

Paediatric Mortality: a Review of Causes among Admissions at the University of Port Harcourt Teaching Hospital (January 2003 - December 2005)

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Summary

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Background: Millennium Development Goal 4 (MDG4) which seeks to reduce child mortality globally can only be achieved if the causes of the deaths are known.

Objectives: To review the pattern of paediatric deaths at the University of Port Harcourt Teaching Hospital and identify possible preventive measures.

Materials and Methods: Data of all paediatric deaths documented between January 2003 and December 2005 in the mortality cards of the department of paediatrics, University of Port Harcourt Teaching Hospital, were reviewed retrospectively, and analysed.

Results: Out of 3,959 admissions, 304 (7.67 percent) died; 52.3 percent of those that died were males, and 47.4 percent females, while the remaining one was of an ambiguous gender. Neonatal deaths accounted for 53.3 percent of the deaths, while 90.1 percent were aged under five years. The duration of admission ranged from 0.25 to 4704 hours with 40.8 percent and 58.22 percent of the deaths occurring within 24 and 72 hours, respectively. The major disease categories in the deceased were infections/infestations in 37.9 percent, perinatal conditions in 34.7 percent and nutritional deficiencies in 10 percent.

Conclusions: The under-fives, especially neonates, remain vulnerable to highly preventable or treatable conditions with infections and neonatal conditions being the major causes, while HIV and AIDS are the emerging challenges. MDG4 can only be attained if all well-known high impact strategies such as improved management of obstetric, neonatal and paediatric emergencies, nutritional interventions and control of HIV/AIDS are widely implemented.

Key words: Paediatric deaths, tertiary health facility, causes, prevention.

Introduction

WORLDWIDE, about ten million under-fives were estimated to have died in 2005.¹ Most of these deaths (9.971 million) occurred in developing countries with about half in sub-Saharan Africa and a third in south east Asia. Thus, without reductions in under-five deaths in these regions, the Millennium Development Goal 4 (MDG4),² will probably not be attained. In 2005, Nigeria's population was 18.4 percent of the

total for sub-Saharan Africa but the country contributed 21.5 percent to the region's under-five deaths, thereby making her an important determinant of the status of MDG4 attainment in the region.^{1,2} Reviews of paediatric deaths in Nigeria from teaching hospitals and other sources showed that in infancy, excluding the neonatal period, lower respiratory tract infections, diarrhoea, vaccine preventable diseases and malnutrition were the major causes.³⁻⁷ Beyond infancy, these conditions have also remained major challenges to paediatric survival; they were also and have remained the major contributors to under-five deaths in other developing countries.^{2,8-10} Thus, the United Nations Report on MDGs in 2005 noted that "just five diseases — pneumonia, diarrhoea, malaria, measles and AIDS — account for half of all deaths in children under age 5". It also lamented that "most of these lives could be saved by expanding low-cost prevention and treatment measures. These include exclusive breastfeeding of infants, antibiotics for acute

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respiratory infections, oral rehydration for diarrhoea, immunization, and the use of insecticide-treated mosquito nets and appropriate drugs for malaria. Proper nutrition is part of prevention, because malnutrition increases the risk of dying from these diseases. Better care for mothers and babies before and after birth would address the challenge of the one third of these deaths that occur in the first days of life.¹² The World Health Report 2002 also noted that 50-70 percent of the burden of diarrhoeal diseases, measles, malaria and lower respiratory infections in childhood are attributable to malnutrition.¹¹ It is therefore important that periodic reviews of paediatric deaths be carried out to determine the impact of current preventive measures and newer challenges to child survival. This is the reason for this review.

Materials and Methods

This study was conducted in the Paediatric Department of the University of Port Harcourt Teaching Hospital. The department, operational since 1981 when the hospital was established, has grown in terms of its bed capacity, clientele and the cadre and number of staff. It serves not only as a referral centre for patients from within Rivers State but also the surrounding states. It provides all levels of care through its Children's Outpatient Clinic, Diarrhoeal Training Unit, as well as Consultant Paediatric and Specialist Clinics. It admits children from birth up to 15-16 years through its services in the Special Care Baby Unit, Children's Emergency Ward and Children's Medical Wards. Children with surgical problems who present to the department are managed until they are either wholly taken over or co-managed by the Surgery Department. The department, like others in the hospital, operates a Revolving Fund Scheme but the ability of a patient to pay does not determine the timing of receipt of requisite services, including those

from other departments, except when such was not available in the hospital.

