Original article:

Analysis of causes of deaths and contributing factors using Child Death Audit under 5 children

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ABSTRACT :

Introduction: Child Death Audit means to thoroughly examine and respond to the social, biological and medical events that lead to a child death. Analysis of child deaths not only informs about the medical cause of death but also identifies the gaps in health service delivery

Objectives: *Primary objective* To analyze the cause of deaths in children below 5 years of age. *Secondary Objective* To identify the contributing factors which were analyzed as delays like delay in deciding to seek adequate medical help, delay in transport and delay due to operational inadequacies.

Methods : *Setting* The tertiary care referral centre. *Type of study* Prospective Hospital based observational study of Child Death Audit using the Verbal Autopsy Questionnaire *Participants* All under- five deaths occurring in the department of Paediatric Medicine from November 2010 to July 2012.*Methods* Infant and Child Death Audit Proforma prepared by Government of Maharashtra was used for Verbal Autopsy Questionnaire. Total 640 deaths were audited for under 5 children. Two groups were analysed birth to 1 month(Newborn) & 1 month to 5 years. Special emphasis were given for delays in seeking medical attentions, transportation delays and operational inadequacies.

Results : Neonatal deaths accounted for 75% of the total under five deaths whereas deaths in age group of 1 month – 5years accounted for 25% of deaths. Poor maternal schooling and low socioeconomic status were significant factors associated with under 5 mortality (p<0.001) . DELAY 3 i.e. delay due to operational inadequacies in health care was observed in 63% cases in <1month age group while in 78% cases in 1month to 5years age group.

Conclusion : Neonatal mortality is the main contributor in under -5 deaths, RDS being the major cause of death being RDS in neonatal and in post neonatal age group, LRTIs. Major contributory factor for death was operational inadequacies.

Key words : Child death audit, verbal autopsy questionnaire

Introduction:

In India of the 26 million born 1.83 million die before 5th birthday. India has a dubious distinction of contributing to more than 1/3rd ,approximately 5,000 deaths/day, of which half do not survive even a month. [1]For India the Latest under- 5 mortality rate (U5MR) is 52 in the year 2012 which is a significant achievement as against the mortality of 115 in the year 1990. UNICEF defines under five mortality as annual number of deaths of children less than 5 years of age expressed as a rate per 1000 live births.[2] It is the best barometer of social and economic progress and achievement of a country towards highest standard of living. It forms a component of health indicators like PQLI(Physical Quality Of Life Index) and HDI

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(Human Development Index) and a key component of the RCH (Reproductive and Child Health) programme.[2]

In order to accelerate the pace of decline of Infant Mortality Rate (IMR) and in order to achieve the National Rural Health Mission (NRHM) and Millennium Development Goals (MDG) goals, there is need not only to give impetus to the implementation of technical strategies and interventions for child health but also set up systems of CHILD DEATH AUDIT.[3] Child Death Audit means to thoroughly examine and respond to the social, biological and medical events that lead to a child death.[4] One of the method's for a CDA is the Verbal Autopsy Questionnaire others being Vital Registration Systems, Population Based Reporting Systems and Demographic Survey[5].

Child Death Audit (CDA) is an important strategy to improve the quality of child care and reduce infant mortality and morbidity. The importance of CDA lies in the fact that it provides detailed information on various factors at facility, district, community, regional and national level that are needed to be addressed to decrease the infant deaths. Analysis of these deaths not only inform about the medical cause of death but also identify the gaps in health service delivery, including delays like delay in deciding to seek adequate medical help, delay in transport and delay due to operational inadequacy at various levels that can contribute to infant deaths . [3] In developing country settings, where many deaths occur at home, verbal autopsy is the investigative method most often used to determine the prevailing biological causes of death.(6) A Verbal Autopsy is a method of finding out the cause of death based on an interview with next of kin or other care givers. Health care programmers and policymakers need these data to identify strategies for increasing health-promotive behaviours and access to and

utilization of quality health care services. Verbal autopsy studies are now widely used throughout the developing world to estimate cause-specific mortality, and are increasingly being used for disease surveillance and sample registration. Verbal autopsy has long been used to generate mortality data, often with the needs of specific programs of childhood and maternal mortality, in mind.

