cotrimoxazole prophylaxis had increased in 2007 compared to the previous year but was still low. It is possible that this had an impact as the percentage of children dying of PCP, which decreased more than six times from 2006 to 2007.

The proportion of children accessing ART was still very low. This needs to be addressed and corrected.

CAUSES OF DEATH

Pneumonia remained the first cause of death in children and acute diarrhoea increased in relation to 2006. Tuberculosis, in varying presentations, also increased slightly.

About quality of child healthcare

Modifiable factors relating to the ward increased and there was a relative decrease in home-based factors.

There was a significant decrease in the quality of record keeping which will need to be addressed.

Recommendations

The following measures must be implemented in Limpopo:

- PMTCT clinics must be available in hospitals for babies who are discharged to ensure they are managed following the provincial PMTCT protocols.
- All hospitals in the Waterberg district must participate in a paediatric mortality review (with at least the paper version of Child PIP) and this must be expanded to other districts. This would be greatly facilitated by the province's decision to release a person to focus exclusively on PPIP and Child PIP.
- The Child Health Resource Package (CHeRP CD) and other guidelines will be distributed to all hospitals.
- The first provincial training workshop in Limpopo was held in October 2008 and hospitals will be invited to send delegates to future workshops.
- The annual district and provincial Perinatal Problem Identification (PPIP) meetings must be combined with Child PIP meetings.

Conclusion

Child PIP is an effective tool when implemented in health institutions with support form management. It brings hope for children and health personnel, both clinical and administrative, in order to find solutions to the high child mortality rate in Limpopo.

North West

Introduction

All hospitals in the Ngaka Modiri Molema District (NMMD) in North West are currently using Child PIP, having started in 2001. The district has a population of 780 000, mainly rural and periurban, and 108 primary healthcare clinics (PHC). HIV prevalence among antenatal clients is 29% and rates of unemployment and poverty are high. The hospitals in NMMD are Mafikeng Provincial (MPH), a level one and two facility, and Gelukspan, Thusong-General Delarey, Lehurutshe and Zeerust Hospitals which are all level one with mixed paediatric medical and surgical wards.

Since August 2007, the University of the Witwatersrand's paediatric HIV clinics supported the prevention of mother-to-child (PMTCT) quality improvement and paediatric antiretroviral treatment (ART) services in three sub-districts of NMMD (ECHO project). The number of children on ART in the district was doubled from 221 to 469, but it is estimated that more than 2 000 children in NMMD are still in need of ART.

Methods

All paediatric admissions and deaths in the NMMD for 2007, apart from MPH, were included in this report. Data for individual hospitals are available on the website (www.childpip.org.za).

Due to severe clinical personnel shortages at MPH, the in-depth Child PIP death review was only done for medical paediatric deaths every alternate month. Thus, only six months data of MPH are included for 2007. However, a full 12 months' data is available for 2006.

Results

Baseline data

Ngaka Modiri Molema District	*2006*	*2007**
Total admissions	5871	5325
Total deaths	465	340
In-hospital mortality rate (%)	7.9	6.4
Total modifiable factors	1169	1298
Modifiable factor rate (per death)	2.5	3.8

* *Only 6 months from MPH*

Inpatient mortality

Under-5 admissions	*Admissions (no.)*		*Deaths (no.)*		*IHMR (%)*	
Nutritional status	*2006*	*2007*	*2006*	*2007*	*2006*	*2007*
≥ 3rd centile	1691	1835	78	66	4.6	3.6
< 3rd centile	1201	1275	96	117	8	9.2
Severe malnutrition	712	809	168	130	23.6	16.1
Unknown	300	386	16	16	5.3	4.1
Total	3904	4305	358	329	9.2	7.6

Information about children who died

Demographics

The table below lists the percentage of all deaths, in each age category.

Age	*2006 (% of deaths)*	*2007 (% of deaths)*
0-1 month	1.1	5.3
1 month-1 year	58.3	65.3
1-5 years	30.8	22.9
5-13 years	9.8	6.5
Total	100	100

Health context

NUTRITION

Nutrition data are represented in the table below.

Nutritional category	*2006 (% of deaths)*	*2007 (% of deaths)*
Normal	18.8	20.9
UWFA	27.2	32.9
Kwashiorkor	38.6	33.3
Marasmus	4.6	5.9
Marasmic Kwashiorkor	4.0	3.2
Unknown	6.8	3.8
Total	100	100

REFERRALS

Out of the 88 audited deaths at MPH, one patient came from Zeerust Hospital; four came from Thusong Hospital and four from Ratlou Hospital. Out of 73 audited deaths at Gelukspan Hospital, 13 came from Ratlou and 21 from Tswaing community hospitals.

HIV&AIDS

The tables below show data with regard to HIV, namely PMTCT, feeding practices, *Pneumocystis carinii* pneumonia (PCP) prophylaxis and ART.

Laboratory category	*2006 (% of deaths)*	*2007 (% of deaths)*
Negative	36	10.6
Exposed	56	16.5
Infected	123	36.2
Not tested (but indicated)	62	18.2
Not tested (not indicated)	5	1.5
Unknown	58	17.0
Total	340	100

Clinical HIV staging	*2006 (% of deaths)*	*2007 (% of deaths)*
Stage I	0	0
Stage II	2	0.6
Stage III	68	20.0
Stage IV	152	44.7
Not staged (but indicated)	31	9.1
Not staged (not indicated)	32	9.4
Unknown	55	16.2
Total	340	100

PMTCT

Nevirapine prophylaxis	*2006 (% of deaths)*	*2007 (% of deaths)*
Given	11.5	15.6
Not given	9.9	7.4
Mother negative	5.1	7.9
Unknown	64.5	69.1
Total	100	100

FEEDING PRACTICE

Infant feeding	*2006 (% of deaths)*	*2007 (% of deaths)*
Exclusive breast	18.3	12.9
No breast, ever	7.5	20.6
Mixed	11.0	10.3
Unknown	63.2	56.2
Total	100	100

Causes of child deaths

The table below shows the top six causes of death in NMMD.

All diagnoses: top 6	*2006 (% of deaths)*	*2007 (% of deaths)*
Septicaemia, possible serious bacterial infection	22.1	22.6
Pneumonia, ARI	13.4	15.0
Acute diarrhoea, hypovolaemic shock	10.0	13.0
TB: Pulmonary	11.2	10.8
PCP (suspected)	8.8	7.1
Meningitis: bacterial	6.4	6.1

Information about quality of child healthcare

RECORDS

Records	*2006 (% of deaths)*	*2007 (% of deaths)*
Folder not available	9.3	1.8
Folder available: records incomplete	42.6	44.7
Folder available: notes inadequate	1.8	0.6
Folder available: incomplete AND inadequate	9.7	0
Folder available: OK	36.6	52.9
Total	100	100

MODIFIABLE FACTORS

The following tables describe where modifiable factors were identified, and who were responsible for them.

Modifiable factors: where?	*2007 (no.)*	*2007 (% of MFs)*
Home	112	8.6
Primary health clinic	247	19.0
Admission & Emergency care	284	21.9
Ward	648	50.0
Missing records	6	0.5
Total	1297	100
Modifiable factors: who?	***2006 (% of MFs)***	***2007 (% of MFs)***
Caregiver and family	8	9
Administrator	61	49
Clinical personnel	31	42
Total	100	100

The most prevalent modifiable factors are listed in the table below:

Family, caregiver	Delay in seeking care; no caregiver available as ART supporter for child
PHC: clinical personnel	IMCI nutrition and HIV assessment not done; IMCI not used for case management; delay in referring for failure to thrive; no TB contact treatment
Hospital: clinical personnel	Problems with shock assessment and management, IV fluids; PCR not done; patient not started on ART at previous admission; inappropriate antibiotic prescribing; TB score not used; delay in starting TB treatment; lumbar puncture not done; no ward rounds on public holidays/weekends
Administrator	Lack of appropriate emergency transport; severe shortage of doctors and professional nurses for paediatric care and ART services; severe shortage of high care and ICU beds; wards overcrowded; severe shortage of HIV counsellors/HIV testing in the wards; shortage of social workers; mobile x-ray broken, or no staff to do x-rays in the ward

Discussion

Child deaths in poor communities are unseen, uncountable and thus uncounted. This leads to the global scandal of invisibility.[1] In North West, only 40% of all *registered* child deaths occur in health facilities.[2] Presently only these facility-based deaths are analysed by Child PIP. Additional regular surveys are needed to identify and analyse deaths occurring in the community and the reasons why these children could not access health facilities for care.

The increase in paediatric admissions during 2007 was less than during the previous years. This was partially due to very low patient numbers

[1] Setel PW et al. A scandal of invisibility: Making everyone count by counting everyone. Lancet 2007; 370: 1569-1577

[2] Stats South Africa 2000-2005

during the public sector strike in June 2007, which affected two out of the five hospitals in NMMD.

About children who died

The average in-hospital mortality rate for NMMD hospitals improved during 2007, dropping from 7.9% to 6.4%. This means that 80 more children have been saved. The in-hospital mortality rate for severe malnutrition decreased from 23.6% to 16.1%. This was achieved in spite of severe clinical personnel shortages. MPH recently received three doctors and one additional cubicle for paediatric services.

HEALTH CONTEXT

Coverage of all steps of effective PMTCT, including cotrimoxazole prophylaxis and support for safe infant feeding, was still far too low. Although 95% of women attended antenatal care, only 35% of HIV-infected women were identified at delivery.

Breastfeeding prevalence has decreased. This is mainly due to the propagation of formula feeding for HIV-infected mothers. Healthcare workers and communities need to be educated on the positive effect of exclusive breastfeeding on child survival.

CAUSES OF DEATH

Diarrhoea deaths were increasing.

About quality of child healthcare

Administrative modifiable factors increased from 31% to 42%. Shortage of clinical staff (doctors and nurses) and HIV counsellors has worsened and needs urgent attention.

Recommendations to prevent avoidable child deaths

- Urgently implement and monitor dual therapy PMTCT in all facilities. Promote and support exclusive breastfeeding. Record PMTCT information on the child's Road-to-Health Chart.
- Fast track and increase the referral for ART of children, pregnant and lactating mothers.
- Ensure sufficient budgets for 2008/9 to double CD4 counts, PCR testing and ART for children, pregnant and lactating mothers.
- Increase clinical staff for paediatric ART services and paediatric wards (Target for 2010: double the clinical staff).

- Motivate for high care beds in paediatric wards and General Delarey casualty, and for more posts for professional nurses.
- Evaluate and correct quality of Emergency Medical Rescue Services for sick children and newborns (i.e. improve staff training, skills, equipment, oxygen, timing).
- Fast track appointments of professional nurses and doctors. Lobby for rural allowance for MPH and Mafikeng sub-district. Implement effective retention strategies for clinical personnel.
- Secure training budgets for integrated management of childhood illness (IMCI) courses. Ensure that effective IMCI training is part of the undergraduate professional nursing curriculum. Increase the number of IMCI supervisors through training. Ensure transport for IMCI supervision and quality of the supervisory visits. Support and coach all PHC workers to do the IMCI malnutrition and HIV assessment on every child.
- Evaluate and support paediatric care in Tswaing community hospitals.

Conclusion

Patient care litigations are increasing in both private and public sector paediatric care. The Child PIP audit can be used by management as a preventive programme, to identify problem areas, and to establish and implement necessary interventions to improve patient care and outcomes.

The strategies and priorities for improving child survival locally are known. The challenge is to advance access, coverage and equity for paediatric healthcare delivery, and to implement and sustain better services on the ground.

One should never let the familiarity of mortality data dull the outrageousness of the situation. Ultimately, these findings on child healthcare are about how much each of us values the life of every child. It is a test of our humanity and, indeed, infant and child mortality rates are a reflection of the failure or success of a state.

KwaZulu-Natal

Introduction

This chapter contains information on in-hospital mortality for 2007 from 17 participating Child PIP sites in KwaZulu-Natal (KZN). It will build on the details provided in the 2005 and 2006 reports and start looking at trends during three years.

The estimated mid-year population for KZN in 2006 was 9.9 million, and the proportion of children under 15 years of age was 34%.

Area 1 (South Eastern Area) has the eThekwini metropole as its hub and has the highest population density as it is the economic hub of the province. However, informal settlements due to population migration are a reality. Area 2 (Western Area) has the Umgungundlovu district as its hub. Area 3 (North Eastern Area) has the Empangeni/Ngwelezana Complex as its health hub and has a more rural population, resulting in different health needs to those in urban settings. The referral pattern of hospitals in KZN is available, along with several other policy documents, in the index of the KZN Department of Health website.

Methods

The 2007 data comes from 17 participating Child PIP sites throughout KZN. There has been phenomenal growth in the number of sites during the three years with a doubling of the number of sites participating in Child PIP. Area 1 has made great strides in contributing to this increase; today all academic paediatric units affiliated to the University of KwaZulu-Natal Nelson R Mandela School of Medicine are part of the team.

Results

Baseline data

The results are presented in the same format as the 2006 report, so that comparison of 2005, 2006 and 2007 data is possible for the reader.

KwaZulu-Natal	***2005***	***2006***	***2007***
Total admissions	6346	10 476	21811
Total deaths	553	904	1481
In-hospital mortality rate (%)	8.7	8.6	6.8
Total modifiable factors	1150	1 409	2710
Modifiable factor rate (per death)	2.1	1.6	1.8
Number of sites	5	9	17
Total audited deaths	562	866	1850

Inpatient mortality

	Admissions (no.)			*Deaths (no.)*			*IHMR (%)*		
	2005	***2006***	***2007***	***2005***	***2006***	***2007***	***2005***	***2006***	***2007***
All ages	*4044*	*10476*	*21811*	*366*	*904*	*1481*	*9.1*	*8.6*	**6.8**
Age									
0-1 month	161	1364	1869	7	88	92	4.3	6.5	4.9
1 month-1 year	1544	3965	9237	188	489	833	12.2	12.3	9.0
1-5 years	1370	3292	7117	108	214	372	7.9	6.5	5.2
5-13 years	957	1841	3522	62	113	182	6.5	6.1	5.2
13-18 years	12	14	66	1	0	2	8.3	0	3.0
Under-5 years **Nutritional status:**									
< 3rd centile	356	1526	3380	38	228	369	10.7	14.9	10.9
Severe malnutrition	192	710	1689	16	170	370	8.3	23.9	21.9
Unknown	1831	3391	4157	220	199	186	12.0	5.9	4.5
Illness:									
ARI	904	2926	6212	113	322	428	12.5	11.0	6.9
DD	728	2517	6038	82	229	410	11.3	9.0	6.8

Information about children who died

Demographics

Age	***2005 (% of deaths)***	***2006 (% of deaths)***	***2007 (% of deaths)***
0-1 month	5.5	8.0	7.2
1 month-1 year	48.3	58.0	56.7
1-5 years	28.6	23.0	23.8
5-13 years	15.9	11.0	11.7
13-18 years	0.2	0	0.2
Unknown	1.5	0	0.4
Total	100	100	100

Health context

NUTRITION

Nutritional category	***2005 (% of deaths)***	***2006 (% of deaths)***	***2007 (% of deaths)***
OWFA	1.8	1.7	1.5
Normal	22.2	28.0	28.2
UWFA	24.7	28.0	31.0
Kwashiorkor	4.6	6.5	5.6
Marasmus	25.4	22.0	21.4
Marasmic Kwashiorkor	5.3	3.2	3.2
Unknown	16.0	10.6	9.1
Total	100	100	100

HIV&AIDS

Laboratory category	***2005 (% of deaths)***	***2006 (% of deaths)***	***2007 (% of deaths)***
Negative	7.9	11.0	9.8
Exposed	24.0	32.0	29.9
Infected	26.1	25.0	27.5
Not tested (but indicated)	12.2	8.7	6.9
Not tested (not indicated)	0.9	4.3	5.8
Unknown	6.5	19.0	20.1
Total	100	100	100

Clinical HIV staging	*2005 (% of deaths)*	*2006 (% of deaths)*	*2007 (% of deaths)*
Stage I	1.8	3.8	2.2
Stage II	3.5	4.5	3.4
Stage III	18.9	19.0	15.6
Stage IV	19.6	27.0	30.4
Not staged (but indicated)	24.4	11.0	12.2
Not staged (not indicated)	4.2	12.0	15.5
Unknown	27.6	22.7	20.7
Total	100	100	100

