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Mortality within 24 hours of admission to the Paediatric Unit, *Harare Central Hospital, Zimbabwe*

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Abstract

Objective: To determine the proportion of deaths, characteristics of children and risk factors for mortality within 24hours of admission to a Paediatric hospital in Harare.
Study Design: Prospective cohort study.
Settings: Paediatric Unit, Harare Central Hospital.
Subjects: All patients admitted to the medical wards who consented to participate were enrolled. Pre-admission factors including duration of illness and health seeking behaviour prior to presentation, delays in A&E department assessed by lag time to assessment, administration of initial medications and admission to the ward were documented. The presenting clinical signs and admission diagnoses were also recorded.
Main Outcome Measure: Death within 24hours of admission.
Results: Of the 737 paediatric admissions during the study period, 54 children died within 24 hours giving a case fatality rate of 7.3%. These constituted 34.6% of total deaths in the study population (54/155).The median age of the children in this study was 16 months (Q_1= 4, Q_3= 36) and 53.2% were male. Having sub-costal recessions on admission was significantly associated with mortality (within 24hours of admission) with a RR 2.99 (95% CI 1.56-5.74) while socio-demographic factors, duration of illness, fever, diagnosis on admission and delays in A&E department were not.
Conclusion: The contribution of deaths within 24hours of admission to the overall mortality in children remains unacceptably high. Sub-costal recessions on admission (a proxy for severe pneumonia) had the highest risk of mortality within 24hours of admission. There is need for early identification and aggressive management of children with pneumonia.

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Introduction

Under 5s mortality remains unacceptably high in Zimbabwe with estimates of 84/1000 live births (ZDHS 2010-11)[1]Integrated Management of Childhood Illness (IMCI) is a recognized approach to triaging and managing children under 5 aiming to reduce mortality in this age group.[2] IMCI approach was adopted in Zimbabwe in 1996.

Several studies have shown have reported varied rates of 24hr mortality in this age group, with 65% in a Kenyan study[3], 63% in Afganistan[4], 60% in Bangui[5] and 50% in India.[6]

Events occurring prior to hospitalization, late presentation, initial resuscitation, prompt correction of hypoglycaemia and hypoxia, have been cited as important factors that contribute to early mortality.[3,5,6-8]

Clinical diagnoses including pneumonia,

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gastroenteritis, anaemia (secondary to malaria) and measles are documented to cause high mortality within 24hours of admission.[3,7]

While the causes of under 5s mortality are known, the hospital factors associated with 24hr mortality in Zimbabwe need further study. There is need for local data on factors associated with mortality during this very significant period of hospitalization. We therefore set out to document risk factors for mortality within 24 hours in children admitted to the Paediatric Wards at Harare Central Hospital.

Materials and Methods

A prospective cohort study was undertaken from 1st December 2004 to 31st January 2005 at Harare Central Hospital, a major referral and teaching hospital in Zimbabwe. Patients were recruited from the Accidents and Emergency (A&E) department and followed up through the first 24 hours of admission and then to hospital discharge or death. Data was collected using a standardized data-collecting tool, by direct parent interviews and real time records capture or within 24hours for patients admitted at night and within 48hours for patients hospitalized over the weekend.

The Paediatric A&E department handles about 150 sick children per day. Between 500 and 800 medical patients are admitted per month.[9]. Admission of sick children was decided and managed by the attending doctor who gave the necessary emergency care after the initial assessment according to the standard protocols. The caregiver was requested to give consent after the child was stabilized. A consultant Pediatrician or the Paediatric resident (with minimum of 2years training in Paediatrics) also examined the patients within 24hours of admission. Some patients demised before being seen by the Paediatric resident or consultant. These patients were still included in the study.

All new patients who presented to the A&E department, and proceeded to be admitted to the medical wards were included in the study after informed consent was given. Surgical patients, deaths before arrival to or in the emergency department, dumped babies and referrals from other hospitals were excluded.

Detailed information was captured by protocol trained study nurses who also interviewed the patients /caregivers and completed the data collecting tool. The patients' course on the ward for the first 24hours and the outcomes of all the enrolled children were recorded.

Ethics

Approval to conduct the study was granted by the Institutional Review Board of Harare Hospital. Informed consent was obtained from the caregivers. All treatment was given according to the hospital treatment protocols.

Statistics

Data cleaning and analysis was done using Epi Info version 6.

Descriptive statistics were generated. Odds ratios with 95% Confidence Intervals (CI) for factors associated with mortality within the first 24 hours of hospitalization were derived. Univariate analysis was done to determine predictors for mortality in first 24 hours.

