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# BMJ Paediatrics Open

## Brought in dead cases to a tertiary referral pediatric Emergency Department: a prospective qualitative study

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4 **Brought in dead cases to a tertiary referral pediatric Emergency Department:**  
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6 **a prospective qualitative study**  
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## *Abstract*

**Objectives:** Brought in dead (BID) presentation is profoundly related to pre-hospital variables including disease related determinants and social and system related factors. Identifying these factors would help us recognize various gaps in health services.

**Setting:** Tertiary Pediatric Emergency Department (ED) in north India

**Patients:** Children aged 12 years or younger presented in cardiac arrest between April 2016 and March 2017 were prospectively enrolled irrespective of outcome of cardiopulmonary resuscitation (CPR). Data was collected from multiple sources including referral documents, direct interview from parents and field observations at the referring facility.

**Results:** Of 100 BID cases enrolled, 55 were neonates. Low birth weight (n=43,78%) and malnutrition (n=31,69%) were respectively common in neonates and post neonatal children. The most frequent symptom was breathing difficulty (n=80,80%). Common diagnoses included respiratory distress syndrome (n=21,38.2%), birth asphyxia (n=19,34.5%) and sepsis (n=11,20%) in neonates and pneumonia (n=11,25%) congenital heart disease (n=6,13%) and acute gastroenteritis (n=5,11%) in post neonatal children. Eighty-nine cases were referred from another health care facility, majority after first health care contact (n=77,86.5%). Progressive severity of illness (n=61,71%) and lack of expertise for acute care (n=35,39.3%) were the common reasons for referral. Ambulance (n=77) was the most common mode of transport; median (IQR) distance and duration of travel were 80 (25-111.5) km and 120 (60-180) minutes respectively. Respiratory support during transport included supplemental nasal oxygen (n=41,46%) and bag and tube ventilation (n=30,34%). Clinical deterioration was recognized in 62 children during transport, only

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3 5 received CPR en-route. Ninety-five children underwent CPR at the referral center, 2 (2%) had  
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5 return of spontaneous circulation (ROSC).  
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8 **Conclusion:** Social and system related factors contribute to children presenting to ED in brought-  
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10 in-dead state. Streamlining the referral process and linking transport to hospital care could reduce  
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12 decompensated referrals and thereby decrease child mortality.  
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## Introduction:

Low- and middle-income countries (LMIC) like India face unique challenges in the health care sector. Growing population and limited ability to expand health care resources puts the vulnerable age groups of neonates and young children at high risk for morbidity and mortality. Although global estimates of under-5 mortality have shown a substantial decline over the past two decades, the United Nations' Millennium Development Goal of reducing under-5 deaths by two thirds could not be met in 2015.[1] The failure was mainly due to the slower progress, high mortality rate and low resource and fund allocation in countries from sub-Saharan Africa and south Asia including India. India contributed to nearly 21% of the global under-five child deaths. [2, 3] Under-five mortality is an incisive indicator of a nation's progress and a crucial affirmation of its priorities and values. Therefore, in LMIC with high under 5 mortality, it is imperative to introspect the deficiencies in healthcare delivery as a major portion of these deaths are preventable. Hospital based data have mainly focused on disease specific mortality in children. WHO data and several other studies have listed preterm birth complications, pneumonia, diarrhea and malaria as the top causes for neonatal and child mortality.[2, 4-8] Most child deaths are impacted by a chain of events including social, cultural, environmental, and healthcare related factors and not merely by the medical disease that is usually assigned as the cause of death. Very few studies have explored these system based non-biological factors that are often preventable or modifiable. [6, 9]

Brought in Dead (BID) or Dead on Arrival (DOA) cases are those who are brought to a health facility in cardiac arrest requiring cardiopulmonary resuscitation (CPR).[10, 11] BID presentation at tertiary care level is related to pre-hospital variables including disease related determinants, social and system related factors and referral and transport system. Identifying these factors would place health system within the broader and bigger context of social determinants of

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3 health and help us recognize various gaps in health services. On this premise, we conducted this  
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5 qualitative phenomenology study on BID cases presenting to our Emergency Department (ED) to  
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7 determine disease related and system based causes for such presentations.  
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## 10 **Materials and methods**