PMTCT

NVP prophylaxis	*2005 (% of deaths)*	*2006 (% of deaths)*	*2007 (% of deaths)*
NVP given	7.2	23.0	18.6
NVP not given	8.5	17.0	13.2
Mother negative	6.5	9.4	12.1
Unknown	77.8	50.6	56.1
Total	100	100	100

FEEDING PRACTICE

Infant feeding	*2005 (% of deaths)*	*2006 (% of deaths)*	*2007 (% of deaths)*
Exclusive breast	7.6	16.0	15.1
No breast, ever	13.2	18.0	24.6
Mixed	14.1	16.0	14.4
Unknown*	65.1	50.0	45.9
Total	100	100	100

**Unknown may include the group of patients for whom this information is NOT APPLICABLE*

PCP PROPHYLAXIS

Cotrimoxazole	*2005 (% of deaths)*	*2006 (% of deaths)*	*2007 (% of deaths)*
Current	12.5	28.0	32.3
Ever	2.1	3.2	3.0
Never (but indicated)	3.5	16.0	14.1
Never (not indicated)	5.8	16.0	18.9
Unknown	76.1	36.8	31.7
Total	100	100	100

ART (CHILD DEATHS)

ART – child deaths	*2005 (% of deaths)*	*2006 (% of deaths)*	*2007 (% of deaths)*
Current	0.7	4.6	7.2
Ever	0.5	2.1	1.1
Never (but indicated)	28.6	40.0	38.4
Never (not indicated)	10.4	26.0	28.6
Unknown	59.8	27.3	24.7
Total	100	100	100

Causes of child deaths

All diagnoses: top 5	*2005 (% of deaths)*	*2006 (% of deaths)*	*2007 (% of deaths)*
Pneumonia, ARI	19.9	18.3	18.7
Septicaemia	10.1	14.5	15.9
Acute diarrhoea	11.6	14.4	14.2
PCP (suspected)	5.0	6.9	6.2
Chronic diarrhoea	9.5	4.8	4.6

All diagnoses (grouped)	*2005 (% of deaths)*	*2006 (% of deaths)*	*2007 (% of deaths)*
ARI, with PCP	27	26	22
Diarrhoeal disease	20	19	17
Septicaemia	10	15	14
TB (all)	7	7	8
Other	36	33	39
Total	100	100	100

HIV-associated deaths	*Deaths*		*With HIV (no.)*		*With HIV (%)*	
	2006	*2007*	*2006*	*2007*	*2006*	*2007*
Pneumonia, ARI	172	346	119	224	69	65
PCP (suspected)	71	121	64	106	91	88
Diarrhoeal disease	187	348	124	210	66	60
Septicaemia	121	294	81	200	67	68
TB (all)	46	121	29	94	64	78
Total	597	1230	417	834	69.8	68

Information about quality of child healthcare

Records	*2005 (% of deaths)*	*2006 (% of deaths)*	*2007 (% of deaths)*
Folder not available	19.4	20.0	10.1
Folder: incompl./inadequate	55.4	25.0	25.3
Folder available: OK	25.2	55.0	64.6
Total	100	100	100

The following tables describe where modifiable factors were identified, and who were responsible for them.

Modifiable factors: where?	*2005 (% of deaths)*	*2006 (% of deaths)*	*2007 (% of deaths)*
Home	31.4	36.3	39.4
Primary health clinic	8.7	10.6	11.4
A & E care	15.3	19.8	16.1
Ward	22.5	27.1	25.9
Missing records	22.1	6.2	7.2
Total	100	100	100
Modifiable factors: who?	*2005 (% of deaths)*	*2006 (% of deaths)*	*2007 (% of deaths)*
Caregiver and family	39.9	39.5	42.6
Administrator	12.5	18.2	15.9
Clinical personnel	47.6	42.3	41.5
Total	100	100	100

Modifiable factors: top 10	*2006 (% of MFs)*	*2007 (% of MFs)*
1. Delay in seeking care	13.8	13.3
2. Carer not realizing severity of illness	6.2	6.7
3. Inappropriate nutrition	5.2	6.2
4. Home treatment with negative effect	3.5	3.9
5. Insufficient information on caregiver	3.1	3.2
6. Lack of senior doctors	2.8	0.4
7. Lack of high care beds/resusc. area	2.4	1.8
8. Physical examination incomplete	2.4	1.9
9. Lack of infant/paediatric ICU facilities	2.0	2.0
10.Shock	2.0	0.6

Discussion

The number of reporting sites increased from 8 to 17 in 2007. This is a significant increase with many regional hospitals contributing data to the mortality audit process. One reason for the increase may include two workshops that were held in the province in 2007. These aimed at increasing the profile of Child PIP and promoting the benefits of the process to clinicians and managers, showing where synergy is better than an adversarial relationship, working together to strengthen policy and programmes through empathy, and ultimately putting children first. Further, support from Maternal, Child and Women's Health (MCWH), Primary Health Care (PHC) and the Nutrition directorates in the KZN Department of Health (DOH) has played a role in spreading the word. Asking institutions to provide statistics in line with the audit framework will ensure that this process reaches all the province's hospitals. Key individuals who subscribe to Child PIP have encouraged others to follow, and this will help to ensure sustainability. Staff shortages remain a challenge, but using the enthusiasm of the people that are present has made a great difference to help overcome this and other barriers.

About children who died

HEALTH CONTEXT

Malnutrition remained a major concern, as it is a well-known contributor to mortality from any cause. It is striking that 31% of deaths were in the underweight-for-age, a category that may not receive as much attention as that of severe malnutrition in a hospital setting.

As expected, a large proportion of deaths were related to HIV infection, which is a reflection of the epidemic as well as the challenges facing paediatric services. There was an apparent decline in the proportion of deaths not tested for HIV, which may indicate improvements in testing rates in hospitalised children or more severely ill children. It was also noted that a larger percentage of deaths were on ART. This reflects a changing inpatient profile as treatment services for children grow. There were still long delays in starting ART as reflected by the large proportion of deaths in advanced stages of the disease and the large proportions where ART had not been commenced. The reasons for this cannot be inferred from the available data.

Encouraging trends in the PMTCT statistics have not been sustained with the gains made in 2006 levelling off in 2007.

Exclusive breastfeeding remains poor in the province and this practice must be encouraged, as it remains one of the best ways to improve all-cause morbidity and mortality in children. Improvements in Pneumocystis jirovecii (PCP) preventive medication seen in 2006 has also tailed off, with the percentage of children dying from PCP lung infections remaining among the top five causes of death. Note that this classification incorporates suspected PCP cases, not only confirmed cases.

INPATIENT MORTALITY

All cause in-hospital mortality shows an improving trend (in 2005 it was 9.2%, 8.6% in 2006 and 6.8% in 2007), while the modifiable factor rate per death increased (from 1.6% to 1.8%, respectively). This may be a reflection of the audit process rather than a true increase in the modifiable factor rate. Other possible explanations for the improvement may include that most of the newly enrolled hospitals have paediatricians, relatively better staff ratios or more stringent admission criteria for children (academically linked units). There may be other reasons for this improvement and this will be watched closely as more district hospitals join the process.

CAUSES OF DEATH

The similarities noted previously persist with no change in the rank of the top five causes of death with almost identical percentages recorded for each cause. A slight increase from 7% to 8.2% in ALL TB deaths was noted. Malnutrition and HIV and AIDS remain significant in contributing to mortality affecting around two thirds of all deaths respectively.

About quality of child healthcare

Modifiable factors recorded in the home reflect the same areas mentioned in the last report and efforts to improve this area would take time to implement before changes are seen. It is important to re-iterate that access to health care in KZN and South Africa remains a major challenge and requires huge efforts and even more resources.

At the provincial workshops, the KZN Child PIP team tried to highlight modifiable factors outside the hospital and to get managers and health-care workers in these areas to strengthen ties and to enhance programmes by ensuring proper links with facility-based

programmes. While the effects of this have not been formally evaluated, follow-up workshops in the next year will give us some idea on progress in these areas. The modifiable factors in the home are the next challenge to be addressed.

Recommendations

The recommendations made in the 2006 KZN report must be re-iterated with special emphasis on the following areas.

- Child PIP

A sustained effort to continue to improve coverage of Child PIP, especially in Area 3 and across district hospitals is necessary. For more established sites (>3 years), one needs to look at how to improve quality of data and continue to highlight success stories from which other sites can learn. For this process, the KZN Child PIP organogram was adopted in 2008. This mirrors the National Child PIP structure and stays within the district health framework of the DOH. A KZN Child PIP Executive Committee (Exco) has been constituted with a Provincial Co-ordinator (PC) as the convener. The KZN Technical Task Team (KZN TTT) is made up of 11 district and/or 3 area coordinators as well as the Exco. Districts could form their own committees to provide guidance and solidarity to colleagues and to supplement the institutional Child PIP (Paediatrics and Child Health) teams.

Within this framework, we hope to increase the coordination of efforts, provide closer supervision and support that is easily accessible, and to develop capacity at all levels in different aspects of child health service delivery, research, and policy implementation. This would also include working closely with managers of the various DOH directorates relevant to child health at grassroots and district level, and could serve as a blueprint for all provinces as Child PIP expands.

- Tuberculosis

In terms of the 2006 recommendations, the national initiative towards a single guideline for childhood TB has been started and

the "Uncomplicated Childhood TB Guidelines within the National TB Control Programme" should be released in 2008. In KZN, a draft consensus guideline for all forms of childhood TB has also been completed and negotiations with the KZN TB Control Programmes have progressed in terms of taking this to the next stage.

- Modifiable factors

Strategies to encourage the community and alternate caregivers in early identification and care-seeking behaviour remain important. However, this must be done in conjunction with improving access to health care for the most vulnerable sectors of the KZN population. It would be valuable to monitor the expansion of the outreach model to district hospitals for Paediatrics and Child Health as adopted by the Pietermaritzburg Metropolitan Hospitals Complex in collaboration with the Red Cross Air Mercy Services "Flying Doctors" programme. The framework and content of visits and material required to carry out these services are clearly outlined on the Child Health Resource Package CD (CHeRP) put together by members of the Paediatric Department. The CHeRP CD is available via the intranet (KZN DOH) as well as via the internet.

Limitations of Child PIP data

The increased number of sites has improved representivity of data but the limitations mentioned in the 2006 report remain pertinent. Database problems have improved but individual site data was not always pristine. This should improve with time, and with better supervision and support, the positive changes will be seen earlier.

Conclusion

With increasing sites participating in Child PIP, the data looks about the same as it did with fewer sites, but has become more representative. Several gains have levelled off and the encouraging picture in 2005 to 2006 has not continued. More sites in KZN are urged to begin implementing Child PIP and so strengthen the voice of the children. It is clear that some solutions need only individual application to the task at hand and few resources, while others need the collective efforts of many as well as significant resources.

Free State

Introduction

During 2007, three facilities in the Free State used Child PIP for the purposes of monitoring. Pelonomi Hospital is a regional hospital and Metsimaholo and National District Hospital (NDH) are district hospitals. These hospitals serve different populations yet the pattern of child deaths is similar in all three facilities.

Selected comparative and summative Child PIP data for 2007 are shown in the table below.

Free State	*Pelonomi*	*Metsimaholo*	*NDH*	*Total*
Total admissions	1734	805	816	3355
Total deaths	139	42	26	207
IHMR	8	5.2	3.2	6.2
Total modifiable factors	259	239	40	538
	% of deaths	*% of deaths*	*% of deaths*	*% deaths*
Under 1 year of age	57.3	68.0	40.0	58.0
Normal weight-for-age	30.4	22.0	0	24.8
Underweight-for-age (UWFA)	37.0	41.0	12.0	35.0
Severe malnutrition	23.2	27.0	80.0	31.0
Referral inside drainage area	90.6	85.7	82.0	88.3
Mother alive and well	68.0	81.0	36.0	67.0
Mother sick	11.6	2.0	32.0	11.7
Mother dead	9.4	14.0	24.0	12.0
HIV laboratory negative	14.5	6.0	4.0	11.0
HIV laboratory positive	41.3	39.0	88.0	46.3
HIV-exposed, but not tested	11.8	16.0	0	11.2
PMTCT prophylaxis given	9.5	5.9	8.0	8.4
PMTCT prophylaxis not given	18.1	11.8	40.0	19.6
Mother HIV negative	17.4	6.0	12.0	14.0
PMTCT prophylaxis unknown	49.3	76.0	36.0	54.0
Folders present records complete	59.4	41.0	96.0	60.7

Regional Facility: Pelonomi Hospital

In 2007, Pelonomi Hospital registered 1 734 admissions to the general paediatric wards. Of these, 139 children had died, giving an in-hospital mortality rate (IHMR) of 8%. The deaths were those in the general paediatric wards and in intensive care units. Deaths that may have occurred in casualty (including those Dead-on-Arrival) or those that may have died as a complication of surgical treatment were not included.

Of those children who died at Pelonomi Hospital, slightly more were female (54%) compared to males (46%), and 57% were under one year of age. Of the children who died, 30% were of normal weight-for-age, with 37% underweight-for-age, and 27% severely malnourished at the time of death. Forty-three percent of the deaths took place within 24 hours of hospital admission. Of those children that were referred to Pelonomi Hospital and died, 45% were referred from another hospital, 32% from the clinics and 23% from the private sector. Of those dying at Pelonomi Hospital 91% were regarded as having come from inside the drainage area of the hospital.

Regarding the parental wellbeing, the mother was the primary caregiver of 70% of the children who died, the grandmother in 10%, and other family members were regarded as the primary caregiver in 10%. It was unknown who the primary caregiver was in 10% of the cases. Sixty-eight percent of the mothers were alive and well, 10% were known to have been dead prior to their child's death and 12% of the mothers were severely ill. Only 24% of the fathers were known to be well, and 5% were already dead at the time of their child's death. In 67% the father's wellbeing was not known.

Of those children recorded to have died at Pelonomi Hospital, 41% were known to be infected with HIV, a further 11% were known to be exposed to HIV but not tested, and only 14% of the children were HIV negative. In 30% of the children who died, no HIV test was done or the result was unavailable at the time of death. In only 5%, the result was absent and the test not deemed to have been indicated.

In only 17% of cases where the child died was the maternal HIV test known to be negative, 10% of children were known to have received PMTCT prophylaxis, and 20% of the deaths were known not to have received PMTCT prophylaxis even though it was indicated.

In slightly more than half of the deaths at Pelonomi Hospital, information about PMTCT prophylaxis was unknown. Only 7% of the children that died were on antiretroviral treatment (ART) at the time of death, with 41% of the children not receiving ART even though it was indicated. Considering that almost 60% of deaths were under the age of one year, this does not reflect well on the ability to

prevent mother-to-child transmission in the catchment areas of this regional hospital.

With regard to the main cause of death, it was significant that 22% of the deaths were assessed to be due to Pneumocystis infection and 26% were thought to have been due to serious bacterial septicemia. Acute gastroenteritis with hypovolaemic shock and lower respiratory tract infections contributed to 9.5% and 8% of the deaths respectively. Bacterial meningitis accounted for only 5% of deaths with TB meningitis recorded in 4%. Pulmonary TB also contributed to 4% of the deaths.

With respect to the modifiable factors at Pelonomi Hospital, almost half were assessed as being the responsibility of the caregiver, with the rest being divided up equally between clinical personnel care in clinics, the emergency department and the ward.

The most common modifiable factors of the caregiver were delay in seeking care and not recognizing the severity of illness. Modifiable factors ascribed to the clinic personnel were inaccurate and incomplete assessment of the medical condition and delayed referral, with inability to access the healthcare facility also being significant. The modifiable factors in the emergency department and wards were mainly regarded to be insufficient assessment and management of the condition.

District Facility: Metsimaholo Hospital (northern Free State)

During 2007, Metsimaholo Hospital registered 805 admissions to the general paediatric wards. Of these, 42 children were recorded to have died, giving an in-hospital mortality rate of 5.2%. The deaths were those in the general paediatric wards and included those deaths that may have occurred in casualty and those children brought in as Dead-on-Arrivals.