Results

A total of 739 children were admitted to the medical wards, Paediatric Unit, Harare Central Hospital within the study period. There were 2 dumped babies who were excluded. Therefore results of 737 children, whose caregivers consented to participate, are presented. Three hundred and ninety two (53.2%) were boys. The median age was 16 months, (Q_1= 4 months, Q_3= 36 months).

The majority of children admitted during this period were below 5 years of age (84%) with infants constituting 41% of the admissions. A total of 155 children (21%) died during the study period. Of those who died, 54(34,8%)were within 24hours of admission. Infants contributed 39%, children aged 1 to 5yrs, 43% and the remaining 18% being children between 5 and 12yrs of age. Of the 54 children deaths, 35 were boys and 19 girls. The relative risk of dying within 24hours of admission for males was 1.68 (95% CI 0.91-3.12) compared to females.

The relative risk of dying within 24 hours of admission comparing infants to the rest of the children under 5 years of age was 0.97 (95% CI 0.55-1.72) which was almost similar to that comparing to all the older children up to 12 years (RR.93 95% CI:0.55-1.57). Thus, in this study population, infants were not at any higher risk of dying compared to older children.

Pre-admission factors

Caregiver status, age, level of education, marital status and religion were not significant factors in mortality within 24hours of admission. Consultations prior to hospital presentation, waiting time before assessment in A&E department, time between assessment and initial drugs administration and lag time to transferring patient to the ward after assessment were all not significantly associated with mortality within 24hours of admission.

The median duration of illness before presenting to hospital was 7 days (range 1-120 and IQR 3 - 21 days). Using less than 3days as early presentation, the mortality within 24hours of admission was not significantly different between the groups. (Appendix 1)

Table I: Shows the baseline characteristics of the study population by outcome at 24hours of admission.

Characteristic	Died within 24 hrs of admission Yes	No	Total
Age (Months)			
0-11	21	279	300
12-60	23	296	319
>60	10	108	118
Sex			
Male	35	357	392
Female	19	326	345
Caregiver (Status)			
Mother	39	581	620
Father	5	63	68
Other	2	28	30
Unknown	8	11	19
Age			
<20	4	77	81
20-35	36	468	504
>35	4	101	105
Unknown	10	37	47
Level of education			
Primary	8	125	133
Secondary	34	523	557
Tertiary	0	14	14
Unknown	12	21	33
Marital Status			
Married	40	547	587
Widow	1	53	54
Divorced	1	42	43
Single	3	29	32
Unknown	9	12	21

Table II: Shows the risk factors for mortality within 24 hours of admission by univariate analysis.

Child Characteristics	Died within 24 hrs of admission Yes	No	RR (95% CI)
Age (months)			
0-11	21	279	0.93 (0.55-1.57)
>12	33	404	
0-60	44	575	0.84 (0.43-1.62)
>60	10	108	
Sex			
Male	35	357	1.62 (0.95-2.78)
Female	19	326	
Caregiver: Characteristics			
Mother	39	581	0.88 (0.41-1.91)
Father/Other	7	91	
Parent	44	644	0.96 (0.24-3.77)
Other	2	28	
Age			
<20	4	77	0.75 (0.28-2.05)
>20	40	569	
Level of Education			
Primary	8	125	1.01 (0.42-2.35)
Secondary/Tertiary	34	537	
Marital Status			
Married	40	547	1.76 (0.71-4.37)
**Single	5	124	

****Single includes widows and divorcees.**

Clinical findings

Admission temperature and respiratory rate on admission were not significantly associated with mortality within 24hours. However having sub-costal recessions was significantly associated with mortality within 24hours of admission. The relative risk of dying within 24hours of admission if the child has recessions on initial assessment was 2.99 (1.56-5.74) compared to children without recessions on admission.

The majority of children were admitted with severe pneumonia as the primary clinical diagnosis. Malnutrition was the second commonest problem. These included patients with kwashiorkor, marasmus and marasmic-kwashiorkor. Co-morbidity was high and most of the patients with malnutrition had pneumonia and persistent diarrhoea. Case fatality rates were calculated for the main admission clinical diagnosis.

Of the 14 children who died with malnutrition as the main diagnosis 6 had kwashiorkor, 2 marasmic-kwashiorkor, 4 marasmus and 2 recorded only as malnutrition. The relative risk of dying within 24hours was calculated comparing each of the main diagnoses to the rest of the patients. Neonates were excluded. Children with gastroenteritis and malaria had double the risk of dying within 24hours of admission though this was not significant. Being admitted with other problems besides the 5 main diagnoses was significantly protective against death within the first 24hours of admission.