Most of the child deaths result from a chain of events that include many social, cultural and medical factors. However it is seen that there are three factors which play very important role while seeking health care, which are delay in deciding to seek adequate medical help, delay in reaching a health facility & operational inadequacies in the health care facilities. In the busy tertiary care center most of the emphasis is on diagnosis and management and the analysis about these delays is totally left out. Thus there is a need to find out the cause of death not only in the community but also in the facility where the death occurs. Avoiding these delays may help to reduce in under 5 mortality rate. Hence this study of child death audit was done to analyse the causes of deaths & delays contributing to deaths in children below 5 years in a tertiary care .

AIMS AND OBJECTIVES

PRIMARY OBJECTIVE: A Cross Sectional Study (CHILD DEATH AUDIT) to analyze the cause of deaths in children below 5 years admitted under the discipline of Pediatric medicine at tertiary care centre.

SECONDARY OBJECTIVE: To identify the contributing factors which were analyzed as delays like delay in deciding to seek adequate medical help, delay in transport and delay due to operational inadequacies.

MATERIAL & METHODS

Setting: The tertiary care centre in the above study is a major referral centre in Western and Southern

Maharashtra. Department of Paediatric Medicine at this centre admits on an average 20 patients per day (Neonatal ICU (NICU), Respiratory ICU (RICU), and Paediatric ICU (PICU)

Participants: All under- five deaths occurring in the department of Paediatric Medicine from November 2010 to July 2012 were enrolled in the above study.

Type of study: Prospective Hospital based observational study of Child Death Audit using the Verbal Autopsy Questionnaire

Sample size: All deaths were consent was given during the period of study & satisfying inclusion criteria.

Inclusion criteria: All the deaths occurring in the Discipline of Paediatric medicine under 5 years of age were enrolled. Neonates both inborn and outborn were included.

Exclusion Criteria:

Deaths in medico legal cases & deaths in children below 5 years admitted to disciplines other than Paediatric Medicine were excluded.

Methods:

Detailed records of the under-five deaths were maintained using, a structured proforma. THE VERBAL AUTOPSY QUESTIONNAIRE-Child Death Audit Proforma prepared by Government of Maharashtra with prior permission from the Additional Director, State Family Welfare Bureau, Pune. The questioner was validated. Verbal autopsy was done by interrogating the parent or guardian of the deceased immediately after the death, with complete condolence and empathy towards the family with counselling for auditing .

As per proforma two groups were divided ,neonatal group was defined as birth to one month of age and had 477 deaths were as other group consist of 1 month to 5 years of age had 163 deaths.

The contributing factors which were analysed with specific emphasis on deficiencies in transport system, lack of access to basic health facilities, illiteracy, maternal health, mode of delivery etc. Also the level of care given to patients at tertiary care centre in terms of lacunae, pit falls or delays in initiating the management of case if any and possible remedies to be implemented to avoid the factors contributing to death were studied. Specific emphasis was given to delays .

Section 8 of Infant & Child death Audit verbal autopsy questionnaire was used to define following delays:

The delay 1 is delay in deciding to seek adequate medical help. Social and cultural factors that may contribute to delay which include low education, poverty, lack of mothers' participation in decision making, not recognizing or understanding the importance of danger signals in children, using traditional home care and informal providers for treatment.

The delay 2 is in reaching a health facility which can be due to the time needed to organize funds to pay for transportation or health care and distant health facilities. The delay 3 is due to operational inadequacies in the health care facilities like lack of drugs, blood, medical and surgical equipment or skilled health care personnel in the facility where the child was admitted and subsequently died.

SELECTING THE RESPONDENT:

The respondent was the main person who were provide information about the deceased. The interview was conducted with one who was with the child during his/her fatal illness & knowing past history called the primary caregiver. Complete privacy and confidentiality was assured to the respondent. All potential respondents have the right to determine for themselves whether or not they will participate in the interview. The Informed written Consent was administered to all respondents.

The questionnaire was filled after the death of the deceased by single person and before the body was handed over to the kith or kin. In situations where the respondent had great difficulty in answering questions since they were overcome with emotion, time was given to regain composure. The respondent was never forced to answer any question that she/he did not want to. If the respondent did not know any answer or took time to answer a question, she/he was allowed to think before recording the answer.