Of those children who died at Metsimaholo Hospital, slightly more were female (43%) compared to males (57%). Sixty-eight percent of children that died at Metsimaholo Hospital were under the age of one year. Of those children that died, 22% were regarded to be normal weight-for-age, 41% were underweight-for-age and 27% were severely malnourished at the time of death. Forty-one percent of the deaths took place within 24 hours of hospital admission. Of those children

that were referred to Metsimaholo Hospital and died, 67% were referred from the clinics and 33% from the private sector. Eighty-five percent of those that died at Metsimaholo Hospital were regarded as having come from inside the drainage area of the hospital.

Regarding the parental wellbeing, for 78% of the children that died the mother was the primary caregiver, and the grandmother was in 17%. The majority of mothers (81%) were regarded as alive and well and 14% were known to have been dead prior to their child's death. Only 6.8% of the fathers were known to be well and in 92%, the father's wellbeing was not known.

Of those children recorded to have died at Metsimaholo Hospital, 39% were known to be infected with HIV, a further 16% were known to be exposed to HIV but not tested and only 6% of the children were known to be HIV negative. In 18% of the children that died, no HIV test was done nor was a result available at the time of death.

The maternal HIV test was negative in only 6% of cases where the child died, and 12% of children were known to have received prevention of mother-to-child transmission (PMTCT) prophylaxis.

In the majority (76%) of deaths at Metsimaholo Hospital, information about PMTCT prophylaxis was unknown. Only 12% of the children who died were on ART at the time of death, with 39% of the children not receiving ART although it was indicated. Considering that almost 70% of deaths were under the age of one year, this does not reflect well on the ability to prevent mother-to-child transmission in the catchment areas of this hospital.

With regard to the main cause of death it needs to be noted that 41% of the deaths were assessed to be caused by acute respiratory tract infections and 12% were thought to have been due to serious bacterial septicemia. Acute gastroenteritis with hypovolaemic shock contributed to 9.8% of the deaths.

With respect to the modifiable factors at Metsimaholo Hospital, only a quarter were assessed as being the responsibility of the caregiver, with 40% being identified as being the responsibility of the casualty area, and 20% the responsibility of the ward.

The most common modifiable factors of the caregiver were seen to be delay in seeking care and not recognizing the severity of the illness. Inappropriate nutrition is common in this hospital area. Modifiable factors ascribed to the casualty area were poor communication of personnel and lack of drugs, whereas for the ward personnel it amounted to lack of drugs, poor communication, and lack of access to further referral of these patients.

District Facility: National District Hospital (Bloemfontein)

During 2007, National District Hospital registered 816 admissions to the paediatric ward. Of these, 26 children were recorded to have died, giving an in-hospital mortality rate of 3.2%. The deaths were those in the general paediatric ward and included those known to have died in the casualty before reaching the ward itself. Children brought in as Dead-on-Arrivals were not included during this period.

Of those children who died at National District Hospital, slightly more were female (56%) compared to males (44%). Forty percent of children who died at National District Hospital were under the age of one year, with less than 4% being neonates. Of those children who died, 12% were regarded as underweight-for-age and 88% as severely malnourished at the time of death. It is of note that not one child who died at National District Hospital was categorized as "normally nourished" on admission. Sixteen percent of the deaths took place within 24 hours of hospital admission and more than a quarter of the children died after being in hospital for longer than two weeks. Of those children that were referred to National District Hospital and died, 53% were referred from another hospital, 41% from the clinics and only 6% from the private sector. Eighty-one percent of those who died at National District Hospital were regarded as having come from inside the drainage area of the hospital.

Regarding the parental wellbeing, in 72% of the children who died the mother was the primary caregiver and the grandmother in 20%. Only 36% of the mothers were regarded as alive and well, with 24% known to have been dead prior to their child's death and 32% of the mothers known to be severely ill. Only 16% of the fathers were known to be well and 28% were already dead at the time of their child's death. In 65%, the father's wellbeing was not known.

Of those children recorded to have died at National District Hospital 88% were known to be infected with HIV, and only 4% of the children were HIV negative.

In only 12% of cases where the child died was the maternal HIV test known to be negative, 8% of children were known to have received PMTCT prophylaxis and in 44% of the deaths PMTCT prophylaxis was not received even though it was indicated.

In 36% of the deaths at National District Hospital, information about PMTCT prophylaxis was unknown. Only 28% of the children who died were on ART at the time of death with a further 56% of the children not receiving ART even though it was indicated.

With regard to the main cause of death at National District Hospital, it is noted that 40% of the deaths were due to chronic or acute diarrhoea, 25% were due to lower respiratory tract infections, and 12% were due to pulmonary as well as extra pulmonary TB.

The majority of modifiable factors were in the domain of the caregiver of the child.

The most common modifiable factors regarding the caregiver were delay in seeking care and inadequate nutrition. The modifiable factors in the ward were few.

These figures clearly show that the National District Hospital in Bloemfontein fulfills the function of being a terminal care station for many of the terminal HIV-infected children that have fallen through the net of PMTCT prophylaxis. They mainly succumb to chronic diarrhoea and related complications, and have not benefited from ART.

Conclusion

Combining data for the Free State facilities can be done with Child PIP, but this does not necessarily give a true picture for the entire Free State. The data come from only one regional and two very different district hospitals and are therefore not representative for the entire province. The use of Child PIP has steadily grown in the Free State and interest is being shown by increasing numbers of facilities.

Northern Cape

Introduction

The Northern Cape serves a population of 1 200 000. The province covers 28% of the surface area of South Africa. Distances are therefore a major problem in healthcare delivery.

Kimberley Hospital was the only site in the Northern Cape where the Child Healthcare Problem Identification Programme (Child PIP) was conducted in the three years, 2005 to 2007. It is an 825 bed hospital providing level one, two and three services and is the only regional hospital in the Northern Cape. There are 20 level one hospitals and 11 community health centres in the province. In Kimberley, nine primary healthcare clinics refer patients to Kimberley Hospital.

The paediatric department at Kimberley Hospital managed 5 287 inpatients (paediatric and neonatal) and 10 329 outpatients during 2007. The department has a paediatric antiretroviral treatment (ART) programme. HIV and AIDS contribute 40% to the outpatient workload. An outreach service to Upington, Springbok, Calvinia, De Aar and Kuruman is provided.

Oncology, cardiology and complex paediatric surgery patients are referred to Universitas Hospital in Bloemfontein.

Facilities at Kimberley Hospital include a 5 bed neonatal high-care unit where babies weighing more than 800 grams can be ventilated, a 6 bed paediatric high-care unit that also offers ventilation, a 46 bed general paediatric ward, a 30 bed neonatal unit, a 22 bed paediatric surgical ward, and 6 private beds. Breastfeeding mothers are accommodated on hospital premises and mothers of premature babies in a ten bed Kangaroo Mother Care (KMC) facility in the neonatal unit.

Full-time, non-rotating staff consists of one paediatrician, one registrar and five medical officers. There is one part-time paediatrician. The rotating staff consists of three community medical officers (six-month rotation) and six interns (four-month rotation).

Methods

Morbidity and mortality meetings were held in the morning from Monday to Friday, before daily activities started. On average, these

meetings were attended by 14 doctors and 6 nurses from the wards and lasted 30 to 45 minutes.

During this meeting, all mortalities were discussed in detail. Final diagnosis was assigned and modifiable factors were identified. The attending doctor was responsible for completing the audit form. Data capturing was done by the author.

Results

Baseline data

The data representing the Northern Cape are from Kimberley Hospital only. Admissions included medical and surgical patients.

Northern Cape	*2005*	*2006*	*2007*
Total admissions	3887	3513	4528
Total deaths	166	192	137 (28)*
In-hospital mortality rate (%)	4.3	5.5	3.0
Total modifiable factors	323	374	437
Modifiable factor rate (per death)	1.9	1.9	2.7

**28 deaths on arrival (DOAs) or in casualty were also documented during 2007*

Information about children who died

Demographics

Age	*2005 (% of deaths)*	*2006 (% of deaths)*	*2007 (% of deaths)*
0-1 week	35	30	36
1 week-1 month	11	9	6
1 month-1 year	31	31	30
1-5 years	18	22	19
5-13 years	4	8	9
13-18 years	1	0	0
Total	100	100	100

There were 5 755 births in Kimberley, 1 067 neonatal admissions and 117 neonatal deaths in this group. These patients were not included in this report. They were only used in the age analysis.

Health context

NUTRITION

Nutritional category	*2005 (% of deaths)*	*2006 (% of deaths)*	*2007 (% of deaths)*
Normal	27.1	30.2	39
UWFA	33.1	40.1	28
Kwashiorkor	4.2	3.6	4
Marasmus	27.1	16.7	21
Marasmic Kwashiorkor	5.4	7.8	7
Unknown	3.1	1.6	1
Total	100	100	100

HIV&AIDS

Laboratory category	*2005 (% of deaths)*	*2006 (% of deaths)*	*2007 (% of deaths)*
Negative	17.5	20.3	40
Exposed	13.3	8.3	10
Infected	38.6	31.8	36
Unknown	30.6	39.6	14
Total	100	100	100

Clinical HIV staging	*2005 (% of deaths)*	*2006 (% of deaths)*	*2007 (% of deaths)*
Stage I	0.6	0.5	3.6
Stage II	1.8	1.0	0.6
Stage III	9.0	5.2	4.2
Stage IV	38.6	33.9	33.3
Not staged	38.0	45.3	49.8
Unknown	12.0	14.1	8.5
Total	100	100	100

PMTCT

NVP prophylaxis	*2005 (% of deaths)*	*2006 (% of deaths)*	*2007 (% of deaths)*
NVP given	14.5	10.9	16.4
NVP not given	25.3	22.9	21.2
Mother negative	18.1	13.5	32.1
Unknown	42.1	52.7	30.3
Total	100	100	100

FEEDING PRACTICE

Infant feeding	*2005 (% of deaths)*	*2006 (% of deaths)*	*2007 (% of deaths)*
Exclusive breast	13.3	15.1	24.8*
No breast, ever	9.6	5.7	6.1
Mixed	12.7	18.2	25.5
Unknown	64.4	61.0	43.6
Total	100	100	100

** Data not correlating with experience as exclusive breastfeeding is rare in the Northern Cape*

PCP PROPHYLAXIS

Cotrimoxazole	*2005 (% of deaths)*	*2006 (% of deaths)*	*2007 (% of deaths)*
Current	18.1	21.4	24.8
Ever	1.2	0.5	2.4
Never (but indicated)	11.4	16.1	15.2
Never (not indicated)	8.4	32.3	43.7
Unknown	60.9	29.7	13.9
Total	100	100	100

ART (CHILD DEATHS)

ART – child deaths	*2005 (% of deaths)*	*2006 (% of deaths)*	*2007 (% of deaths)*
Current	7.8	5.7	7.9
Ever	0.6	0	0.6
Never (but indicated)	45.2	32.3	33.9
Never (not indicated)	9.6	46.9	48.5
Unknown	36.8	15.1	9.1
Total	100	100	100

Causes of child deaths

All diagnoses: top 5	*2005 (% of diagnoses)*	*2006 (% of diagnoses)*	*2007 (% of diagnoses)*
Septicaemia	21.4	22.8	20.3
Pneumonia, ARI	24.1	12.5	13.8
TB	9.3	9.1	11.3
Acute diarrhoea	9.3	8.1	12.6
PCP	7.0	8.1	6.9
Main diagnoses: top 5	***2005 (% of deaths)***	***2006 (% of deaths)***	***2007 (% of deaths)***
Septicaemia	37	38	30
Pneumonia, ARI	33	21	21
TB	14	15	17
Acute diarrhoea	14	14	12
PCP	11	14	10

Information about quality of child healthcare

Records	***2005 (% of deaths)***	***2006 (% of deaths)***	***2007 (% of deaths)***
Folder not available	3.6	2.1	3.0
Folder available: inadequate	25.9	25.5	18.3
Folder available: OK	70.5	72.4	78.7
Total	100	100	100

The following tables show the rates of modifiable factors per 100 deaths in terms of the place where they occur and the people responsible.

Modifiable factors: where?	***2005 (rate)***	***2006 (rate)***	***2007 (rate)***
Home	77	120	172
Primary health clinic	48	30	70
Admission & Emergency care	25	9	10
Ward	40	20	13
Modifiable factors: who?	***2005 (rate)***	***2006 (rate)***	***2007 (rate)***
Caregiver and family	79	128	179
Administrator	24	9	20
Clinical personnel	92	58	76

Discussion

About children who died

DEMOGRAPHICS

Information on the age of patients was collected from the Perinatal Problem Identification Programme (PPIP) and Child PIP programmes. A total of 117 neonatal deaths and 137 paediatric deaths were seen in 2007. There were also 28 deaths on arrival or in casualty during 2007. The in-hospital mortality rate (IHMR) dropped from 5.5 per 100 admissions in 2006 to 3.0 in 2007. Seventy-two percent of children died before one year of age, with 42% of these in the neonatal period.

HEALTH CONTEXT

Poor nutritional status was a major contributor to deaths. Sixty-one percent of children who died were underweight-for-age and 32% were severely malnourished.

Thirty-six percent of the deaths had proven HIV infection with either a positive polymerase chain reaction (PCR) or HIV Elisa test. Forty-two percent of patients were clinically staged.

PMTCT prophylaxis was given in 16% of cases. In 21% of cases prophylaxis was not given. Four of the mothers who tested HIV-negative during pregnancy had HIV-infected children. Repeat HIV testing in pregnant mothers will have to be considered.

In 34% of cases, ART was indicated. In most instances the diagnosis was made too late and thus the majority of the deaths on treatment happened during the first six months.

INPATIENT MORTALITY

There was a decrease in IHMR to 3.0/100 admissions. This translates into 1 death for every 33 admissions. The IHMR for underweight children of 11.1/100 admissions translates to 1 death for every 9 admissions.

CAUSES OF DEATH

Septicaemia and acute respiratory infections were still the leading causes of death, with malnutrition and HIV the major underlying problems.

There was an increase in diarrhoea as main cause of death from 6.8% to 12.1%.

Tuberculosis mortality at 17% is a concern.

About quality of child healthcare

The rate of modifiable factors identified at Kimberley Hospital increased to 2.65 per death. Factors at home and at clinic level were still the major contributors.

Recommendations

Adopt recommendations from *Saving Children 2006* as provincial policy, and implement the following recommendations:

- Conduct a public campaign to persuade the community about benefits of exclusive breastfeeding for first six months of a child's life;

- Remove formula feeds from primary healthcare clinics;
- Establish feeding centres managed by dieticians or nutritional advisors;
- Weigh all children once a month until they are one year old, then every three months until they are five years old;
- Provide triple antiretroviral therapy for all HIV-infected pregnant women, continuing for one year post-delivery to allow them to breastfeed their babies;
- Repeat rapid HIV tests on all pregnant women when they are admitted for delivery;
- Introduce the integrated management of childhood illness (IMCI) Household and Community component as a matter of urgency;
- Introduce pneumococcal and rotavirus vaccines;
- Expand the Child PIP audit programme to all hospitals in the province; and
- Appoint a Child PIP co-ordinator in the Maternal, Child and Women's Health directorate.

Conclusion

Data capturing improved considerably during 2007, assisted by the implementation of a weekly statistics meeting.

Child PIP should be expanded to all hospitals in the province to benefit all the children in the Northern Cape.

Major interventions at political and managerial levels will be necessary to reduce childhood mortality by two thirds at 2015. Without trained staff, an informed community, essential equipment and drugs, well-nourished children and a decrease in paediatric AIDS, this will only remain a dream.

Eastern Cape

Introduction

The Eastern Cape encloses 169 580 square kilometres, and in surface area is the second largest province in the country. The average population density in 2002 was 41 people per square kilometre and approximately 63% of the provinces' people live in the rural areas. The Eastern Cape is home to 6,897 685 people live in the Eastern Cape, approximately 15.3% of South Africa's population.

According to the 2001 census, 23% of the provinces' population over 20 years of age had no formal school education and 55% of those 16 to 64 years of age were unemployed. The Eastern Cape has the second highest rate of poverty in South Africa with 47% of the provinces' people living below the poverty line. Less than half the households lived in formal housing.