All deaths in the department are reviewed during the weekly departmental Mortality Review Meeting with co-managing departments in attendance. The sessions aim at identifying the causes of the deaths, auditing the quality of care and training the staff and students. Paediatric deaths in the Children Surgical Ward or the Accident and Emergency Department are not discussed in these sessions. Data on deceased children are entered into the departmental mortality review cards. The cards and corresponding summaries on each case are stored in the department. The present review covers cases reviewed from January 2003-December 2005.

Data on children who died during the period of review were extracted from the mortality cards. They included the medical and personal histories, the diagnoses, duration of hospitalization, the ward and causes of death. For each child, a specific diagnosis or cause of death was entered once. If any other diagnosis(es) or cause of death was documented on the card, they were entered as the second to 4th diagnoses or second cause of death, respectively. The disease conditions were categorized according to the 2000 Global Burden of Diseases.¹² The data were analysed using Microsoft Excel and SPSS Version 11.0 for Windows.

Results

Of the 3959 admissions, 304 (7.67 percent) died. One hundred and fifty nine (52.3 percent) of those that died were males and 144 (47.4 percent) females (m:f ratio: 1.10:1). One child's phenotypic sex could not be determined because of the ambiguity of the external genitalia. The highest number of deaths per year of 127 (41.78 percent) occurred in 2003 while 87 (28.62 percent) occurred in 2004 and 90 (29.61 percent) in 2005. The monthly deaths varied from less than five in December to about 45 in June (Fig. 1). Similarly, the quarterly distribution of the deaths

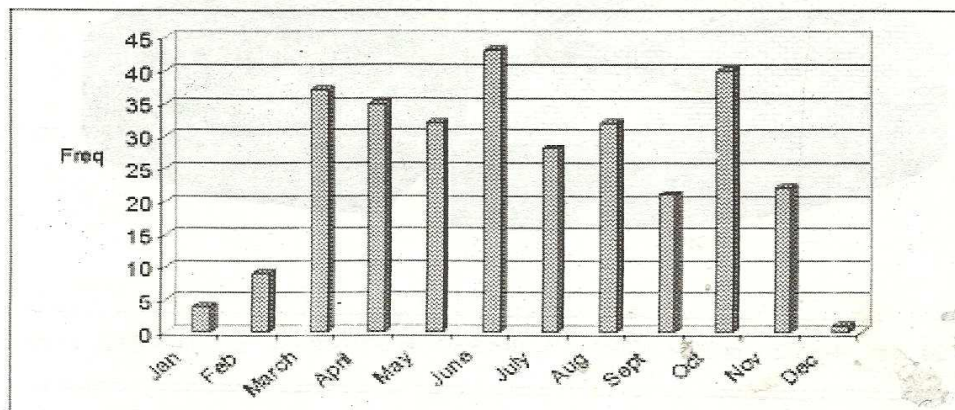


Fig 1: Monthly distribution of the deaths

varied, with the second quarter, April-June, recording the highest deaths of 110 (36.18 percent). Deaths in the other quarters were 50 (16.45 percent) in the first, 81 (26.64 percent) in the third and 63 (20.72 percent) in the fourth. Although the highest number of deaths occurred in the 2nd quarter, these differences were not statistically significant ($\chi^2=0.44$; $df=3$, $p=0.9329$).

The children were aged 30 minutes to 16 years with a mean of 17.38 months, standard error (SE) of 2.25, standard deviation (SD) of 39.17. One hundred and sixty one children (53.3 percent) were neonates of which 44.1 percent were aged less than seven days and 274 (90.1 percent) were under-fives (Fig. 2). There were 146 (48.03 percent) deaths in the Special Care Baby Unit, 99 (32.57 percent) in the

Children's Emergency Ward and 59 (19.41 percent) in the Children's medical wards. The duration of admission before death ranged from 0.25 to 4704 hours with a mean of 125.66 hours, (SE of mean-18 hours, median, 37 hours, mode, 72 hours) and a SD of 313.81. One hundred and twenty four (40.8 percent) deaths occurred within 24 hours of admission and 177 (58.22 percent) within 72 hours (Fig. 3). Fifty two (17.11 percent) children had no hospital registration numbers because they died before they could be fully registered. Only four children had autopsies but the details were not documented in their mortality cards.