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13 *Enrollment:* This prospective qualitative study was conducted in the ED of a tertiary care referral  
14 hospital in north India between April 2016 and March 2017. Consecutive children aged 12 years  
15 or younger who presented in cardiac arrest or cardiopulmonary failure were enrolled irrespective  
16 of outcome of CPR after obtaining written informed consent from parents or guardian. Children  
17 who sustained trauma in a road traffic accident or natural disasters were excluded. The study was  
18 approved by the Ethics Committee of the Institute.  
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28 *Patient and public involvement (PPI):* We did not directly involve parents and public in the design  
29 of the study.  
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33 *Data collection:* The information required for the study was obtained from multiple sources which  
34 included referral documents, direct interview and field observations. Lead and corresponding  
35 authors (PK1 and KN) were responsible for conducting semi-structured interviews. Although no  
36 specific relationship was established prior to conducting interviews, the participants were informed  
37 about the authors' professional background, objectives of the study and outlined about the nature  
38 of interview. Authors PK1, KN and JM were involved in field visits. Data collection began  
39 immediately after enrollment and the entire process for each case was completed within 4 weeks  
40 of enrolment.  
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52 *Interview:* Interview of the parents/guardian was conducted for information regarding their  
53 socioeconomic background, history of presenting illness and caregiver's knowledge and  
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3 awareness towards the illness. For this purpose, the actual sequence of events as narrated by the  
4 parents from the point when child had become symptomatic at home to the point of presentation  
5 to ED was noted. The questionnaire also included elements described in WHO verbal autopsy  
6 standards.[12] The entire process of interview was completed in 20 – 30 minutes. In situations  
7 where obtaining complete information was not possible immediately, telephonic interview or  
8 home visit at a later point were arranged after parent's consent.  
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12 *Field visits:* Investigators made field visits to the referring hospitals and clinics for direct  
13 observations and assessment of the diagnostic, treatment and transport facilities available at the  
14 center. Treating physicians were interviewed after obtaining informed consent and details  
15 regarding the diagnosis, management and referral process were ascertained. All personal or  
16 individual specific data from the direct interview was de-identified and kept strictly confidential.  
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20 Using the information obtained, a detailed timeline of events was generated for each patient;  
21 variables were grouped into pre-hospital determinants (social and disease related factors), health  
22 system based factors and referral factors.  
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26 *Statistical analysis:* Authors PK1 and KN compiled and analyzed the data. Descriptive statistics  
27 were used. Data are presented by compiling the possible contributory factors in all the cases.  
28 Categorical variables are mainly presented as proportions. Continuous variables are presented as  
29 mean and standard deviations (normally distributed data) or as median and interquartile range  
30 (non-parametric data). Statistical package for social sciences (SPSS) version 20.0 for Windows  
31 (SPSS, IBM, Chicago, IL, USA) was used for analysis.  
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## Results

### *Demographic and social factors*

We screened 4364 admissions during the study period and 137 (3%) children were brought in dead to ED. Thirty-seven children were excluded due to challenges in obtaining consent or declined consent. Of 100 BID cases enrolled, more than half (n=55, 55%) were neonates. Two thirds of all neonates (n=37, 67%) presented within first 3 days of life, majority (n=21, 38%) within first 24 hours. More than three fourths of enrolled neonates (n=43, 78%) were low birth weight (< 2.5kg); 12(28%) very low birth weight and 3 (7%) extremely low birth weight babies. Post neonatal infants (aged 29 days to 1 year) constituted (n=22, 22%) about a quarter of all enrolled cases. There was a slight male predominance with boys:girls ratio of 1.27:1. Among post neonatal children, more than two thirds (n=31, 69%) were undernourished with weight for age below 2 standard deviation of mean for the age according to WHO growth standards. Haryana (n=41) and Punjab (n=38) were the two neighbouring states that accounted for the largest share (79%) of enrolled cases. The proportion of patients coming from rural background (n=52) and urban areas (n=48) were almost equal. The distribution of religion in the study cohort to a certain extent is reflective of the distribution in the community as most cases were Hindus (n=74), followed by Sikhs (n=18), and Muslims (n=8). Information regarding socioeconomic status and education of parents could not be ascertained in 36 cases due to inadequate information and parents' preference to not disclose. Among rest (n=64), about half belonged to upper lower class (n=33, 51%) and a third to lower middle class (n=21, 33%) [Table 1].