Mthatha, Port Elizabeth and East London Hospitals Complex provide tertiary services, including oncology and paediatric surgical services. The Childhood Problem Identification Programme (Child PIP) has been introduced into several major centres in the province and due to the dedicated work of certain individuals has been championed successfully in some rural hospitals.

Methods

Child PIP is relatively new in the Eastern Cape. Much of the data in 2006 did not cover the entire year, thus no comparisons are drawn between 2006 and 2007 in this report. However, data were collected from three hospitals in the Eastern Cape for the period 1 January to 31 December 2007, i.e. Frere Hospital (providing level one, two and three care); Uitenhage Hospital (level one and two care); and Zithulele Hospital (level one care). These three hospitals thus represent all levels of care in the Eastern Cape.

Results

Baseline data

Eastern Cape	*2005*	*2006*	*2007*
Total admissions	2927	2515	3545
Total deaths	67	67	114
In-hospital mortality rate (%)	2.3	2.7	3.2
Total modifiable factors	-	130	203
Modifiable factor rate (per death)	-	1.9	1.8

The remaining tables show 2007 for the Eastern Cape data only.

Information about children who died

Demographics

Age	*% of all deaths*
0-1 month	5.9
1 month-1 year	60.8
1-5 years	26.1
5-13 years	7.2
Total	100

Health context

NUTRITION

Nutritional category	*% of all deaths*
OWFA	1.3
Normal	22.9
UWFA	24.8
Kwashiorkor	8.5
Marasmus	21.6
Marasmic-Kwashiorkor	5.2
Unknown	15.7
Total	100

HIV&AIDS

Laboratory category	*% of all deaths*
Negative	14.4
Exposed	25.5
Infected	30.7
Unknown	22.4
Total	100

Clinical HIV staging	*% of all deaths*
Stage I	3.9
Stage II	5.2
Stage III	11.1
Stage IV	14.4
Not staged	33.3
Unknown	32.1
Total	100

PMTCT

Nevirapine (NVP) prophylaxis	*% of all deaths*
NVP given	19.0
NVP not given	7.8
Mother negative	10.5
Unknown	62.7
Total	100

FEEDING PRACTICE

Infant feeding	*% of all deaths*
Exclusive breast	3.3
No breast, ever	28.1
Mixed	4.6
Unknown	64.0
Total	100

PCP PROPHYLAXIS

Cotrimoxazole prophylaxis	*% of all deaths*
Current	37.9
Ever	2.0
Never (but indicated)	7.8
Never (not indicated)	14.4
Unknown	37.9
Total	100

ART (CHILD DEATHS)

ART – child deaths	*% of all deaths*
Current	3.9
Ever	2.0
Never (but indicated)	26.8
Never (not indicated)	32.0
Unknown	35.3
Total	100

Causes of child deaths

All diagnoses: top 5	*% of all diagnoses*
Pneumonia, ARI	19.4
Acute diarrhoea, hypovolaemic shock	12.5
Other endocrine, nutritional, metabolic	8.2
Anaemia	6.0
Chronic diarrhoea	6.0

Information about quality of child healthcare

Records	*% of all deaths*
Folder not available	6.6
Folder available: incomplete and/or inadequate	58.8
Folder available: OK	34.6
Total	100

The following tables show the occurrence and rate of modifiable factors in terms of the place where they occur and the people responsible.

Modifiable factors: where?	*% of MFs*
Home	60.9
Primary health clinic	5.8
Admission & Emergency care	17.6
Ward	11.1
Records	4.6
Total	100
Modifiable factors: who?	***MF rate per 100 deaths***
Caregiver and family	90.3
Administrator	15.7
Clinical personnel	59.7
Total	178

Discussion

About children who died

HEALTH CONTEXT

Nearly 60% of children who died were malnourished.

The significant proportion of "unknown prevention of mother-to-child transmission (PMTCT)" status of children is partly due to an unworkable coding system used to disguise the infant's HIV status on the Road-to-Health Chart. Relieving the crushing health burden due to poverty, and full implementation of PMTCT of HIV and cotrimoxazole prophylaxis, remain the areas that will yield the best returns in terms of reducing child mortality rapidly. Large distances with significant transport delays and inadequate attention to hydration status prior to the transfer of children results in the unnecessary deaths of many children. Children are dying at a young age with advanced (Stage III and IV) HIV disease. The access to antiretroviral treatment (ART), while improving, is far from ideal, with access being limited to a few centres in the province.

CAUSE OF DEATH

Pneumonias (including Pneumocystis jirovecii), diarrhoeal diseases and malnutrition were the main contributors to the cause of death of children in the Eastern Cape. While "anaemia" was listed as an important cause of death, this was a technical matter, and septicaemia and meningitis were more accurate common causes of death.

About quality of child healthcare

Child PIP data suggest that a significant proportion of modifiable factors were due to caregivers, mostly in delay in seeking assistance. Particularly in diarrhoeal disease, the contribution of traditional remedies complicated and exacerbated the presentation of ill children in many instances.

Recommendations

Child PIP needs to be extended to as many hospitals in the Eastern Cape as possible. This will immediately improve child healthcare as it raises awareness of why children are dying and affords the opportunity for immediate and longer-term solutions to be implemented. The information provided by Child PIP needs to be communicated to provincial child health managers in a formal way in order for that information to be of benefit to all children in the province.

Conclusion

While of enormous benefit, Child PIP is time consuming and requires dedicated teams of people on site. Some aspects of Child PIP can be technically difficult for new sites starting the programme, and at smaller sites, this remains a challenge. Ongoing forums on Child PIP will be designed to assist with initiating and sustaining Child PIP in the Eastern Cape and spreading the message of systematically auditing child deaths. A simplified monthly "core data" element may be of use at those sites starting out or with limited human resources.

Western Cape

Introduction

The Western Cape has a mixed population ranging from those living in extremely remote rural areas to those living in urban areas. Most of the population lives in the Cape Peninsula area. The estimated population is 4,5 million with more than 60% living in urban areas. A large number of seasonal labourers are employed on one-off temporary contracts, leaving an increasing number of jobless people mostly without permanent housing. Patients often move to the Western Cape to access health services, coming from areas where there are little or none.

The Western Cape is divided five districts. Karl Bremer, Hottentots Holland, Somerset, GF Jooste and Khayelitsha Hospitals are the level one hospitals referring children to Tygerberg and Red Cross War Memorial Children's Hospitals (level three) in the City of Cape Town Metropolitan Municipality. High-risk neonates are accommodated at Groote Schuur, the other level three hospital in the Western Cape. The remaining five districts are in areas that are more rural and refer patients to one of the three regional (level two) hospitals, i.e., West Coast refers to Paarl Hospital; Overberg and Cape Winelands refer to Worcester Hospital; and Eden and Central Karoo refer to George Hospital.

Paarl, Worcester and George Hospitals all have mixed medical and surgical wards. Each of the three regional hospitals has two paediatricians and four to six medical officers or equivalent. The level one hospitals have two to five medical officers or community service doctors but these doctors are responsible for all patients in the hospital and are not only dedicated to paediatrics.

Methods

Two of the three regional hospitals, Worcester and George, used the Child Healthcare Problem Identification Programme (Child PIP) and contributed data for 2007. In the Overberg/Cape Winelands areas, there are seven level one hospitals; six had 2007 data, although not for the entire year. Data from Worcester Hospital was collected for the whole year, but data from Tygerberg and George Hospitals was incomplete.

In most hospitals, mortality meetings were held monthly. The level one hospitals in the Overberg district were all visited once a month when data was collected and patient data discussed.

Results

Baseline data

Western Cape	*2006*	*2007*
Total admissions	5950	7608
Total deaths	69	87
In-hospital mortality rate (%)	1.2	1.1
Total modifiable factors	207	136
Modifiable factor rate (per death)	3.0	1.6

Information about children who died

Demographics

Age	*2006 (% of deaths)*	*2007 (% of deaths)*
0-1 month	4.7	7.0
1 month-1 year	57.0	66.1
1-5 years	31.4	22.6
5-13 years	5.7	4.3
13-18 years	1.2	0
Total	100	100

Health context

NUTRITION

Nutritional category	*2006 (% of deaths)*	*2007 (% of deaths)*
Normal	26.7	34.8
UWFA	32.6	32.2
Severe malnutrition	36.1	31.3
Unknown	4.6	1.7
Total	100	100

HIV&AIDS

Laboratory category	*2006 (% of deaths)*	*2007 (% of deaths)*
Negative	34.9	33.9
Exposed	9.3	7.8
Infected	26.7	27.8
Unknown	30.1	30.5
Total	100	100
Clinical HIV staging	***2006 (% of deaths)***	***2007 (% of deaths)***
Stage I	0	0
Stage II	3.5	5.2
Stage III	5.8	5.2
Stage IV	17.4	19.1
Not staged	68.6	59.1
Unknown	4.6	11.3
Total	100	100

PMTCT

Nevirapine (NVP) prophylaxis	*2006 (% of deaths)*	*2007 (% of deaths)*
NVP given	26.7	19.1
NVP not given	11.6	13.0
Mother negative	40.8	29.6
Unknown	20.9	38.3
Total	100	100

FEEDING PRACTICE

Infant feeding	*2006 (% of deaths)*	*2007 (% of deaths)*
Exclusive breast	7.0	8.7
No breast, ever	17.4	12.2
Mixed	36.0	31.3
Unknown	39.6	47.8
Total	100	100

PCP PROPHYLAXIS

Cotrimoxazole prophylaxis	*2006 (% of deaths)*	*2007 (% of deaths)*
Current	19.8	20.0
Ever	3.5	2.6
Never (but indicated)	8.1	9.6
Never (not indicated)	46.5	41.8
Unknown	22.1	26.0
Total	100	100

ART (CHILD DEATHS)

ART – child deaths	*2006 (% of deaths)*	*2007 (% of deaths)*
Current	2.3	6.1
Ever	3.5	0.9
Never (but indicated)	26.7	23.5
Never (not indicated)	55.9	50.4
Unknown	11.6	19.1
Total	100	100

Causes of child deaths

All diagnoses: top 5	*2006 (% of deaths)*	*2007 (% of deaths)*
Septicaemia, serious bacterial infection	22.1	20.9
Pneumonia, ARI	19.8	18.3
Acute diarrhoea, hypovolaemic shock	16.3	13.0
Meningitis: Bacterial	3.5	5.2
PCP (suspected)	8.1	5.2

Information about quality of child healthcare

Records	*2006 (% of deaths)*	*2007 (% of deaths)*
Folder not available	1.2	0.9
Folder available: incomp. and/or inad.	32.5	25.4
Folder available: OK	66.3	73.7
Total	100	100

The following tables show the occurrence of modifiable factors in terms of the place where they occur and the people responsible.

Modifiable factors: where?	*2006 (% of deaths)*	*2007 (% of deaths)*
Home	43.1	43.6
Primary health clinic	16.7	21.4
Admission & Emergency care	14.9	13.6
Ward	19.6	17.7
Total	94.3	96.3
Modifiable factors: who?	*2006 (% of deaths)*	*2007 (% of deaths)*
Caregiver and family	46.6	45.4
Administrator	10.0	10.5
Clinical personnel	43.4	44.1
Total	100	100

Discussion

About children who died

DEMOGRAPHICS

Children in the age group, one month to one year, who have been malnourished, are the most vulnerable with the highest death rate. Almost 66% of deaths occurred in children under one year of age.

HEALTH CONTEXT

The general nutritional status was also of concern; in more than two thirds of deaths, children were malnourished. Lack of HIV testing and staging was also worrying. More than 30% of children died with an "unknown" HIV status, increasing markedly from 2006. This raises questions as to the success of the prevention of mother-to-child transmission (PMTCT) programme.

INPATIENT MORTALITY

The in-hospital mortality rate (IHMR) did not change much from 2006, still being 1.1% in 2007.

CAUSES OF DEATH

There was not much change in cause of death data with diarrhoeal disease, septicaemia, pneumonia, Pneumocystis jirovecii pneumonia (PCP) and meningitis still in the top five positions. This was the same from hospital to hospital and from rural to urban areas. One third of children who died were HIV-infected. Of concern was that 20% of those infected were stage IV, something that needs to be addressed.

About quality of child healthcare

Most modifiable factors occurred at home with less in the primary healthcare and hospital settings. The inability of parents to access healthcare especially after hours is of concern and often delay in seeking care was not so much parents not caring as the difficulty they experienced organising transport and accessing the health system. However, lack of clinic visits and immunisation were also a problem and education of mothers needs to be addressed.

At hospital level, the biggest problem, especially in the level one setting, was staffing. The lack of sufficient staffing after hours was the main cause of increased mortality. The level two hospitals all have a dedicated paediatrics on-call duty roster. There was no specific single modifiable factor in the clinical setting but a wide spectrum of single occurrences. Protocols were in place in most hospitals and inadequate care may reflect a lack of staff rather than a lack of knowledge.

Recommendations

Child PIP has been rolled out in the entire old Overberg/Cape Winelands area. A Child PIP workshop was held in the Western Cape towards the end of 2008, which included the provincial department of health (DOH), regional directors and personnel from across the spectrum of hospitals in the Western Cape (WC). The Child PIP process was accepted, and the following recommendations were agreed to and included in the WC Director and DOH Annual Performance Plan - a giant leap for Child PIP in the Western Cape. These recommendations have since been discussed further with the DOH to ensure that they are written into plans and policies.

1) A standard admission sheet for all children and all hospitals must be instituted including necessary data for the Child PIP process and relevant growth indices.
2) Gastric aspirates must be done for all children presenting with failure to thrive or respiratory tract infection.
3) A dedicated and renewed effort must be made by all involved to ensure the PMTCT process is addressed and improved.
4) Renewed efforts must be made to ensure all children with TB contacts are traced and managed correctly.
5) Availability of drugs must be ensured, i.e., vitamins, Potchlor, relevant antibiotics to all clinics and level one hospitals.
6) Training of clinic staff must be a priority and will be addressed in small groups.
7) Outreach to tertiary hospitals by the WC coordinator must be done to ensure expansion of Child PIP in all their wards.
8) Strengthening of the Western Cape network must take place via quarterly and six-monthly meetings between hospitals and regions.
9) The RTHC must be seen and incorporated as an absolute essential document for the health of the child by the family, clinical and hospital personnel.

Conclusion

Child PIP truly came of age in the Western Cape during 2007. Because of the data and networking, several very good and essential processes were started. The Western Cape provincial department of health included clinicians from grass-roots level into planning and policy making which was a great step in improving child health care. We are enthusiastic about the doors that have opened, and opportunities that were created because of Child PIP during 2007 and we look forward to the next year and the continued growth in the healthcare system due to the data gained from the programme.