The number of diagnoses made on each child varied from one to four; 249 (81.91 percent) children had

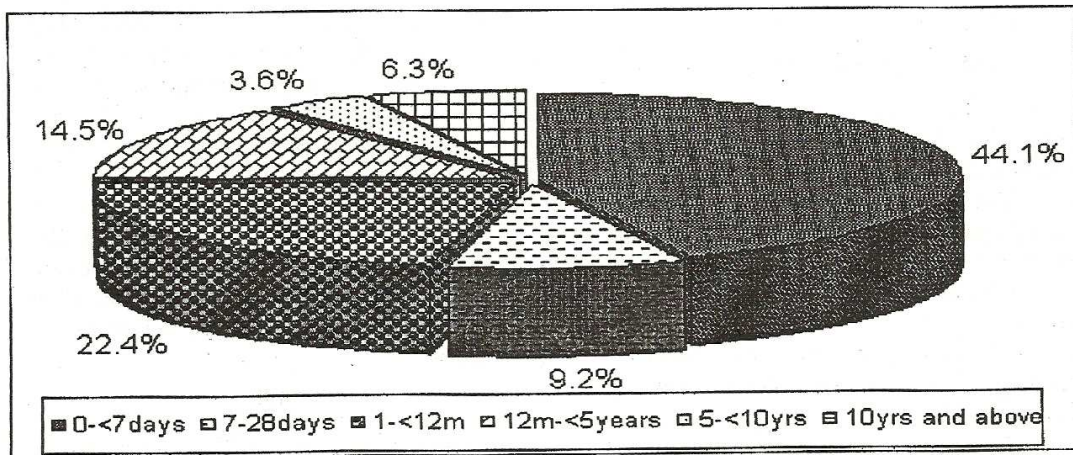


Fig 2: Age distribution of the deceased children

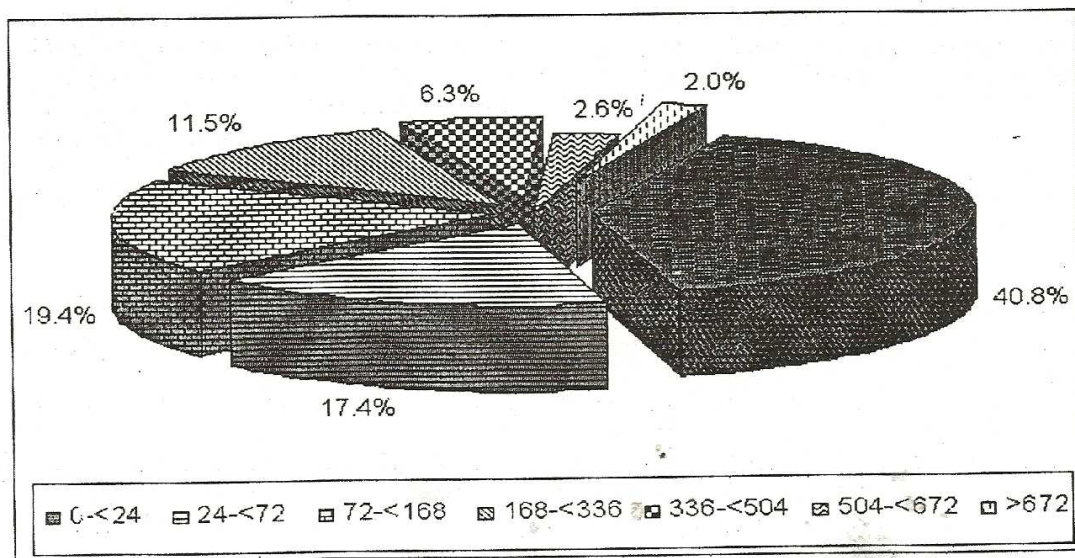


Fig 3: Duration (in hours) of admission before death

Table I

Distribution of Diagnoses in the Deceased Children by Global Burden of Diseases (GBD) 2000 Cause Categories