Of the 54 deaths, 41 (75.9%) occurred during the day between 0700hours and 1900hours.However in children with malnutrition, 50% of the deaths occurred at night. No child died within the first hour of admission. 10 patients died within the first 12hours of admission while the rest died after 12hours of admission. The breakdown of the time spent on the ward prior to death is shown in Appendix II.

Table III: Shows the health seeking behaviour and initial management prior to admission.

Factors	Died within 24 hrs of admission Yes	No	RR (95% CI)
Prior Consultation			
Local clinic/GP	36	564	0.53 (0.23-1.20)
Traditional/faith healer	6	47	
Waiting time in A & E			
<1 hour	7	52	1.59 (0.65-3.89)
>1 hour	11	136	
Duration between Doctor's assessment and Initial drugs Administration (mins)			
<30	7	79	1.18 (0.53-2.62)
<30	27	365	
Duration between doctor's assessment and admission to ward (mins)			
<60	8	92	1.17 (0.55-2.50)
>60	26	354	
<120	25	332	0.96 (0.46-1.99)
>120	9	114	
Duration of illness (days)			
=/<3	20	202	1.36 (0.80-2.30)
>3	34	478	

Table IV: The vital signs and clinical diagnosis and risk of death within 24 hours of admission.

Clinical signs	Died within 24 hours		RR (95% CI)
	Yes	No	
Temperature			
<37.5°C	24	373	0.76 (0.44-1.29)
≥37.5°C	26	300	
<38.5°C	38	545	0.78 (0.41-1.42)
≥38.5°C	12	128	
Respiratory rate			
<60	8	93	0.71 (0.28-1.81)
≥60	8	64	
Recessions			
Yes	30	264	2.99 (1.56-5.74)
No	12	340	
Clinical diagnosis:			
Pneumonia	18	240	0.88 (0.50-1.53)
Malnutrition	14	188	1.07 (0.60-1.92)
Gastroenteritis	6	35	2.06 (0.93-4.53)
Menengitis	2	39	0.61 (0.15-2.44)
Malaria	3	18	1.94 (0.66-5.73)
Others	8	103	0.43 (0.20-0.93)

Others: 1 acute asthmatic, 1 congenital cyanotic heart disease, 1 acute one chronic renal failure, 1 acute post streptococcal, 2 congestive cardiac failure, 1 advanced AIDS, 1 no specified cause.

Discussion

The 24 hour fatality rate was high. Of the155 died children who died during the study fifty-four (34.8%) occurred within 24hours of admission. This is lower than the 24hr mortality reported by Nathoo *et al* from the same setting.[10] This could, in this study, be due to the use of the strict definition of 24hours of admission based on the time that the patient is assessed and ordered for admission by the doctor whilst

Nathoo *et al* do not state how they estimated the 24hours of admission. The overall mortality is much higher than that quoted in other studies.[3,5,6]

Nathoo *et al* found the majority of admissions (51.8%) were infants and pneumonia was the major cause of morbidity followed by malnutrition with pneumonia as co morbidity in some patients. The main admission diagnoses in this study were pneumonia, severe malnutrition, gastroenteritis, neonatal sepsis, meningitis and malaria. The highest case fatality, within 24hours of admission, was in-patients with gastroenteritis and malaria. This was probably because only children with gastroenteritis are only admitted when they have severe dehydration or electrolyte derangements. There is need to strengthen appropriate management of children with gastroenteritis and severe dehydration on admission to hospital. Two of the three malaria deaths were due to cerebral malaria. Though malaria is an important cause of mortality in high prevalence areas, a 24 hour case fatality rate of 14.3% in this study population needs further evaluation with a larger sample size.

The relative risk of dying within 24hours was not significantly different between the infants and older children. This is different from what Lankriet *et al* found where sixty percent of the children dying within 24 hours were below 1 year of age.[5]

Maternal factors.

Whether the caregiver was the mother or not did not have a significant impact on mortality within 24hours. The majority of caregivers were between 20 and 35 years of age. The risk of dying within 24hours of admission was not significantly different in the children whose caregivers were relatively young, <20yrs, compared to those with older caregivers. This was unexpected as the young mother is usually expected to be non-experienced and therefore their children being at higher risk. The tendency to a protective effect in single caregivers was surprising. This might be because in this community, single caregivers usually can make a decision to take the child to hospital independently whereas most married women cannot make that decision independently. The need to consult the partner might result in delays in presentation. However, this needs to be further explored in a larger study. More than 95% of caregivers were Christians and there was no difference in the risk of dying within 24hours in children whose caregiver was Christian compared to non-Christian.

Health seeking behaviour.