List of Abbreviations and Definitions

	Definitions
A&E	Admission and Emergency
ARI	Acute Respiratory Infection
ART	Antiretroviral Treatment
CFR	Case Fatality Rate: Number of deaths in a specific age group during a specific period divided by number of admissions in the same age group and period. Can also be calculated for specific disease categories.
Case management	Drug treatment and non-drug treatment, intravenous fluids, feeding, communication with the caregiver and follow-up.
CHC	Community Health Centre
Child PIP or ChIP	Child Healthcare Problem Identification Programme
Clinic nurse	Nurse employed by the district, working in a peripheral clinic
Clinical personnel	Nurses and doctors
DOA	Dead On Arrival
DOH	Department of Health
EDL	Essential Drug List

EPI-SA	Expanded Programme on Immunisation South Africa
ETAT	Emergency Triage Assessment and Treatment
FIO	Facility Information Officer
HIV & AIDS	Human Immunodeficiency Virus & Acquired Immunodeficiency Syndrome
HSRC	Human Sciences Research Council
IHMR	In-Hospital Mortality Rate
IMCI	Integrated Management of Childhood Illness (a WHO training and implementation programme for paediatric primary care)
IV fluids	Intravenous fluids
Health worker	Doctors, nurses, paramedical health workers
(P)ICU	(Paediatric) Intensive Care Unit
IMR	Infant Mortality Rate
INP	Integrated Nutrition Programme
KMC	Kangaroo Mother Care
MCWH	Maternal, Child and Women's Health
MF	Modifiable Factor: Events, actions, omissions contributing to the death of a child or to substandard care, in a child who died.
M&M	Morbidity and Mortality meeting
Mortality review meetings	Regular audit meetings with all health workers involved, to discuss paediatric deaths that have occurred in health institutions.
MRC	Medical Research Council

NCCEMD	National Committee for Confidential Enquiries into Maternal Deaths (could be regarded as maternal component of PPIP and Child PIP)
NGO	Non-Governmental Organisation
OPD	Outpatient Department
OWFA	Overweight-For-Age
PCP	Pneumocystis carinii or Pneumocystis jirovecii pneumonia
PCR	Polymerase Chain Reaction blood test
PHC	Primary Health Care
PMTCT	Prevention of Mother-To-Child Transmission of HIV
QI	Quality Improvement
PPIP	Perinatal Problem Identification Programme
RTHC	Road-to-Health Chart: Under-five chart, patient-retained record of the child's weights, immunizations and health problems.
SAPA	South African Paediatric Association
Severe malnutrition	Marasmus, kwashiorkor and marasmic kwashiorkor
U5PIP	Under-five Problem Identification Programme
UWFA	Underweight For Age (below the 3rd centile for weight-for-age, according to the Wellcome classification)
VCT	Voluntary Counselling and Testing (for HIV)
WHO	World Health Organisation

Appendices

Appendix A: Data Tables for Chapter 1

Appendix B: Child PIP Data Capture Sheets

Monthly Tally

Deaths Register

Death Data Capture Sheet

Appendix C: Child PIP Code Lists

Cause of Death

Modifiable Factors

Appendix D: Additional Tools

Clerking Admission Sheet

Paediatric Ward Admissions and Discharge Register

Child PIP Mortality Review Process Guideline

Table A1. Admissions, Deaths and Modifiable Factors, Per Province: 2005-2007

	Gauteng			***Mpumalanga***			***Limpopo***			***North West***			***KwaZulu-Natal***		
Year	*2005*	*2006*	*2007*	*2005*	*2006*	*2007*	*2005*	*2006*	*2007*	*2005*	*2006*	*2007*	*2005*	*2006*	*2007*
No. of sites	2	2	2	2	2	6	1	2	1	5	5	5	5	9	17
Admissions	3169	3798	6734	2349	3598	5362	934	1730	955	5303	5921	5327	6346	15782	23189
Deaths	201	193	217	125	168	289	45	113	48	380	466	340	565	1254	1556
IHMR	6.3	5.1	3.2	5.3	4.7	5.4	4.8	6.5	5.0	7.2	7.9	6.4	8.9	7.9	6.7
Audited deaths	226	235	233	126	167	294	41	110	48	381	435	341	621	1432	1893
MFs (total)	394	305	341	171	282	611	140	315	129	1526	1115	1298	1240	2611	3559
MF rate per death	1.7	1.3	1.5	1.4	1.7	2.1	3.4	2.9	2.7	4.0	2.6	3.8	2.0	1.8	1.8

	Free State			***Northern Cape***			***Eastern Cape***			***Western Cape***			***Total***		
Year	*2005*	*2006*	*2007*	*2005*	*2006*	*2007*	*2005*	*2006*	*2007*	*2005*	*2006*	*2007*	*2005*	*2006*	*2007*
No. of sites	2	2	3	1	1	1	-	1	3	2	3	11	19	30	49
Admissions	1811	862	3356	3251	2751	4528	-	-	3836	529	5978	7702	23692	40420	60989
Deaths	86	20	207	132	97	137	-	-	135	6	72	87	1540	2383	3016
IHMR	4.7	2.3	6.2	4.1	3.5	3.0	-	-	3.5	1.1	1.2	1.1	6.5	5.9	4.9
Audited deaths	86	84	214	166	192	165	-	87	144	27	86	133	1677	2828	3555
MFs (total)	235	395	592	323	374	454	-	1	216	61	281	245	4091	5679	7445
MF rate per death	2.7	4.7	2.8	1.9	1.9	2.8	-	-	1.5	2.3	3.3	1.8	2.4	2.0	2.1

Notes:

- Data in the above tables are taken only from those sites that submitted data to the Child PIP database from 2005-2007. The numbers may differ in some instances from those published previously which combined paper- and computer-collated data.

Table A2. In-Hospital Mortality Rates by Age, Nutritional Status and Illness: 2005-2007

	Admissions			*Deaths*			*IHMR (%)*		
All admissions	**2005**	**2006**	**2007**	**2005**	**2006**	**2007**	**2005**	**2006**	**2007**
0-1 month	1349	2916	4430	74	150	176	5.5	5.1	4.0
1-12 months	8687	14354	23040	885	1270	1728	10.2	8.8	7.5
1-5 years	8516	13184	21223	409	591	727	4.8	4.5	3.4
5-13 years	4957	7336	10530	155	254	319	3.1	3.5	3.0
13-18 years	178	314	424	5	11	7	2.8	3.5	1.7
Total	23687	38104	59647	1528	2276	2957	6.5	6.0	5.0
Under-5 admissions									
Nutritional status									
≥ 3rd centile	5303	13262	24717	246	510	741	4.6	3.8	3.0
< 3rd centile	3558	6620	9034	517	545	772	14.5	8.2	8.5
Severe malnutrition	371	3422	5046	74	561	811	19.9	16.4	16.1
Unknown	6637	6665	7126	491	319	260	7.4	4.8	3.6
Illness									
ARI	4852	9704	14896	473	725	921	9.7	7.5	6.2
Acute diarrhoea	3520	7870	13017	254	456	651	7.2	5.8	5.0
Other	9475	13221	19462	634	736	1135	6.7	5.6	5.8

Table A3. Age and Gender of Deaths: 2005-2007

	2005		2006		2007	
Age	***No.***	***%***	***No.***	***%***	***No.***	***%***
0 - 1 month	253	15.1	215	7.6	221	6.2
1 month – 1 year	694	41.4	1597	56.5	2088	58.7
1 - 5 years	534	31.8	715	25.3	854	24.0
5 - 13 years	180	10.7	284	10.0	375	10.5
13 - 18 years	8	0.5	11	0.4	10	0.3
Unknown	8	0.5	6	0.2	7	0.2
Total	1677	100	2828	100	3555	100
Gender	***No.***	***%***	***No.***	***%***	***No.***	***%***
Female	760	45.3	1331	47.1	1636	46.0
Male	872	52.0	1433	50.7	1863	52.4
Unknown	45	2.7	64	2.3	56	1.6
Total	1677	100	2828	100	3555	100

Table A4. Referral Patterns of Deaths: 2005-2007

	2005		2006		2007	
Referred from	***No.***	***%***	***No.***	***%***	***No.***	***%***
Another hospital	262	27.3	347	32.1	418	28.6
Clinic	426	44.5	558	51.7	759	51.8
Private	119	12.4	169	15.6	281	19.2
Unknown	151	15.8	6	0.6	6	0.4
Total	958	100	1080	100	1464	100
Referral location	***No.***	***%***	***No.***	***%***	***No.***	***%***
Inside drainage area	641	73.1	757	87.7	1061	90.8
Outside drainage area	78	8.9	85	9.8	98	8.4
Unknown	158	18.0	21	2.4	10	0.9
Total	877	100	863	100	1169	100

Table A5. Length of Stay and Time of Deaths: 2005-2007

	2005		2006		2007	
Length of stay	***No.***	***%***	***No.***	***%***	***No.***	***%***
< 24 hours	531	31.7	949	33.6	1187	33.4
1 - 3 days	433	25.8	715	25.3	872	24.5
4 - 7 days	290	17.3	484	17.1	549	15.4
8 - 14 days	201	12.0	307	10.9	432	12.2
> 14 days	222	13.2	373	13.2	515	14.5
Total	1677	100	2828	100	3335	100
Time of death	***No.***	***%***	***No.***	***%***	***No.***	***%***
Weekday (07:00-19:00)	577	34.4	1017	36.0	1268	35.7
Weeknight (19:00-07:00)	513	30.6	946	33.5	1256	35.3
Weekend/Public Holiday	505	30.1	806	28.5	1007	28.3
Dead-on-arrival (DOA)	58	3.5	51	1.8	19	0.5
Unknown	24	1.4	8	0.3	5	0.1
Total	1677	100	2828	100	3555	100

Table A6. Social Context: Caregiver Data for Deaths: 2005-2007

	2005		*2006*		*2007*	
Primary Caregiver	***No.***	***%***	***No.***	***%***	***No.***	***%***
Mother	996	59.4	1849	65.4	2487	70.0
Grandmother	206	12.3	339	12.0	471	13.2
Father	9	0.5	28	1.0	32	0.9
Other	128	7.6	90	3.2	134	3.8
Unknown	338	20.2	522	18.5	431	12.1
Total	1677	100	2828	100	3555	100
Mother's wellbeing	***No.***	***%***	***No.***	***%***	***No.***	***%***
Alive and well	933	55.6	1765	62.4	2513	70.7
Dead	107	6.4	217	7.7	274	7.7
Sick	171	10.2	257	9.1	315	8.9
Unknown	466	27.8	589	20.8	453	12.7
Total	1677	100	2828	100	3555	100
Father's wellbeing	***No.***	***%***	***No.***	***%***	***No.***	***%***
Alive and well	321	19.1	746	26.4	1215	34.2
Dead	56	3.3	125	4.4	156	4.4
Sick	38	2.3	40	1.4	70	2.0
Unknown	1262	75.3	1917	67.8	2114	59.5
Total	1677	100	2828	100	3555	100

Table A7. Nutritional Status of Deaths: 2005-2007

	2005		*2006*		*2007*	
Nutritional category	***No.***	***%***	***No.***	***%***	***No.***	***%***
OWFA	15	0.9	27	1.0	39	1.1
Normal	365	21.8	734	26.0	966	27.2
UWFA	468	27.9	814	28.8	1098	30.9
Kwashiorkor	415	24.7	764	27.0	852	24.0
Marasmus	67	4.0	144	5.1	209	5.9
Marasmic Kwashiorkor	72	4.3	127	4.5	124	3.5
Unknown	275	16.4	218	7.7	267	7.5
Total	1677	100	2828	100	3555	100

Table A8. HIV Status of Deaths: 2005-2007

	2005		2006		2007	
Laboratory category	***No.***	***%***	***No.***	***%***	***No.***	***%***
Negative	135	8.1	296	10.5	458	12.9
Exposed	346	20.6	666	23.6	865	24.3
Infected	428	25.5	875	30.9	1153	32.4
Not tested (but indicated)	237	14.1	252	8.9	276	7.8
Not tested (not indicated)	29	1.7	114	4.0	190	5.3
Unknown	502	29.9	625	22.1	613	17.2
Total	1677	100	2828	100	3555	100
Clinical HIV staging	***No.***	***%***	***No.***	***%***	***No.***	***%***
Stage I	47	2.8	61	2.2	65	1.8
Stage II	91	5.4	105	3.7	107	3.0
Stage III	344	20.5	359	12.7	516	14.5
Stage IV	494	29.5	973	34.4	1120	31.5
Not staged (but indicated)	299	17.8	356	12.6	448	12.6
Not staged (not indicated)	72	4.3	416	14.7	674	19.0
Unknown	330	19.7	558	19.7	625	17.6
Total	1677	100	2828	100	3555	100

Table A9. PMTCT – Nevirapine Prophylaxis: 2005-2007

	2005		2006		2007	
Nevirapine prophylaxis	***No.***	***%***	***No.***	***%***	***No.***	***%***
Given	121	7.2	429	15.2	622	17.5
Not given	334	19.9	462	16.3	538	15.1
Mother negative	141	8.4	270	9.5	507	14.3
Unknown	1081	64.5	1667	58.9	1888	53.1
Total	1677	100	2828	100	3555	100

Table A10. PCP Prophylaxis in All Deaths (Cotrimoxazole): 2005-2007

	2005		2006		2007	
Cotrimoxazole prophylaxis	***No.***	***%***	***No.***	***%***	***No.***	***%***
Current	270	16.1	801	28.3	1008	28.4
Ever	30	1.8	82	2.9	97	2.7
Never (but indicated)	169	10.1	370	13.1	582	16.4
Never (not indicated)	106	6.3	461	16.3	736	20.7
Unknown	1102	65.7	1114	39.4	1132	31.8
Total	1677	100	2828	100	3555	100

Table A11. Cotrimoxazole Prophylaxis in PCP Deaths (Susp. or Conf.): 2005-2007

	2005		*2006*		*2007*	
Cotrimoxazole prophylaxis	***No.***	***%***	***No.***	***%***	***No.***	***%***
Current	46	20.9	96	34.8	127	35.9
Ever	5	2.3	9	3.3	12	3.4
Never (but indicated)	59	26.8	94	34.1	122	34.5
Never (not indicated)	0	0	9	3.3	22	6.2
Unknown	110	50.0	68	24.6	71	20.1
Total	220	100	276	100	354	100

Table A12. Antiretroviral Therapy (ART) in Child Deaths and in Mothers: 2005-2007

	2005		*2006*		*2007*	
ART - child deaths	***No.***	***%***	***No.***	***%***	***No.***	***%***
Current	46	2.7	141	5.0	238	6.7
Ever	9	0.5	34	1.2	37	1.0
Never (but indicated)	724	43.2	1185	41.9	1444	40.6
Never (not indicated)	141	8.4	675	23.9	1060	29.8
Unknown	757	45.1	793	28.0	776	21.8
Total	1677	100	2828	100	3555	100
ART - mothers	***No.***	***%***	***No.***	***%***	***No.***	***%***
Current	13	0.8	42	1.5	96	2.7
Ever	1	0.1	16	0.6	11	0.3
Never (but indicated)	295	17.6	413	14.6	455	12.8
Never (not indicated)	106	6.3	415	14.7	856	24.1
Unknown	1262	75.3	1942	68.7	2137	60.1
Total	1677	100	2828	100	3555	100

Table A13. HIV Laboratory Status and Nutritional Status: 2005-2007

Nutrition / *Laboratory*	OWFA			Normal			UWFA			Marasmus			Kwashiorkor			Maras-Kwash			Unknown			**Total**		
	'05	*'06*	*'07*	*'05*	*'06*	*'07*	*'05*	*'06*	*'07*	*'05*	*'06*	*'07*	*'05*	*'06*	*'07*	*'05*	*'06*	*'07*	*'05*	*'06*	*'07*	*'05*	*'06*	*'07*
Negative	2	8	9	49	110	166	49	89	129	12	35	53	10	28	43	5	10	21	8	16	37	135	296	458
Exposed	5	6	10	97	216	269	130	226	309	93	139	164	9	27	43	7	20	18	5	32	52	346	666	865
Infected	3	5	9	48	107	159	125	237	361	202	401	477	13	34	62	24	62	51	13	29	34	428	875	1153
Not tested (**but** indicated)	4	0	0	71	62	80	69	71	94	53	66	60	15	22	21	15	21	12	10	10	9	237	252	276
Not tested (**not** indicated)	0	4	4	11	57	116	10	26	42	1	10	12	1	6	4	0	0	2	6	11	10	29	114	190
Unknown	1	4	7	89	182	176	85	165	163	54	113	86	19	27	36	21	14	20	233	120	125	502	625	613
Total	15	27	39	365	734	966	468	814	1098	415	764	852	67	144	209	72	127	124	275	218	267	1677	2828	3555

Table A14. HIV Laboratory Status in Different Age Groups: 2005-2007

Age / *Laboratory*	0-1 month			1 month-1 year			1-5 years			5-13 years			13-18 Years			Unknown			**Total**		
	'05	*'06*	*'07*	*'05*	*'06*	*'07*	*'05*	*'06*	*'07*	*'05*	*'06*	*'07*	*'05*	*'06*	*'07*	*'05*	*'06*	*'07*	*'05*	*'06*	*'07*
Negative	12	17	32	57	162	235	46	85	140	18	31	48	2	1	2	0	0	1	135	296	458
Exposed	81	52	68	205	530	684	59	77	97	1	6	15	0	0	0	0	1	1	346	666	865
Infected	9	32	11	164	369	545	160	297	352	90	168	235	4	8	8	1	1	2	428	875	1153
Not tested (**but** indicated)	33	20	20	113	141	173	74	71	70	16	18	13	1	1	0	0	1	0	237	252	276
Not tested (**not** indicated)	2	12	26	13	54	96	11	37	50	3	10	17	0	1	0	0	0	1	29	114	190
Unknown	116	82	64	142	341	355	184	148	145	52	51	47	1	0	0	7	3	2	502	625	613
Total	253	215	221	694	1597	2088	534	715	854	180	284	375	8	11	10	8	6	7	1677	2828	3555