<i>GBD Cause Name</i>	<i>Disease Classifications</i>	<i>Specific Diseases</i>	<i>Total</i>	<i>Percent</i>
I: Communicable, (maternal), perinatal and nutritional conditions				
A. Infectious & parasitic diseases	Tuberculosis	Tuberculous meningitis	2	0.26
		Pulmonary tuberculosis	5	0.66
	HIV/AIDS	HIV/AIDS	21	2.76
	Diarrhoeal diseases	Diarrhoeal diseases/ Gastroenteritis	35	4.61
	Childhood-cluster diseases			
	Measles	Measles	4	0.53
	Tetanus	Neonatal tetanus	11	1.45
		Post neonatal tetanus	6	0.79
	Meningitis	Bacterial meningitis	20	2.63
	Other CNS Infections	Brain abscess	1	0.13
		Cavernous sinus thrombosis	1	0.13
	Malaria	Severe/complicated malaria	44	5.79
		Hyperreactive malarial splenomegaly	1	0.13
	Others	Rabies	1	0.13
		Sepsis(neonatal and non-neonatal)	125	16.45
		Cellulitis/osteomyelitis/ scalded skin syndrome	7	0.92
		Urinary tract infection	2	0.26
		Typhoid enteritis/Peritonitis	2	0.26
B. Respiratory infections	Lower respiratory infections	Pneumonias and Bronchiolitis	36	4.74
D. Conditions arising during the perinatal period	Low birth weight	Low birth weight/small for gestational age	47	6.18
	Birth asphyxia and birth trauma	Birth asphyxia and trauma and their complications	96	12.63
	Other perinatal conditions	Persistent pulmonary hypertension of the newborn	7	0.92
		Macrosomia/large for date baby/infant of diabetic mother	4	0.53
		Meconium aspiration syndrome	16	2.11
		Neonatal jaundice/ Kernicterus	46	6.05
		Prematurity	46	6.05
		Respiratory distress syndrome	10	1.32
E. Nutritional deficiencies	Protein-energy malnutrition	Various categories of protein calorie malnutrition	14	1.84

GBD Cause Name	Disease Classifications	Specific Diseases	Total	Percent
	Other nutritional disorders	Anaemia and complications (heart failure)	46	6.05
		Fluid overload	1	0.13
		Acid-Base imbalance	6	0.79
		Hypoglycaemia	9	1.18
II. Non-communicable diseases				
A. Malignant neoplasms	Lymphomas	Burkitt and Non-Hodgkins lymphomas	3	0.39
	Leukaemia	Acute lymphoblastic leukaemia and CNS complications	4	0.53
	Other malignant neoplasms	Wilm's tumour	3	0.39
Other neoplasms		Sarcoma butyroides	1	0.13
C. Diabetes mellitus		Diabetes mellitus	1	0.13
		Cerebral palsy	2	0.26
E. Neuropsychiatric disorders		Intracranial space occupying lesion/ Raised intracranial pressure	2	0.26
		Hydrocephalus	2	0.26
G. Cardiovascular diseases	Other cardiovascular diseases	Congestive cardiac failure	8	1.05
		Disseminated intravascular coagulopathy	13	1.71
		Sickle cell disease	4	0.53
H Respiratory diseases	Other respiratory diseases	Pneumothorax	1	0.13
		Respiratory failure	2	0.26
		Pulmonary oedema	5	0.66
		Acute chest syndrome	1	0.13
I. Digestive diseases		Hepatic failure	2	0.26
		Intestinal obstruction	2	0.26
J. Genito-urinary diseases	Other genitourinary system diseases	Chronic renal failure	3	0.39
		Acute renal failure	8	1.05
		Haemolytic uraemic syndrome	1	0.13
L. Musculoskeletal diseases	Other musculoskeletal disorders	Bone marrow failure	1	0.13
M. Congenital anomalies	Abdominal wall defect	Gastroschisis/ Omphalocele	2	0.26
			3	0.39
	Other congenital urogenital diseases	Polycystic kidneys	1	0.13
		Posterior urethral valve	1	0.13
	Down syndrome	Down syndrome	5	0.66
	Congenital heart anomalies	Cyanotic congenital heart diseases	3	0.39
		Acyanotic congenital heart diseases/ ventricular septal defect	3	0.39
	Spina bifida	Spina bifida	1	0.13
		Myelomeningocele	1	0.13
	Other congenital anomalies	Multiple congenital anomalies	1	0.13
		Duodenal atresia	1	0.13
		Foetal dysmorphism	2	0.26
		Beckwith Weidemanns syndrome	1	0.13
		Tracheoesophageal fistula	1	0.13
		Cystic hygroma	1	0.13