Pre - admission factors including consulting the clinic or traditional healers and the duration of illness before presenting to hospital did not have any statistically significant impact on the risk of dying within 24hours. The majority of the patients who had sought help before presentation had consulted a local clinic (86.7%) followed by faith healers (6.9%) then general practitioners and traditional healers (1.2%). Consulting western medical practice (a clinic or general practitioner) prior to hospital presentation had a protective effect on mortality within 24hours of admission compared to those who consulted traditional or faith healers though this was not statistically significant (RR 0.53, 95% CI 0.23-1.2). Gamatie *et al* in Tunisia found that visiting a traditional healer prior to hospitalization was a significant risk factor for mortality though their study was limited to children less than 2yrs of age.[8] The population in this study was mostly urban and their behaviour in relation to use of traditional and faith healers could be different from the settings Gamatie *et al* looked at. Whether the findings would be different in a rural setting in Zimbabwe is a question for future research.

In-hospital factors.

The majority of the children (71%) died during the day between 0700hours and 1900hours. This is in contrast to the finding by Singh *et al* where, of 63% of the deaths which occurred within the first 24hours, the majority were out the regular working hours[4].

In our study the majority of the children (53.5%) died between 12 and 24hours after admission. 11.6% of the children died within 4hours of admission. This means

that, where possible, there are a few hours for aggressive resuscitation and management. This could make a difference especially in patients with gastroenteritis. In their study on prognostic factors, Berkley[11] *et al* found 14% of the children died within 4hours and 44% within 4-48hours. The prognostic indicators for early mortality that they found include subcostal recessions, which this study also found as the only significant factor for mortality within 24hours of admission (RR 2.99, 95%CI 1.56-5.74).

The high mortality within a few hours of admission probably reflects that patients are very sick and die within few hours of admission. Though the shortage of staff at night and parents not spending the night at the baby's bedside, have been put forward as important factors contributing to deaths during the night, this study did not show them as significant factors.

The median duration of illness prior to presentation was 7days.The relative risk of dying within 24hours of admission if the child has been ill for up to 3 days or less was 1.39 and for the duration of illness up to 7days it decreases to 0.93. Though these were not statistically significant, the increased risk of dying in 24hours in children who have been ill for up to 3 days probably reflects severity of illness related to high risk of early mortality. The slightly protective effect of the longer duration of illness is probably explained by that it is the children who are not very sick that parents delay bringing to hospital. This needs further exploration considering that this is an urban population as compared to the study by Menge *et al* at a rural hospital in Kenya.[3] Adams *et al* also found late referral as an important contributing factor to early mortality in a black paediatric department.[7]

The most common cause of morbidity was pneumonia. This is similar to what Nathoo *et al* found in the same settings. The second commonest admission diagnosis was malnutrition then neonatal sepsis. Though gastroenteritis was the fourth most common diagnosis, it had the highest case fatality rate. The study was done during the off peak season for diarrhea and as a recommendation most cases of gastroenteritis except severe and complicated cases, are managed in A&E Department. Though the case fatality rate from gastroenteritis (14.6%) within 24hours of admission is the highest in this study, it is much less than the 41% that Nathoo *et al* found. Improvement in case management of diarrhoea might be a contributory factor though the sample size was small. There were only 3 cases of malaria, two died of cerebral malaria, which is known to have a high case fatality rate. The number of malaria cases limits the usefulness of the data and therefore any meaningful conclusions.

Though Nathoo *et al* (14) found neonatal sepsis to contribute the highest proportion of deaths within 24hours (50%) it had the lowest case fatality in this study. The sample size was small to make meaningful conclusions raising the need for further study.

Clinical signs.

The admission temperature and fastrespiratory rate was not associated with an increased risk of dying within 24hours. However, the presence of sub costal recessions increased risk of dying within 24hours of admission by 3 times. Planche *et al* in their study found presence of respiratory distress to be among the predictors of mortality in children with diseases other than malaria.[12] Their study was on mortality in hospital but not focused on the first 24hours of admission. That respiratory distress comes out as an important risk factor for mortality within 24hours of admission emphasizes the importance of pneumonia in early childhood mortality. Aggressive management and monitoring of children with pneumonia is important.

Conclusion

The contribution of deaths within 24hours of admission to the overall mortality in children remains unacceptably high. Subcostal recessions, as a proxy for severe pneumonia, was associated with a three times higher risk of mortality within 24hours of admission. There is need for early identification and management of severe pneumonia in children.

Limitations of the study

The study was conducted during a very challenging economic time for the hospital. Most of the machines were not working therefore basic investigations were not being done. The bedside tests including pulse oximetry were not available. Due to financial constraints, the data collection was done only during the day. This resulted in inadequate documentation of data for patients admitted out of the normal working times particularly if the children died during the night of admission or weekends.

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