Table A15. HIV Laboratory Category and Staging for Those Deaths Where Testing was done: 2005-2007

Stage / Lab	Stage I			Stage II			Stage III			Stage IV			Total Staged			Not staged			Unknown			**Total**		
	'05	*'06*	*'07*	*'05*	*'06*	*'07*	*'05*	*'06*	*'07*	*'05*	*'06*	*'07*	*'05*	*'06*	*'07*	*'05*	*'06*	*'07*	*'05*	*'06*	*'07*	*'05*	*'06*	*'07*
Negative	5	5	4	1	4	1	6	4	4	3	8	6	15	21	15	113	241	376	7	34	67	135	296	458
Exposed	13	39	44	27	50	55	88	136	198	131	208	219	259	433	516	72	178	237	15	55	112	346	666	865
Infected	0	9	11	17	26	34	122	151	225	250	614	783	389	800	1053	31	64	75	8	11	25	428	875	1153
Total	18	53	59	45	80	90	216	291	427	384	830	1008	663	1254	1584	216	483	688	30	100	204	909	1837	2476

Table A16. Infant Feeding Practice in the First 6 months of Life: 2005-2007

Age / Feeding	0-1 month			1 month-1 year			1-5 years			**Total**			**%**		
	2005	*2006*	*2007*	*2005*	*2006*	*2007*	*2005*	*2006*	*2007*	*2005*	*2006*	*2007*	*2005*	*2006*	*2007*
Exclusive breast	41	42	52	106	268	299	40	85	108	187	395	459	12.6	15.6	14.5
No breast, ever	36	35	56	130	337	651	35	79	96	201	451	803	13.6	17.8	25.4
Mixed	37	21	19	149	329	412	103	117	147	289	467	578	19.5	18.5	18.3
Unknown	139	117	94	309	663	726	356	434	503	804	1214	1323	54.3	48.0	41.8
Total	253	215	221	694	1597	2088	534	715	854	1481	2527	3163	100	100	100

Table A17. Infant Feeding Practice and Cause of Death (Top 5 of All Diagnoses): 2005-2007

Feeding / *All diagnoses*	Exclusive breast			No breast, ever			Mixed			Unknown			**Total**		
	2005	***2006***	***2007***	***2005***	***2006***	***2007***	***2005***	***2006***	***2007***	***2005***	***2006***	***2007***	***2005***	***2006***	***2007***
ARI	40	78	92	45	91	155	58	82	106	210	265	272	353	516	625
Septicaemia	25	70	91	37	90	146	48	93	124	143	246	227	253	499	588
Acute diarrhoea	27	57	60	25	78	128	23	65	84	135	234	208	210	434	480
PCP	44	63	54	41	58	118	63	76	81	72	79	101	220	276	354
TB (all forms)	6	24	22	10	22	38	40	42	48	55	131	166	111	219	274
Total	142	292	319	158	339	585	232	358	443	615	955	974	1147	1944	2321

Table A18. Infant Feeding Practice and HIV Laboratory Category: 2005-2007

Feeding / *Lab*	Exclusive breast			No breast, ever			Mixed			Unknown			**Total**		
	2005	***2006***	***2007***	***2005***	***2006***	***2007***	***2005***	***2006***	***2007***	***2005***	***2006***	***2007***	***2005***	***2006***	***2007***
Negative	35	53	88	12	32	69	13	74	92	75	137	209	135	296	458
Exposed	57	115	130	93	208	359	92	126	126	104	217	250	346	666	865
Infected	38	93	103	51	148	252	104	178	258	235	456	540	428	875	1153
Total	130	261	321	156	388	680	209	378	476	414	810	999	909	1837	2476

Table A19.1 Cause of Death: Main and Other Diagnosis (All Diagnoses): 2005

2005	*Main*	*Other*	*Total*	*Percent*
Pneumonia, ARI	353	198	551	18.6
Septicaemia, possible serious bacterial information	253	122	375	12.7
Acute diarrhoea, hypovolaemic shock	210	126	336	11.4
PCP (suspected or confirmed)	220	42	262	8.9
TB: pulmonary/extra-pulmonary	111	133	244	8.3
Chronic diarrhoea	82	80	162	5.5
Other serious infection (specify)	22	75	97	3.3
Meningitis: bacterial	72	22	94	3.2
Anaemia	2	88	90	3
Other Circulatory System (specify)	25	56	81	2.7
Other diagnosis (specify)	41	8	49	1.7
AIDS	19	24	43	1.5
Heart failure, Pulmonary Oedema	22	17	39	1.3
Ill-defined/unknown causes of mortality	37	2	39	1.3
Other Endocrine, Nutritional, Metabolic (specify)	19	19	38	1.3
Cirrhosis, portal hypertension, liver failure, hepatitis	16	16	32	1.1
Hospital-acquired infection	9	22	31	1.0
Hypoglycaemia	6	24	30	1.0
Other respiratory failure (specify)	10	20	30	1.0
Missing	0	26	26	0.9
Acute renal failure	3	22	25	0.8
Inhalation of foreign body or gastric content	10	14	24	0.8
Leukaemia	16	7	23	0.8
Other Nervous System (specify)	7	15	22	0.7
Status epilepticus	9	12	21	0.7
Surgical (Appendix, hernia, intestines, peritoneum)	12	7	19	0.6
Cardiomyopathy	7	9	16	0.5
Pneumothorax, Pyothorax, Pleural effusion	5	10	15	0.5
Other Oncology, Haematology (specify)	1	14	15	0.5
Other Poisonings (specify)	3	11	14	0.5
Other Digestive System (specify)	2	9	11	0.4
Meningitis: Viral (meningo-encephalitis)	5	4	9	0.3
Croup	4	4	8	0.3
Non-accidental injury, abuse related, neglect	5	3	8	0.3
Dysentery	3	4	7	0.2
Burns	6	1	7	0.2
Congenital malformations of the respiratory system	2	3	5	0.2
Myocarditis	3	2	5	0.2
RHD, Rheumatic fever	4	1	5	0.2
Congenital Infections (not HIV)	2	2	4	0.1
Other inflammatory disease of CNS (e.g. abscess)	1	3	4	0.1
Unknown	4	0	4	0.1
Other accidents (including Drowning; specify)	3	0	3	0.1
Other Genito-urinary System (specify)	1	2	3	0.1
Chronic renal disease	3	0	3	0.1
Congenital Heart Disease	2	0	2	0.1
Paraffin	2	0	2	0.1
Transport-related accidents	0	1	1	0
IDDM, DKA	1	0	1	0
Bites and stings, Toxic plants	1	0	1	0
Acute nephritic	1	0	1	0
Malaria	1	0	1	0
Total	1677	1280	2957	100

Table A19.2 Cause of Death: Main and Other Diagnosis (All Diagnoses): 2006

2006	*Main*	*Other*	*Total*	*Percent*
Pneumonia, ARI	516	312	828	17.4
Septicaemia, possible serious bacterial information	499	285	784	16.4
Acute diarrhoea, hypovolaemic shock	434	192	626	13.1
TB: Pulmonary/extra-pulmonary	219	236	455	9.5
PCP (suspected or confirmed)	276	96	372	7.8
Chronic diarrhoea	88	109	197	4.1
Meningitis: bacterial	134	37	171	3.6
Anaemia	5	117	122	2.6
Other Endocrine, Nutritional, Metabolic (specify)	35	69	104	2.2
Other diagnosis (specify)	42	60	102	2.1
Other respiratory failure (specify)	49	28	77	1.6
Other Nervous System (specify)	33	41	74	1.6
Hospital-acquired infection	39	26	65	1.4
Other serious infection (specify)	18	40	58	1.2
Other Poisonings (specify)	20	36	56	1.2
Ill-defined/unknown causes of mortality	50	2	52	1.1
Heart failure, Pulmonary Oedema	31	20	51	1.1
Cirrhosis, portal hypertension, liver failure, hepatitis	31	18	49	1.0
Hypoglycaemia	16	25	41	0.9
Acute renal failure	12	25	37	0.8
Status epilepticus	20	17	37	0.8
Other Oncology, Haematology (specify)	3	24	27	0.6
Unknown	21	5	26	0.5
Congenital Heart Disease	17	9	26	0.5
Other Digestive System (specify)	7	19	26	0.5
Inhalation of foreign body or gastric content	22	4	26	0.5
Other Circulatory System (specify)	11	14	25	0.5
Other inflammatory disease of CNS (e.g. abscess)	20	3	23	0.5
Meningitis: Viral (meningo-encephalitis)	16	7	23	0.5
Surgical (Appendix, hernia, intestines, peritoneum)	8	14	22	0.5
Pneumothorax, Pyothorax, Pleural effusion	7	11	18	0.4
Dysentery	9	9	18	0.4
Cardiomyopathy	8	8	16	0.3
Missing	12	0	12	0.3
Croup	7	4	11	0.2
Burns	7	1	8	0.2
Other Genito-urinary System (specify)	2	6	8	0.2
Non-accidental injury, abuse related, neglect	3	5	8	0.2
Congenital Infections (not HIV)	6	1	7	0.1
Chronic renal disease	3	2	5	0.1
Leukaemia	5	0	5	0.1
Paraffin	4	0	4	0.1
Myocarditis	1	2	3	0.1
Malaria	2	0	2	0
Other accidents (including Drowning; specify)	1	1	2	0
IDDM, DKA	2	0	2	0
Congenital malformations of the respiratory system	1	1	2	0
Transport-related accidents	1	1	2	0
Tumours	2	0	2	0
RHD, Rheumatic fever	0	1	1	0
Endocarditis	0	1	1	0
Homicide	1	0	1	0
Total	2828	1944	4772	100

Table A19.3 Cause of Death: Main and Other Diagnosis (All Diagnoses): 2007

2007	*Main*	*Other*	*Total*	*Percent*
Pneumonia, ARI	625	339	964	15.9
Septicaemia, possible serious bacterial information	588	286	874	14.4
Acute diarrhoea, hypovolaemic shock	480	275	755	12.5
TB: Pulmonary/extra-pulmonary	274	256	530	8.7
PCP (suspected or confirmed)	354	103	457	7.5
Other Endocrine, Nutritional, Metabolic (specify)	68	196	264	4.4
Chronic diarrhoea	128	135	263	4.3
Meningitis: bacterial	141	58	199	3.3
Anaemia	15	143	158	2.6
Other diagnosis (specify)	61	68	129	2.1
Other Nervous System (specify)	49	69	118	1.9
Other respiratory failure (specify)	66	49	115	1.9
Cirrhosis, portal hypertension, liver failure, hepatitis	48	26	74	1.2
Hospital-acquired infection	42	32	74	1.2
Status epilepticus	36	34	70	1.2
Other Oncology, Haematology (specify)	9	58	67	1.1
Other serious infection (specify)	32	34	66	1.1
Hypoglycaemia	18	45	63	1.0
Acute renal failure	23	40	63	1.0
Other Poisonings (specify)	22	39	61	1.0
Heart failure, Pulmonary Oedema	30	29	59	1.0
Ill-defined/unknown causes of mortality	49	2	51	0.8
Cardiomyopathy	19	17	36	0.6
Inhalation of foreign body or gastric content	24	9	33	0.5
Other Digestive System (specify)	9	24	33	0.5
Other Circulatory System (specify)	21	12	33	0.5
Congenital Heart Disease	18	11	29	0.5
Unknown	25	2	27	0.4
Meningitis: Viral (meningo-encephalitis)	12	13	25	0.4
Other Genito-urinary System (specify)	4	19	23	0.4
Dysentery	5	18	23	0.4
Surgical (Appendix, hernia, intestines, peritoneum)	12	10	22	0.4
Pneumothorax, Pyothorax, Pleural effusion	7	14	21	0.3
Other inflammatory disease of CNS (e.g. abscess)	18	3	21	0.3
Leukaemia	15	2	17	0.3
Tumours	15	1	16	0.3
Missing	10	5	15	0.2
Myocarditis	7	3	10	0.2
Burns	8	2	10	0.2
Congenital Infections (not HIV)	2	7	9	0.1
Croup	7	2	9	0.1
Chronic renal disease	1	6	7	0.1
Non-accidental injury, abuse related, neglect	4	3	7	0.1
Other accidents (including Drowning; specify)	5	1	6	0.1
Acute nephritic	4	2	6	0.1
Congenital malformations of the respiratory system	3	0	3	0
Transport-related accidents	3	0	3	0
Paraffin	2	0	2	0
Asthma	1	1	2	0
Bites and stings, Toxic plants	1	1	2	0
Measles	0	2	2	0
Malaria (1) and IDDM, DKA (1)	2	0	2	0
RHD, Rheumatic fever	1	0	1	0
Total	3555	2506	6061	100

Table A20. Underlying Conditions for All Deaths: 2005-2007

	2005		*2006*		*2007*	
Underlying condition	***No.***	***%***	***No.***	***%***	***No.***	***%***
None	783	46.7	2305	81.5	3089	86.9
Other (specify)	221	13.2	348	12.3	250	7
Ex-low birth weight/Prematurity	57	3.4	81	2.9	104	2.9
Birth defect	23	1.4	27	1	34	1
Cerebral palsy	10	0.6	26	0.9	28	0.8
Hydrocephalus	5	0.3	12	0.4	15	0.4
Twin/multiple pregnancy	9	0.5	12	0.4	10	0.3
Unknown/Missing	569	33.9	17	0.6	15	0.7
Total	1677	100	2828	100	3555	100

Table A21. Modifiable Factors in Home and Community: 2005-2007

	2005		*2006*		*2007*	
Caregiver	***No.***	***%***	***No.***	***%***	***No.***	***%***
Delay in seeking care	270	28.2	632	33.0	841	30.7
Caregiver did not realize severity of illness	141	14.7	310	16.2	469	17.1
Inappropriate nutrition	126	13.2	302	15.8	438	16.0
Home treatment with negative effect on child	71	7.4	161	8.4	223	8.1
Other modifiable factor (specify)	37	3.9	124	6.5	181	6.6
Infrequent clinic attendance	57	5.9	111	5.8	153	5.6
Declining HIV test	72	7.5	98	5.1	122	4.5
Did not arrive on day of referral/ keep appointment	31	3.2	56	2.9	115	4.2
RTHC not present/referral letter lost	82	8.6	47	2.5	95	3.5
Never immunised/behind with immunisations	55	5.7	37	1.9	67	2.4
Caregiver refusing treatment	16	1.7	36	1.9	33	1.2
Total	958	100	1914	100	2737	100

Table A22. Modifiable Factors at Primary Healthcare Level: 2005-2007

	2005		*2006*		*2007*	
Clinical Personnel	***No.***	***%***	***No.***	***%***	***No.***	***%***
Case Management	117	26.0	214	29.7	239	23.9
Case Assessment	153	34.0	193	26.8	243	24.3
Delay in referring	135	30.0	161	22.4	241	24.1
Other	21	4.7	25	3.5	59	5.9
Insufficient Monitoring	24	5.3	23	3.2	63	6.3
Total - Clinical Personnel	450	78.9	616	85.6	845	84.6
Administrators						
Transport	20	4.4	34	4.7	42	4.2
Communication	9	2.0	26	3.6	24	2.4
Access/Barriers	39	8.7	18	2.5	29	2.9
Personnel	11	2.4	7	1.0	7	0.7
Lack of Drugs, IV fluids	34	7.6	6	0.8	26	2.6
Lack of Equipment	7	1.6	6	0.8	6	0.6
Laboratory	7	1.2	5	0.7	9	0.9
Policy	0	0	2	0.3	11	1.1
Total - Administrators	120	21.1	104	14.4	154	15.4
Total	570	100	720	100	999	100