Statistical analysis was done by using Microsoft office 2007 and were ever applicable chi square statistical test was applied. Ethical committee approval was taken.

RESULTS:

In the present study period which extended from November 2010 to July 2012 total deaths under 5 were 723, out of which in 640 deaths were consented for enrollment. Main reasons for non consented were emotional instability & grief. Out of 640 deaths 477 were neonatal deaths i.e. 75% of the total under five deaths. The rest of the 163 deaths were in the age group of 1 month – 5years which accounted for 25% of deaths. Overall among the 640 deaths 58% were male children and 42% were female.

Majority of deaths were from urban area but difference between urban and rural area among both neonatal & 1 month to 5 years group was statistically not significant(P=0.021).Maximum deaths in 1 month to 5 years group were referred babies to tertiary care center. Neonatal mortality was maximum with inborn & registered pregnancy. Maternal schooling and low socioeconomic status was significant factors associated with under 5 mortality (p<0.001).[Ref.Table1]

Table I : Baseline Characteristics

	Age group Birth to 1 month	Age group 1 month to 5years	p value
Total Admissions(n=3317)	2225	1092	
Total deaths(n=640)	477(75%)	163(25%)	
Male	278	95	
Female	199	68	
Urban	353(74%)	105(64%)	0.021
Rural	124(26%)	58(36%)	
Inborn	299(63%)	N.A	
Outborn	178(37%)	N.A	
Antenatal care – Registered			
Yes – Registered	365(77%)	N.A	
Non Registered	112(23%)	N.A	
Non referred	N.A	55(34%)	
Referred	N.A	108(66%)	

Maternal Schooling			
7 years /less/no	112(23%)	94(58%)	<0.001
>7 years	365(77%)	69(42%)	
Socioeconomic status – LOW			
SE Low-Yes	448(94%)	150(92%)	<0.001
SE Low – NO	29(6%)	(8%)	

*SE - Socioeconomic status, N.A - Not applicable

Table II Neonatal Mortality , Weight wise(n=477)

Weight	No Of Deaths n =477	Percentage (%)Of Total Deaths
ELBW(<1000G)	110	23
VLBW(1000-1500G)	169	35
LBW(1500-2500G)	158	32
TERM>2500G	40	10

Majority of deaths in neonates were between 1000-1500grams group.Only 40 babies were more than 2500 grams.

Table III Causes of Neonatal Mortality

Cause Of Deaths	No Of Deaths	Percentage (%)Of Total Deaths
LRTI	40	25
Septic Shock	32	20
Meningoencephalitis	24(TBM-8)	15(33)
Diarrhoeal Diseases	9	5
Malnutrition	5	3
Others	53	32
Total Deaths	163	

Most important cause of neonatal mortality appeared to be respiratory distress syndrome **(RDS)** comprising 40% of deaths. RDS is closely related to prematurity and low birth weight. Sepsis was the culprit behind close to one third i.e. (28%) deaths. Majority of them were Late Onset Sepsis. 59 deaths (12%) were of Birth asphyxia. Meconium aspiration syndrome **(MAS)** as a single diagnosis was responsible for 4.5% of deaths. But added to other respiratory disorders it becomes a major respiratory factor affecting mortality.

Table IV :1 month-5year Mortality causes (n=163)

Cause Of Deaths	No Of Deaths	Percentage (%)Of Total Deaths
LRTI	40	25
Septic Shock	32	20
Meningoencephalitis	24(TBM-8)	15(33)
Diarrhoeal Diseases	9	5
Malnutrition	5	3
Others	53	32
Total Deaths	163	

The mortality was mainly contributed by childhood pneumonia and sepsis. Contradictory to the mortality rates in India, diarrhoea and malnutrition related deaths were less common. 'Other' causes of death superseded common causes of death like diarrhoea and malnutrition. Of the deaths due to pneumonia, 2 cases were of cerebral palsy and 2 were due to Myopathy. One of the cases of sepsis was a post-operative case of Ileal atresia. Meningoencephalitis (mostly viral) also contributed a major group with differentiation as encephalitis and meningitis being difficult in most of the instances. Eight of the patients of meningitis were diagnosed as TBM of whom 1 child was seropositive.