Table II
Summary of the Diseases by Categories

<i>Categories</i>	<i>Total</i>	<i>Percent</i>
I: Communicable, perinatal and nutritional conditions	664	87.37
A. Infectious and parasitic diseases	288.00	37.89
B. Respiratory infections (Lower respiratory infections)	36.00	4.74
D. Conditions arising during the perinatal period	264.00	34.74
E. Nutritional deficiencies	76.00	10.00
II. Non-communicable diseases (less congenital anomalies)	69.00	9.08
M. Congenital anomalies	27.00	3.55
Total	760.00	100.00

at least two diagnoses, 150 (49.3 percent) at least three and 57 (18.75 percent), four diagnoses. The total recorded diagnoses were 760 made up of 304 primary diagnoses and 256 other diagnoses (Tables I and II). Category I diseases made up of communicable diseases, perinatal and nutritional conditions contributed 87 percent of the diagnoses. Specifically, infections and parasitic diseases contributed 41 percent, perinatal and neonatal conditions, 35 percent and congenital malformations, 3.6 percent. There were 303 primary causes of deaths since one child with suspected tuberculous meningitis had an indeterminate cause of death. An additional 58 causes of deaths were identified (Table III). The major causes of deaths involved the cardiovascular and respiratory systems, each of which contributed 24.86 percent of the total causes of deaths, infections (20.17 percent) and metabolic disorders (11.6 percent).

Discussion

These results confirm the vulnerability of children, especially the under-fives, to a number of highly preventable conditions or those which can be treated using available low cost measures if early diagnosis is made.² It is particularly interesting to note that deaths in the first one week and one month of life have assumed worrisome proportions considering the fact that the expansion of available essential obstetric and newborn care services can drastically reduce these deaths. The multiplicity of diagnoses in the children confirms the observations that led to the adoption of the Integrated Management of Childhood Illness (IMCI) strategy as the single most important approach that could drastically impact on child survival.¹³⁻¹⁵ This is because unless all conditions with which the child presents are accurately identified and specifically treated, mortality will remain high. It is therefore important to integrate all the required management in children to reduce associated morbidity and mortality. This is particularly important in resource-

limited settings where lack of facilities for detailed investigations or their costs do not allow full investigation of cases for appropriate diagnoses. The improvement in the quality of care attributable to the adoption of the IMCI strategy for the management of children at the first level of care should be expanded to the first level referral facilities where about 5-15 percent of children referred from the first level are likely to receive care. This need is urgent since about 40-60 of such referred children die at the referral hospitals during the first 24 hours of admission.

One of the main contributors to the high death rates in referred children is late presentation. In the present series, 17 percent of the children who died were so ill that the full registration process with the opening of folders could not be performed, while over 40 percent died within 24 hours of admission. This identifies a serious need for improved services for critically ill children even at this level of care. Emergency Triage, Assessment and Treatment (ETAT), a process by which all ill children are rapidly but objectively assessed and sorted according to the severity of their presentations has been recommended for implementation in all facilities where a significant proportion of deaths occurs within 24 hours of admission.¹⁶ The implementation of ETAT in this setting will impact positively not only on paediatric mortality but also on deaths in all age groups since it will result in the improvement of the skills of the staff and ensure that the facility is equipped to handle emergencies.

Some other important issues that have emerged from this series include the following:

- The persistence of known preventable or easily treatable causes of deaths in our children even at the tertiary level. These conditions include malaria, diarrhoea, vaccine preventable diseases (tetanus, diarrhoea, tuberculosis). It is important