Table A23. Modifiable Factors at Admission & Emergency: 2005-2007

	2005		*2006*		*2007*	
Clinical Personnel	***No.***	***%***	***No.***	***%***	***No.***	***%***
Case Management	226	21.0	311	25.3	343	26.4
Case Assessment	326	30.3	523	42.6	499	38.4
Insufficient Monitoring	124	11.5	135	11.0	155	11.9
Total - Clinical Personnel	676	62.8	969	79.0	997	76.7
Administrators						
Lack of Personnel	99	9.2	66	5.4	39	3.0
Access/Barriers	176	16.4	70	5.7	91	7.0
Communication	44	4.1	52	4.2	60	4.6
Lack of Equipment	37	3.4	26	2.1	34	2.6
Lack of Transport	15	1.4	19	1.5	21	1.6
Lack of Drugs, IV fluids	11	1.0	18	1.5	23	1.8
Laboratory	13	1.2	6	0.5	17	1.3
Policy	5	0.5	1	0.1	18	1.4
Total - Administrators	400	37.2	258	21.0	303	23.3
Total	1076	100	1227	100	1300	100

Table A24. Modifiable Factors in Ward: 2005-2007

	2005		*2006*		*2007*	
Clinical Personnel	***No.***	***%***	***No.***	***%***	***No.***	***%***
Case Assessment	175	17.0	301	19.2	361	17.5
Insufficient Monitoring	185	18.0	249	15.9	291	14.1
Case Management	141	13.7	194	12.4	224	10.9
IV Fluids & Intake/Output	129	12.6	153	9.8	157	7.6
Feeding	49	4.8	33	2.1	31	1.5
Delay in referring	29	2.8	30	1.9	44	2.1
Delay in calling senior opinion	32	3.1	30	1.9	55	2.7
Other	18	1.8	26	1.7	65	3.2
Total - Clinical Personnel	758	73.8	1016	65.0	1228	59.6
Administrators						
Lack of Personnel	134	13.0	226	14.5	336	16.3
Access	37	3.6	201	12.9	264	12.8
Communication	39	3.8	47	3.0	83	4.0
Lack of Equipment	24	2.3	35	2.2	61	3.0
Lack of Transport	5	0.5	7	0.4	6	0.3
Lack of Drugs, IV fluids	20	1.9	22	1.4	41	2.0
Laboratory	4	0.4	6	0.4	21	1.0
Policy	6	0.6	4	0.3	20	1.0
Total - Administrators	269	26.2	548	35.0	832	40.4
Total	1027	100	1564	100	2060	100

Table A25. Avoidable Deaths: 2005-2007

	2005		*2006*		*2007*	
'Was this death avoidable?'	***No.***	***%***	***No.***	***%***	***No.***	***%***
Yes	222	13.2	854	30.2	998	28.1
Not sure	81	4.8	995	35.2	1069	30.1
No	60	3.6	538	19.0	1007	28.3
Unknown	1314	78.4	441	15.6	481	13.5
Total	1677	100	2828	100	3555	100

Appendix B: Child PIP Data Capture Sheets

- Monthly Tally
- Deaths Register
- Death Data Capture Sheet

Child Healthcare Problem Identification Programme

Monthly Tally Sheet

ChIP v2.0

Hospital: _____ Year: _____

Ward: _____ Month: _____

		Admissions[1]	Deaths[2]	Case fatality rates[4,5]
Age	0 - < 1 month			
	≥ 1 month - < 1 yr			
	≥ 1 yr - < 5 yrs			
	≥ 5 yrs - < 13 yrs			
	≥ 13 yrs - 18 yrs			
	Unknown			
	Totals			

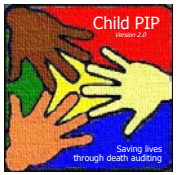
Complete information below for children <u>< 5 years only</u>				
Weight	Above or on 3rd centile			
	UWFA			
	Severe malnutrition[3]			
	Unknown			
	Totals			
Illness	Acute lower respiratory infections			
	Diarrhoeal disease			
	Other			
	Totals			

Notes:

1. Include **<u>all</u>** children admitted to your institution's paediatric/paediatric surgical/children's service
2. Include all "deaths-on-arrival" (applies mainly to POPD/Casualty)
3. Severe malnutrition includes Marasmus, Marasmic-Kwashiorkor and Kwashiorkor
4. Case fatality rates should be calculated for each group and each month (the computer does this automatically)
5. The formula is: CFR = $\frac{\text{deaths}}{\text{admissions}} \times 100$

Compiled by: _____(Print name) _____(Sign)

Date: _____ Fax / Tel number: _____



Child Healthcare Problem Identification Programme

Monthly Deaths Register

ChIP v2.0

Hospital: _____ Year: _____

Ward: _____ Month: _____

Deaths Register No.	Surname Name	Folder number	Age	Date of Admission	Date of Death	Weight (N/UWFA/Severe malnutrition)	Discharge (death) Diagnosis	Folder in ChIP box?	ChIP form completed?	Entered on PC?

Hospital: _____ Child Healthcare Problem Identification Programme Ward: _____

Child Death Data Capture Sheet

ChIP v2.0

Deaths Register Number: _____ Entered on computer: _____

Patient name:				Folder no:		Nearest town/district:			
DoB	yyyy-mm-dd	Age	pc calculates	Gender	Ⓜ / Ⓕ	Re-admission	Ⓨ / Ⓝ / Ⓤ	Dead on arrival	Ⓨ / Ⓝ / Ⓤ
When death occurred	Weekday (07:00-19:00)			Weeknight (19:00-07:00)		Weekend/ Public holiday			
Date of Admission	yyyy-mm-dd	Time	__:__	Date of Death	yyyy-mm-dd	Time	__:__		

Records

1. Folder not available	2. Folder present, records incomplete e.g. no RTHC	3. Folder present, notes inadequate (quality of notes is poor)	4. Folder present, records incomplete AND notes inadequate	5. Folder available, records & notes OK

Referred

	Name of hospital/clinic:				
Ⓨ / Ⓝ / Ⓤ	If yes, from:	1. Another hospital	2. A clinic	3. Private sector	Unknown
	If yes, from:	1. Inside drainage area	2. Outside drainage area	Unknown	

Social

Mother	1. Alive and well	2. Dead	3. Sick	Unknown	Primary caregiver	1. Mother	2. Grandmother
Father	1. Alive and well	2. Dead	3. Sick	Unknown		3. Father	4. Other: _____

Nutrition (tick one category box, then fill in actual weight: enter "999" if weight unknown)

1. OWFA	2. Normal	3. UWFA	4. Marasmus	5. Kwashiorkor	6. M-K	Unknown	Weight _____kg

HIV / AIDS (enter status at time of admission, not at time of audit: this is NOT a post-mortem assessment)

Lab	1. Negative	2. Exposed	3. Infected	4. No result	5. Not tested (but indicated)	6. Not tested (not indicated)	Unknown
Clinical	1. Stage I	2. Stage II	3. Stage III	4. Stage IV	5. Not staged (but indicated)	6. Not staged (not indicated)	Unknown

PMTCT	1. Prophylaxis given	2. Prophylaxis not given	3. Mother negative at delivery	Unknown
Feeding in first 6 months	1. Exclusive breast for 6/12	2. No breast, ever	3. Mixed, from birth	Unknown

Cotrimoxazole	1. Current	2. Ever	3. Never (but indicated)	4. Never (not indicated)	Unknown
ARV (child)	1. Current	2. Ever	3. Never (but indicated)	4. Never (not indicated)	Unknown
ARV (mother)	1. Current	2. Ever	3. Never (but indicated)	4. Never (not indicated)	Unknown

Cause of Death (insert codes)

Main cause of death:		Underlying condition:		
Other important diagnoses (max 4):				

Modifiable Factors (insert codes)

Code	Family/Caregiver		Comments	Code	Clinic/Ambulatory		Comments
	Probable	Possible/ ?			Probable	Possible/ ?	
	Probable	Possible/ ?			Probable	Possible/ ?	
	Probable	Possible/ ?			Probable	Possible/ ?	
	Probable	Possible/ ?			Probable	Possible/ ?	
	Admissions & Emergency: Hospital				**Ward: Hospital**		
	Probable	Possible/ ?			Probable	Possible/ ?	
	Probable	Possible/ ?			Probable	Possible/ ?	
	Probable	Possible/ ?			Probable	Possible/ ?	
	Probable	Possible/ ?			Probable	Possible/ ?	
	Probable	Possible/ ?			Probable	Possible/ ?	

In your opinion, had the process of caring been different, would this death have been avoidable?

Yes	Not sure	No	Unknown

Case Summary/Comments (write summary at time of death, if possible)

Child's Details (age, weight, where from, admission date/time)
History of Presenting Complaint
Relevant Background History (including details of HIV and TB)
Examination

Problem List

Problem	Investigations	Progress	Outcome
1.			
2.			
3.			
4.			
5.			

Appendix C: Child PIP Code Lists

- Causes of Death
- Modifiable Factors

Child Healthcare Problem Identification Programme

Causes of Death

ChIP v2.0

Please note: The **nutritional** categories and the clinical and laboratory classifications concerning **HIV** do not appear here. They have to be captured in the relevant fields on the data sheet.

Category	Causes of Death	Code
Infections and Parasitic Diseases	Acute diarrhoea, hypovolaemic shock	101
	Chronic diarrhoea	102
	Dysentery	103
	TB: Pulmonary	110
	TB: Meningitis	111
	TB: Miliary, other extra-pulmonary	112
	Septicaemia, possible serious bacterial infection	120
	Congenital Infections (not HIV)	130
	Meningitis: bacterial	140
	Meningitis: viral (meningo-encephalitis)	141
	Other inflammatory disease of CNS (e.g. abscess)	142
	Measles	150
	Other possible serious infection (specify)	151
	Malaria	170
	Hospital-acquired infection	180
Oncology, Haematology	Tumours	201
	Leukaemias	204
	Anaemia	202
	Other Oncology / Haematology (specify)	203
Endocrine, Nutritional, Metabolic	IDDM, DKA	301
	Hypoglycaemia	304
	Other Endocrine, Nutritional, Metabolic (specify)	305
Nervous System	Status epilepticus	401
	Other Nervous System (specify)	402
Circulatory System	RHD, Rheumatic fever	501
	Heart failure, Pulmonary oedema	502
	Myocarditis	503
	Cardiomyopathy	507
	Congenital Heart Disease	504
	Endocarditis	505
	Other Circulatory System (specify)	506
Respiratory System	Croup	601
	Pneumonia, LRTI (ARI)	602
	PCP (suspected)	603
	PCP (confirmed)	608
	Pneumothorax, Pyothorax, Pleural effusion	604
	Asthma	605
	Congenital malformations of the respiratory system	606
	Other Respiratory System (specify)	607

Category	Causes of Death	Code
Digestive System	Cirrhosis, Portal Hypertension, Liver Failure, Hepatitis	701
	Surgical (appendix, hernia, intestines, peritoneum)	702
	Other Digestive System (specify)	703
Genito-urinary System	Acute nephritis	801
	Acute renal failure	802
	Chronic renal disease	803
	Other Genito-urinary System (specify)	804
Ill-defined / Unknown Cause	Ill-defined / Unknown causes of mortality	900
Other Diagnosis	Other diagnosis (specify)	901
Burns	Burns	1000
Poisoning	Paraffin	1101
	Corrosives	1102
	Other Poisoning (specify)	1103
Bites and Stings, Toxic plants	Bites and stings, Toxic plants	1200
Inhalation / Aspiration	Inhalation of foreign body or gastric contents	1300
Accidents	Transport-related accidents	1400
	Other accidents (incl. Drowning; specify)	1500
Non-accidental injury, Abuse	Non-accidental injury, Abuse-related, Neglect	1600
Homicide	Homicide	1700
Suicide	Suicide	1800

Underlying Conditions	Code
Cerebral palsy	1
Hydrocephalus	2
Birth defect (preconception = chromosomal/genetic, or post conception e.g. foetal alcohol syndrome)	3
Ex-low birthweight / preterm infant	4
Twin / Multiple pregnancy	5
Other Underlying Condition (specify)	10

Modifiable Factors

ChIP v2.0

Family / Caregiver		
Timing	F101	Infrequent clinic attendance
	F102	Delay in seeking care
Recognition	F103	Caregiver did not realise severity of illness
	F104	Caregiver refusing treatment
	F105	Home treatment with negative effect on the child, e.g. enema
Immunisations	F106	Never immunised / behind with immunisations
Nutrition	F107	Inappropriate nutrition
RTHC	F108	Not present / referral letter lost
Consents / Returns	F109	Declining HIV test
	F110	Did not arrive on day of referral / did not keep appointment
Other	F189	Other modifiable factor concerning caregiver / family (specify)
Insufficient Information	F190	Insufficient information / notes on caregiver / family care

Clinic / Ambulatory Care: Clinical Personnel		
Case Assessment	P301	Insufficient assessment for acute respiratory infection / LRTI
	P302	IMCI not used for patient assessment
	P304	Insufficient assessment for failure to thrive
	P309	Other insufficient assessment (specify)
Monitoring	P311	No weight / other inappropriate use of RTHC
	P312	O_2 saturation (at Community Health Centre)
	P319	Other insufficient monitoring (specify)
Case Management	P321	No appropriate stat antibiotics / antibiotics for acute infection
	P322	No TB contact treatment
	P323	Insufficient fluid management for gastro-enteritis with dehydration
	P324	Insufficient investigations done
	P325	IMCI not used for case management
Delay in Referring - Acute	P331	Delay in referring acute respiratory infection
	P332	Delay in referring gastro-enteritis with dehydration
	P333	Delay in referring other acute problem (specify)
Delay in Referring - Chronic	P341	Delay in referring failure to thrive
	P342	Delay in referring chronic cough
	P343	Delay in referring chronic diarrhoea
Other	P379	Other modifiable factor - clinical personnel at clinic level (specify)
Inappropriate Care by GP	P380	Inappropriate care / late referral from Private Sector
Insufficient Information	P390	Insufficient notes
Clinic / Ambulatory Care: Administrators		
Lack of Transport	C211	Home to Institution
	C213	Clinic / CHC to Hospital
Lack of Access	C222	Lack of clinic / limited opening times
	C224	Lack of high care beds / resuscitation area
Barriers	C227	Barriers to entry to healthcare
Lack of Personnel	C231	Lack of professional nurse at clinic
	C239	Other lack of personnel (specify)
Communication	C241	Communication problems: Staff to caregiver
	C249	Staff to staff communication problem at clinic or between clinic and hospital
Lack of Drugs, IV fluids etc	C254	O_2 supply / equipment
	C255	Antibiotics
	C256	Other lack of drugs, IV fluids (specify)
Laboratory	C258	Basic laboratory investigation not available (e.g. blood glucose)
Lack of Equipment	C261	Pulse oxymeter (at CHC)
	C262	Suction
	C263	Lack of other equipment (specify)
Lack of Policy	C271	Concerning short-stay for paediatric patients at health care centre
	C279	Other lack of protocol / policy (specify)
Insufficient Information	C290	Insufficient notes

Admission and Emergency (Hospital): Clinical Personnel		
Case Assessment	P401	History taking incomplete
	P402	Physical examination incomplete
	P403	Respiratory rate not taken, respiratory distress not noticed
	P404	Assessment of shock / dehydration insufficient
	P405	Appropriate investigations not done (blood, x-ray, other)
	P406	Results of investigations not noted
	P407	Not classified as critically ill by nurse / danger signs not noticed
	P409	Other insufficient case assessment (specify)
Monitoring	P411	Respiratory rate
	P412	O_2 saturation
	P413	Blood glucose
	P414	Shock
	P415	Level of consciousness, convulsions
	P419	Other insufficient monitoring (specify)
Case Management	P421	Shock not treated appropriately (e.g. intra-osseus line)
	P422	Airway obstruction not managed appropriately
	P423	Appropriate O_2 therapy not prescribed / not recorded / not given
	P424	Convulsions not managed appropriately
	P425	Appropriate antibiotics not prescribed
	P426	Other insufficient case management (specify)
Insufficient Information	P490	Insufficient notes
Admission and Emergency (Hospital): Administrators		
Lack of Transport	A211	Home to Institution
	A214	Hospital to Referral Hospital / Institution to Institution
Lack of Access	A223	Lack of hospital beds / ward overcrowded
	A224	Lack of high care beds / resuscitation area
	A225	Lack of infant / paediatric ICU facilities
Barriers	A227	Barriers to entry to healthcare
Lack of Personnel	A232	Lack of professional nurse at hospital (specify: day / night / week end)
	A233	Lack of senior doctors (post Community Service)
	A239	Other lack of personnel (specify)
Communication	A242	Staff to caregiver
	A243	Doctor not called for critically ill child
	A245	Doctor to doctor (e.g. no hand over of critically ill patient)
	A246	Doctor called, but did not respond / did not come
	A249	Other staff to staff communication problem (specify)
Lack of Drugs, IV Fluids etc	A254	O_2 supply / equipment
	A255	Antibiotics
	A256	Other lack of drugs, IV fluids (specify)
	A257	Lack of blood products
Laboratory	A258	Basic laboratory investigation not available
Lack of Equipment	A261	Pulse oxymeter
	A262	Suction
	A263	Lack of other equipment (specify)
Lack of Policy	A273	Lack of case management protocol
	A279	Other lack of protocol / policy (specify)
Insufficient Information	A290	Insufficient notes