Table V: Contributing factors

DELAYS	NO OF PATIENTS AGE GROUP <1 Month (Neonatal)	NO OF PATIENTS AGE GROUP 1 Month to 5 Years
DELAY 1(Delay in deciding to seek adequate medical help)	26(10%)	11(7%)
DELAY 2(Delay in reaching health facility)	72(27%)	24(15%)
DELAY 3(Delay due to operational inadequacies in health care)	168(63%)	68(78%)
Total Deaths Due To Delays	266(56%)	103(63%)
Total deaths	477	163

Timely interventions can go a long way in preventing neonatal mortality. But various delays as described above can seriously jeopardize the genuine efforts to prevent them. In little over half of the cases delays were a major reason. In both group 78% & 63% of the delays, delay 3 was the major culprit.

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DISCUSSION:

[Refer Table I]

In present study 477(75%) were neonatal deaths and 163 (25%) were post the neonatal age group. In a study by Shah et al, 'Verbal autopsy to determine causes of deaths among under-five children' in Aligarh in the year 2005-2006, of the infant deaths, about 60% were in the neonatal period whereas 40% died in the post-neonatal age group.[7]

The results of the death as per age from this study are comparable with the study of Vaid et al where majority of the deaths occurred in the neonatal period, with deaths in the first six months contributing to most infant deaths[8]. Thus deaths on the day of birth represent a large proportion of perinatal and neonatal deaths, highlighting an urgent need to improve coverage with skilled birth attendants and to ensure access to emergency obstetric care. Health interventions to improve essential neonatal care and care-seeking behaviour are also needed, particularly for preterm neonates in the early postnatal period.[9]

SEX[Refer Table I]

Deaths in the male child predominated as compared to deaths in the female child in all age groups in the above study. The results of this study regarding the sex wise distribution of deaths were comparable with NFHS-3 [10], Parks text book of preventive and social medicine [1] for the neonatal period and the age group of 1 month to 5 years. This reflects the sex distribution in the total admissions in the pediatric ward in the present study which were 56% males and 44% female respectively and that newborn boys are biologically more fragile than girls. Sick male neonates were more likely to be taken to a health facility.[11]

Other studies have also shown that girls are often brought to a health facility in more advanced stage of illness than boys, are taken to less qualified doctors when they are ill, and less money is spent on medicines for them than for boys.[12]

Data from Bangladesh also showed higher mortality rates among girls for malnutrition (2.5 times) and diarrhoea (2.1). [13]Higher unclassified deaths among girls could be due to their care givers not providing sufficient information on their deaths, either due to disinterest or because of hesitation that this may reflect on their female neglect.

Residence wise distribution of deaths: [Refer Table I]

Maximum deaths are from urban area in contradiction with the NFHS-3 data where infant and child mortality were considerably higher in rural areas than urban areas[10].

The non-comparability was due to the distance which the patients from the rural areas had to travel was more along with expenses needed for the travel & the study was carried out in a tertiary care centre in an urban setting where the deaths occurred.

Antenatal care: [Refer Table1]

This determinant was studied only for the neonatal mortality. In the above study, 365(77%) of the mothers were registered at various levels of health care centres by the government or at private set ups. This was consistent with the study by Bapat et and Sudha Yadav et al in Gujarat[14]

Referral and Inborn / Outborn: [Refer Table I]

In neonatal group maximum deceased babies were inborn 299(63%) which was not comparable with Kumar et al where mortality among outborns was much higher[15] . This difference can be attributed to higher percentage of inborn admissions and also because this tertiary centre bears the major brunt of complicated deliveries in the Pune city metropolitan area.

However, in the age group of 1 month – 5years, 66 %(108) were referred from outside health facilities, Most of whom had received some form

of health intervention. This were similar to those observed by Bapat et al in their study of referrals from urban slums in Mumbai. Main reported reasons for referral were lack of equipment, services, clinical indication and less commonly the non-availability of health personnel. [16]

Thus tertiary care providers are often at the receiving end of inappropriate or delayed treatment and referrals: higher maternal mortality rates in major referral hospitals have been attributed to the large number of complicated referrals they receive.