Table III
Yearly Distribution of the Immediate Causes of Death

Categories	Specific Causes of Death	Years			Total
		2003	2004	2005	
Haematologic/ Cardiovascular disorders	Anaemia/anaemic heart failure	17	5	16	38
	Cardiopulmonary arrest	-	-	1	1
	Congestive heart failure	8	5	5	18
	Disseminated intravascular coagulopathy	8	6	7	21
	Hemolytic uremic syndrome	-	-	1	1
	Hypovolemic shock	3	3	5	11
	Sub-total	36	19	35	90
Respiratory disorders	Apnoea	1	1	4	6
	Asphyxia	1	-	-	1
	Aspiration/aspiration pneumonitis	5	3	3	11
	Congenital pneumonia	-	1	-	1
	Pulmonary oedema	3	-	3	6
	Hypoxia	-	-	1	1
	Laryngeal spasm	3	-	-	3
	Meconium aspiration syndrome	-	-	1	1
	Persistent pulmonary hypertension of the newborn	7	2	7	16
	Respiratory distress	1	6	-	7
	Respiratory failure	17	11	8	36
	Severe bronchopneumonia	-	-	1	1
	Sub-total	38	24	28	90
Infections	Endotoxaemia	-	1	1	2
	Necrotising enterocolitis	-	2	2	4
	Peritonitis	1	-	-	1
	Sepsis	30	9	12	51
	Septic shock	-	-	2	2
	Cerebral malaria	2	1	-	3
	AIDS	4	4	2	10
		Sub-total	37	17	19
Metabolic conditions/ electrolyte derangements	Acidosis	1	2	2	5
	Neonatal jaundice/kernicterus	8	4	1	13
	Hypoglycaemia	2	7	3	12
	Hypokalaemia	1	1	-	2
	Drug complication	1	1	-	2
	Electrolyte imbalance	5	1	1	7
	Fluid imbalance	-	1	-	1
	Sub-total	18	17	7	42
Prematurity	Prematurity	12	15	12	39
	Raised intracranial pressure	1	-	-	1
	Hypoxic ischaemic encephalopathy III	-	8	-	8
	Hydrocephalus	-	1	-	1
Nervous system disorders	Encephalitis	-	-	1	1
	Coning	-	2	1	3
	Cerebral oedema	-	1	1	2
	Sub-total	1	12	3	16
Renal disorders	Acute renal failure	2	2	1	5
	Chronic renal failure	1	-	-	1
	Renal vein thrombosis	-	-	1	1
	Uremic encephalopathy	-	-	1	1
		Sub-total	3	2	3

Table III Contd..

Categories	Specific Causes of Death	Years			Total
		2003	2004	2005	
Malignancies and related complications	Tumor lysis syndrome	-	1	-	1
	Paraneoplastic neuropathy	1	-	-	1
	Bone marrow failure	-	-	1	1
	Sub-total	1	1	1	3
Inconclusive	Inconclusive	-	-	1	1

to note that whereas non-communicable diseases prevail in the economically more advanced countries, contributing about 58.2 percent of mortalities, communicable and related diseases prevail in resource-limited settings,¹⁰ and in our series accounted for 87.37 percent of the deaths.

- The emergence of HIV and AIDS as a contributor to under-five deaths as opposed to the findings in previous reports. With the magnitude of HIV and AIDS in Nigeria, unless control efforts, including the Prevention of Mother-to-Child Transmission (PMTCT) programmes are intensified, HIV/AIDS will henceforth, most likely contribute significantly to the under-five deaths as has been reported in some South and East African countries.¹⁷
- The shift of the age of deaths to the neonatal period. This has been noted in other series.^{19,23} It is probably due to the limited implementation of a number of interventions in the post-neonatal under-fives which has positively impacted on their survival leaving the neonates at increased risk. Additionally, some interventions that would have improved neonatal survival such as antenatal care, obstetric and neonatal emergency services, tetanus toxoid immunization and delivery with the assistance of skilled attendants have remained largely under-utilised. In Nigeria for example, although 58 percent receive skilled antenatal care, only 35 percent of pregnant women deliver with skilled attendants, and only 51 percent receive two doses of tetanus toxoid.¹⁸

There is therefore a need to improve the management of neonatal and paediatric emergencies if the MDG4 is to be attained. Bottle-necks to quality care should be identified through regular audit of services. They should be addressed through a multisectoral approach. Some high impact and cost-effective strategies for improved survival of children

which should be implemented on a wider scale include:^{19,23}

- Services for improved management of obstetric, perinatal, neonatal and paediatric emergencies
- Emergency Triage Assessment and Treatment
- HIV and AIDS control programme including PMTCT
- Nutritional interventions such as breast-feeding, infant and young child feeding, food and micronutrient supplementation programmes
- Expanded (National) Programme on Immunisation, the Control of Diarrhoeal Diseases, Outpatient Management of Acute Respiratory Infections, Malaria Control Programme - all integrated into the IMCI

As has been shown from this review, there is a need to regularly monitor the trend of paediatric deaths so that persisting contributors and emerging ones can be identified for control actions.²³ Although this study did not set out to assess the impact of the Revolving Fund Scheme on the clientele of the facility, it has been noted that lack of funds often causes delayed presentation for care. There is therefore a need to critically appraise the impact of the scheme on the care seeking behaviour of parents in order to ensure it does not lead to undue delay in care seeking.

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- 98 *Mortality: a Review of Causes among Admissions at the University of Port Harcourt Teaching Hospital*
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