Ward (Hospital): Clinical Personnel		
Case Assessment	P501	Physical examination incomplete
	P502	Appropriate investigations not done
	P504	Results of investigations not traced / not noted (including x-rays)
	P507	LRTI/ARI not responding to treatment, not reassessed
	P508	Other condition not responding to treatment, not reassessed
	P509	Patient not seen during week-end / public holiday
	P510	Insufficient case assessment / management at previous admission / OPD visit
Monitoring	P521	Respiratory rate / O_2 saturation
	P523	Blood glucose
	P524	Shock
	P525	Level of consciousness, convulsions
	P526	Electrolytes
	P529	Other insufficient monitoring (specify)
Case Management	P531	Appropriate O_2 therapy not prescribed / not recorded / not given
	P532	Convulsions not managed appropriately
	P533	Appropriate change / addition of antibiotics / TB Rx not prescribed
	P534	Appropriate blood product not prescribed
	P535	Other appropriate treatment not prescribed (specify)
	P536	Other case management protocol not followed (specify)
	P537	No team decision for terminal care
	P538	Prescribed treatment not given
Delay in Calling for Senior Opinion	P601	Community Service Doctor / Intern did not call senior Medical Officer
	P602	MO at peripheral hospital did not call provincial hospital / referral hosp
	P603	Other delay in calling for senior opinion
Delay in Referring	P611	To provincial hospital / referral hospital for coma / CT scan
	P612	To provincial hospital / referral hospital for other problem
	P613	Other delay in referring
IV Fluids / Intake-Output	P621	No prescription for IV fluids
	P622	IV fluids not monitored / not recorded appropriately
	P623	Too much / too little / incorrect type of IV fluids prescribed / given
	P624	No appropriate intake-output charting done
Feeding/ NG Tube	P631	NG tube feedings not prescribed
	P632	NG tube feedings not recorded / given
	P633	Other appropriate feedings not recorded / not given
	P634	Problems with NG tube feedings (e.g. cough, cyanosis)
Other	P689	Other modifiable factor (specify)
Insufficient Information	P690	Insufficient notes

Ward (Hospital): Administrators		
Lack of Transport	W214	Hospital to Referral Hospital
Lack of Access	W223	Lack of hospital beds / ward overcrowded
	W224	Lack of high care beds / resuscitation area
	W225	Lack of infant / paediatric ICU facilities
Lack of Personnel	W232	Lack of professional nurse at hospital (specify: day / night / week-end)
	W233	Lack of senior doctors (post Community Service)
	W239	Other lack of personnel (specify)
Communication	W242	Staff to caregiver
	W243	Doctor not called for critically ill child
	W245	Doctor to doctor (e.g. no handover of critically ill patient)
	W246	Doctor called, but did not respond / did not come
	W249	Other staff to staff communication problem (specify)
Lack of Drugs, IV etc	W254	O_2 supply / equipment
	W255	Antibiotics
	W256	Other lack of drugs, IV fluids (specify)
	W257	Lack of blood products
Laboratory	W258	Basic laboratory investigation not available
Lack of Equipment	W261	Pulse oxymeter
	W262	Suction
	W263	Lack of other equipment (specify)
Lack of Food / Milk	W269	Lack of food / milk
Lack of Policy	W272	For weekend / holiday ward rounds
	W273	Lack of case management protocol
	W279	Other lack of protocol / policy (specify)
Insufficient Information	W290	Insufficient notes

Appendix D: Additional Tools

- Paediatric Ward Admissions and Discharge Register
- Paediatric Patient Admission Sheet
- Child PIP Mortality Review Process Guideline

Paediatric Ward Admissions and Discharge Register

Year:_______________ Month:_______________ Ward:___________________ Hospital:_________

No.	Surname Name Folder Number	Caregiver Name Telephone Street, Town	DoB	Age	DoA ToA	From?	Weight & Gender	Nutrition status: o/n/u/k/ m/m-k	Diagnosis	DoD ToD	To?	ChIP reg y/n
Totals												

DoB = date of birth; **DoA** = date of admission; **ToA** = time of admission; **From?** = enter where patient came from (e.g. another ward, home, clinic, another hospital); **Nutrition status:o//n/u/k/m/m-k** = overweight/normal/underweight for age/kwashiorkor/marasmus/marasmic-kwashiorkor; **Dx** = admission diagnosis (enter main reason for admission but update if diagnosis changes or child dies); **DoD** = date of discharge OR death; **ToD** = time of discharge OR death; **To?** = enter where patient was discharged to (e.g. another ward, home, clinic, POPD, another hospital, died); **ChIP reg y/n** = yes/no for entry on the Child PIP death register

Paediatric patient admission sheet (to be completed by admitting doctor after usual clerking notes)

Name:					Date of Birth:	DoA:	ToA:
Admitted from					**Admitting Doctor (print)**		
Admitting to	ICU	High care	Medical	Surgical	Mixed	**Receiving Doctor (print)**	

Referred

	Name of hospital/clinic:				
Ⓨ / Ⓝ / Ⓤ	**If yes, from:**	Another hospital	A clinic	Private sector	Unknown
	If yes, from:	Inside drainage area	Outside drainage area	Unknown	

Social

Caregiver Name: **Telephone:**

Mother	Alive and well	Dead	Sick	Unknown	**Primary caregiver**	Mother	Grandmother
Father	Alive and well	Dead	Sick	Unknown		Father	Other: _____

Nutrition

OWFA	Normal	UWFA	Marasmus	Kwashiorkor	M-K	Unknown	Weight: _____kg

HIV / AIDS

Laboratory test	Negative	Exposed	Infected	No result	Not tested (but indicated)	Not tested (not indicated)	Unknown
Clinical	Stage I	Stage II	Stage III	Stage IV	Not staged (but indicated)	Not staged (not indicated)	Unknown
PMTCT	Prophylaxis given	Prophylaxis not given	Mother negative at delivery	Unknown			
Feeding in 1st 6 months	Exclusive breast for 6/12	No breast, ever	Mixed, from birth	Unknown			
Cotrimoxazole	Current	Ever	Never (but indicated)	Never (not indicated)	Unknown		
ARV (child)	Current	Ever	Never (but indicated)	Never (not indicated)	Unknown		
ARV (mother)	Current	Ever	Never (but indicated)	Never (not indicated)	Unknown		

Main diagnosis/reason for admission

Illness/Condition	**ICD 10**

Basis for diagnosis (tick relevant)

Previous diagnosis	Symptoms	Signs
Current Rx:		

Reasons for admission

1. Life-threatening problems (tick applicable)

Airway	Critical	Narrow		Normal
Breathing	Needs IPPV	Needs oxygen	Hyperventilation	Normal
Circulation	Shock	Hypovolaemia	Hypervolaemia	Normal
Deydration	10%	5%	Oedema	Normal
Consciousness	Coma	Depressed	Seizures	Normal
Infection	SIRS (“toxic shock”)	IV agent	Oral agent	No
IMCI classification	“Red”	“Yellow”		“Green”

2. Diagnostic workup (e.g. tuberculosis):

3. Social (e.g. poverty, distance, caregiver):

4. Specialist review/opinion:

5. Other:

Red flags (circle applicable)

readmission	admitted within past 28 days for the same condition
young infant	< 28 days old / 1 - 3 months
malnutrition	kwashiorkor / marasmus / wt < 3rd centile / wt for ht < 3rd centile
fever/hypothermia	temperature > 38°C or < 36°C
infection	measles, HIV, urinary tract, meningitis, pneumonia, septicaemia, other
dysentery	blood and/or mucus in stool / PR exam / fits / encephalopathy
hypoglycaemia	blood glucose < 2.6 mmol/ l

Significant biochemical problems (circle applicable)

Hypoxia	pH < 7.2	K+ < 2.0 /	K+> 6	Na+<120	Na+> 150	Albumin < 20

Urgent management

	Specific Rx	**Other Rx**
Airway	ETT:	Bag/Mechanical IPPV:
Breathing	Oxygen"	Continue on way to ward:
Circulation/Shock	Volume expand:	Continue on way to ward:
Dehydration	Rehydrate:	Check Na:
Consciousness	Protect airway:	Coma position:
Infection	IV antibiotic stat:	Steroid/antipyretic:

Initial investigations (tick for "done", circle for "to do")

Chemistry	acid-base	renal FT's	liver FT's	blood glucose	urine Na+ , K+	urine protein:creatinine
Haematology	FBC	diff	INR/PTT	retics	smear	factorVIII/IX
Microbiology	blood culture	CSF	urine dipstix	urine MC&S	stool MC&S	syphilis
Radiology	chest X-ray	abdo X-ray	CT Brain	MRI	U/S	echo
TB	skin test	CSF	Sputum AFB's	GW AFB's	**Started TB R_x:**	yyyy/mm/dd
HIV	rapid/ELISA	PCR	CD_4	**Other Virus:**		
Toxins/Drugs						

Parameters for monitoring on arrival in ward (circle "to do")

Nurse	Temperature	Respiratory rate	Sats/O_2 requirement	Respiratory pattern	Heart rate	Blood pressure	Glucose
	Weight	Urine volume	Stools	**Other:**			
Doctor	Perfusion	Acid-base	Urea, creatinine	Serum Na+, K+	Hydration		

Problem list and plans

#1:	**#4:**
Plan:	**Plan:**
#2:	**#5:**
Plan:	**Plan:**
#3:	**#6:**
Plan:	**Plan:**

Pain Assessment

No pain	Mild Pain	Moderate Pain	Severe Pain
Analgesia plan:			

Sign: _____ Date: _____ Time: _____

THE CHILD PIP MORTALITY REVIEW PROCESS

Saving lives through death auditing

It is the structured clinical audit of all children dying in hospital (including in casualty/outpatients, and those who are 'dead on arrival') that enables a thorough assessment of the quality of care that children receive in the health system.

For a clinical audit / mortality review to be successfully implemented there are two vital requirements:

1) Dedicated individuals willing to spend time and effort to make the process happen
2) A carefully structured system where roles and responsibilities are well-defined

Thus, the mortality review process in a paediatric/children's ward consists of two main activities:

1) The data collection process
2) The actual mortality review process

Data collection

To conduct a mortality review, 2 data sources are needed:

1) The ward admissions, discharges and deaths register
2) The individual clinical records of the children who die

Keep a separate register of children who die for tracing their medical records. Admission and deaths counts should be captured on **monthly tally sheets.** Detailed information on each death should be captured on the **death data capture sheet**.

To organise and keep track of the data it is helpful to compile a lever arch file, clearly labelled Child PIP. It is helpful to order the contents in each section as follows:

1) Laminated copies of code lists (Cause of death and Modifiable factors), and growth charts
2) Monthly dividers for each month followed by a Monthly Tally Sheet for that month as well as a Death Data Capture Sheet completed for each death that occurred during that month
3) Spare data capture forms

The review process

Follow the four components of the mortality review process in your hospital:

Component	When	Who	Purpose
1. 24 hour review	Each death should be reviewed and summarised within 24 hours	The attending doctor or nurse at the time of the death	▪ Ensure all necessary information is captured at a time when information is available
2. Preparatory meeting	Before the Mortality Review Meeting	The doctor and nurse in charge of the ward/unit	▪ A detailed analysis of **all** deaths, with **case selection** for presentation at the Mortality Review Meeting ▪ Compilation of monthly statistics for presentation at the meeting
3. Mortality review/Child PIP meeting (see below)	Weekly to monthly depending on load	Whole paediatric department (doctors and nurses) as well as clinic staff	▪ Presentation of statistics, case discussions and task reviews ▪ Assign new **tasks** based on each meeting's discussion ▪ Ensure all data capture sheets have been **completely completed**
4. Epidemiology & Analysis	6 monthly/annually	Managers and clinical personnel	▪ Broader problem identification with trend assessment, and with proposed solutions/recommendations

The 24 hour review

Every single death occurring in your hospital should be summarised using the Child PIP Death Data Capture sheet at the time of death. The person best placed to do this is either the on-duty doctor or by way of handover, the daytime team responsible for the long-term care of the child. The death summary should be regarded as no more burdensome, and no less important, than the discharge summary for other children leaving the ward/unit.

It is still best to have a single person in the ward/unit making sure that this process happens.

This can be a doctor or a nurse.

The preparatory meeting

This meeting is crucial. All data capture sheets must be **completely completed,** to the stage of readiness for entry onto the computer. This means that all fields must be filled in, and **codes** must be entered where required. This makes data entry onto the computer efficient and accurate, and allows for any category of employee to enter data.

Careful selection of cases for presentation will enhance learning opportunities, and facilitate problem identification, and task definition and allocation.

The preparatory meeting is the responsibility of the most senior doctor and most senior nurse in the ward/unit.

The mortality review meeting

Mortality meetings must be well organised and managed by the nurse and doctor responsible for the paediatric/children's ward.

1) Meetings should be held weekly to monthly depending on the number of deaths.
2) A suitable time and venue is needed.
3) All staff involved with child care should be invited (doctors, nurses, allied healthworkers and administrators). Staff must understand that mortality meetings are very important. It is especially helpful to invite staff from clinics referring to the hospital.
4) Case presentations should be concise and professional. Discussion is encouraged if the presenter does not provide the cause of death and modifiable factors. This is best done by the group.
5) The meeting should by consensus establish the main cause of death and then look carefully for modifiable factors. The meeting must never become a "witch hunt", and should be confidential. The meeting should NOT be dominated by senior doctors. The thoughts and insights of **all** participants make the meeting worthwhile.
6) All decisions (causes and modifiable factors) made must be recorded on the mortality sheets (death data capture sheets) for entry later onto a computer.
7) **Problems with the process of caring for children in the hospital, the referring clinics and in communities must be identified and prioritised, and plans should be made and documented for addressing each problem.**
8) Tasks arising out of discussions around cases should be assigned to team members, and minuted. Progress with the tasks should be reviewed at the start of the next meeting.

The meeting agenda

A typical mortality review agenda is a follows:

1) Welcome and introductions, and identification of a minute taker
2) Review of tasks set at last meeting
3) Summary of last meeting's statistics
4) Summary of this meeting's statistics
5) Case presentations
6) **Task identification and allocation**
7) Closure and date of next meeting

Epidemiology and Analysis

The power of Child PIP lies in its ability to provide instant feedback on child death and quality of care information to ward/unit staff. Simply by initiating this systematic review process, change will happen.

It is, however, important both for the identification of broader system problems and for monitoring change that 6-monthly or annual reviews are performed.

These reviews should be compiled into reports, which document both findings and recommendations arising out of the review. This is the point at which the power of Child PIP can be used for communicating problems to managers. Once the process of mortality review is established in your site, the report will also look at success of implementation of, and response to, previous recommendations.

You can use the Child PIP Report pro forma for guiding your report writing.

Making change happen

When making recommendations, it is important to link each recommendation clearly to specific information arising out of your Child PIP review process. It is then useful to clearly define its requirements for implementation at each of the following levels:

1) Policy
2) Administration
3) Clinical practice
4) Education

Finally, responsibility for implementation at each level should be assigned, so that at the next review, implementation (or lack thereof) can be accounted for (for an example of this see *Saving Children 2005*).

By conducting mortality reviews in this systematic way, we will save lives and improve quality of care, through death auditing.

(Adapted from Philpott and Voce: "4 Key Components of a Successful Perinatal Audit Process", Kwikskwiz #29, 2001)