Maternal Education : [Refer Table I]

Illiteracy is considered as the greatest barrier to any improvement in the health condition. Mothers' education level is a key determinant of the child's health. In present study majority of mothers (65%) were educated for 7 years or less or were illiterate in neonatal group, however in age group of 1 month to 5years it was 58%.Thses results were comparable with were comparable to the NFHS-3 survey[10] and Mondal et al[17]. It was seen that infant and child mortality rates decrease steadily with an increase in the mothers' schooling[10]

Socioeconomic status: [Refer Table I]

A large number of patients in the present study were from the lower socioeconomic strata (Modified Kuppuswami Class V and IV). In most Indian cities poverty is more prevalent in slums and most poor people live in slum areas.[16] The same holds true in India where even in the large urbanised cities. Child mortality has been studied by Bapat et al in the slums of Mumbai and Vaid et al in the slums of Vellore etc.[8,16] ,thus it is an indirect indicator that a low socioeconomic status has a direct bearing on the mortality. These observations serve to emphasize the need for continuous monitoring of the relationship between infant mortality and income inequality so that relevant health and social agencies, both public and

private, can adjust their policies and plan their programs accordingly.

Causes of mortality:[Refer Table III and IV]

Most important cause of neonatal mortality appeared to be respiratory distress syndrome (RDS) comprising 40% of deaths followed by sepsis and birth asphyxia . Most of the deaths in the age group of 1 month to 5 years of age 25% of cases was Acute Lower Respiratory Tract Infection due to the climatic conditions at Pune followed by Septic Shock, Meningoencephalitis.

According to the WHO fact sheet the leading causes of Under Five Mortality 2011 worldwide include Pneumonia 18%, Prematurity 14%, Diarrhoea11%, Birth Asphyxia9%,Malaria7% , Others41%.[18] National Family Health Survey 3 (NFHS-3) data include fever (15% prevalence in the previous 2-week period), acute respiratory infections (6 %), diarrhoea (9%) and malnutrition (46%) - and often a combination of these conditions.[10] Recent global estimates put prematurity first, followed by infection and asphyxia.[19] The cause of under five deaths in the present study were comparable to results obtained in various studies like study in rural Maharashtra [20], Shah et [7],a community based study in Melghat Maharashtra using the verbal autopsy questionnaire[21], Bapat et al at [16] and Bassini et al [22] . However, diarrhoeal deaths were less common, this could be because of the better awareness of the community or diarrhoea getting treated and then presenting as sepsis.

Contributing factors, Delays [Refer table IV]

In the neonatal period a delay was identifiable in 56% of the deaths. The commonest of the delay was the delay 3 accounting for 63% .Similarly in the age group of 1 month – 5years of age, since most of the patients were referred, majority was Delay 3 accounting for 78% of the deaths. The results in present study in regards to delays were

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comparable with study by Bapat et al[16] & Mubarak et al [23].However result in present study differed from Waiswa et al in Uganda[24] due to behavioural and cultural differences in the community in their approach to illness.

The improvement of institutional health care may have a significant impact on the decision to attend health institutions and, thereby, reduce first delays.[23] With best of our knowledge and extensive internet search no study was done to identify delays using Child Death Audit proforma prepared by Government of Maharshtra .

Strength of the study is the audit proforma designed by the Government of Maharashtra , which has been prepared meticulously, easy to administer and has given volume of information . However few limitations were being a 'verbal' autopsy, its results are not representative of the diagnoses obtained by pathological autopsy , questionnaire was filled after the death of the deceased at a time when the respondents were overwhelmed by emotions and as it was a hospital based study, so causes of death in hospital may not be representative of the picture in the community.

Conclusions:

- Neonatal mortality is the main contributor in under -5 deaths contributing to three fourths of all deaths. In neonates, major causes of deaths are RDS, sepsis & birth asphyxia.

- In post neonatal age group, LRTIs, Sepsis, Diarrhoeal diseases and malnutrition were major contributors.

- Majority of deaths in both the groups were due to Delay 3 that is due to operational inadequacies in the health care facilities like lack of drugs, blood, medical and surgical equipment or skilled health care personnel in the facility & Delay 2 which is in reaching a health facility which can be due to the time needed to organize funds to pay for transportation or health care and distant health facilities where the child was admitted and subsequently died .Hence addressing these delays will contribute to reduced under 5 mortality.

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