### *Disease related factors*

Clinical symptoms and referral diagnoses are presented in Table 2. The most frequently reported symptoms common to all age groups were breathing difficulty (n=80, 80%), refusal to feed (n=17, 17%), and cyanosis (n=11, 11%). Other symptoms such as fever (21%), vomiting (12%) and loose stools (10%) were predominantly seen in post neonatal age. The median duration of symptoms was shorter in neonates as compared to post neonatal age group [1 (1-1) vs 3 (1-4) days]. The common diagnoses in neonates were respiratory distress syndrome (n=21, 38.2%), birth asphyxia (n=19, 34.5%), sepsis (n=11, 20%) and meconium aspiration syndrome (n=8, 14.5%). In post neonatal age group, pneumonia (n=11, 25%) was the most frequent illness followed by congenital heart disease (n=6, 13%) and acute gastroenteritis (n=5, 11%).

### *Health system based factors*

Out of 100 cases, 89 were referred from another health care facility and 11 reached directly from home [Table 3]. Majority were referred after first health care contact (n=77, 86.5%), while 11 (12.4%) were referred after two health care contacts. One (1.1%) child however had four health facility visits before being referred. The median (IQR) duration of stay in referring hospital was noted to be 3 (1-20.5) hours. A total of 41 referring hospitals were identified that served as the last contact point for the 89 referred cases. Most (n=26, 63%) hospitals had a bed strength of less than 20. While out-patient services (93%), indoor admission wards (88%) and an emergency room (85%) were commonly available, level II or higher neonatal (29%) and pediatric (19%) acute care facilities were less prevalent. About a third (n=12, 30%) of all referring hospitals did not have ambulance services for referral. Of 88 referring physicians interviewed in our study, a little more than half (n=51, 58%) were either qualified pediatricians (38%) or undergoing training in pediatrics (20%).

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3 *Pre-referral management and referral process:*  
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6 Respiratory support was commonly provided by supplemental oxygen through nasal  
7 prongs (n=41, 46%) or bag and tube ventilation (n=30, 33.7%). Eight (9%) children received  
8 mechanical ventilation and one child received bubble CPAP. Antibiotics (47, 53%) were the most  
9 commonly administered drugs followed by vitamin K (19, 21.3%), steroids (7, 7.9%) and  
10 antiepileptics (6, 6.7%). Inotropic/vasopressor support was provided in 21 (24%) children through  
11 a peripheral venous access. The common reasons for referral were progressive severity of illness  
12 (n=61, 71%) and lack of expertise for acute care at referring hospital (n=35, 39.3%). Financial  
13 constraints (n=6, 6.7%) and lack of specific treatment (n=5, 5.6%) were less common reasons  
14 [Table 3].  
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27 *Transport:*  
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30 Of the 100 children, a little over three fourth used ambulance (n=77, 77%) to commute  
31 from referring hospital or home. All except one of the ambulances used for transit (n=76, 98.7%)  
32 had provision for oxygen supply while less than half (n=32, 41.5%) were equipped with  
33 resuscitation drugs and equipment. A healthcare provider (doctor or paramedic) accompanying a  
34 sick child was noted in a little less than two third of cases (n=49, 63.6%). The distance travelled  
35 by the study subjects ranged from 0.3 km to 322 km with the median (IQR) of 80 (25-111.5) km.  
36 Correspondingly, the time taken to travel the distance ranged from 10 minutes to 540 minutes with  
37 the median (IQR) 120 (60-180) minutes. In 62% (n=62) cases, clinical deterioration was  
38 recognized during commute; majority were respiratory deterioration in the form of gasping or  
39 laboured breathing (n=58, 93.54%). Only 5 (8%) children received cardiopulmonary resuscitation  
40 during transport [Table 4]. Ninety-five children underwent cardiopulmonary resuscitation on  
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3 reaching the referral center, of which only 2 (2.1%) cases had return of spontaneous circulation  
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5 (ROSC).  
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## 8 **Discussion**

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11 In this observational study in a tertiary referral public health care setting, we could discern  
12 several factors potentially influencing the BID status of children at presentation. Firstly, a  
13 significant proportion of our children belonged to a socially and economically deprived strata  
14 placing them at a disadvantaged position with respect to health seeking. Additionally, most  
15 parent's education level was till high school or lower. Education level and socioeconomic status  
16 are closely interlinked. The level of education is an important determinant of the total income and  
17 the health perception of the family. Expectedly a reciprocal relationship has been reported between  
18 per capita income and under five mortality.[13] A study from Bangladesh observed an increasing  
19 trend of neonatal and post neonatal mortality with lower educational qualification of the father.[14]  
20 Biswas *et al* showed that in urban slums of Kolkata the morbidity episode/child/year increased as  
21 the per capita income decreased.[15]  
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37 Secondly, the BID cohort were very young; about half were neonates and another quarter  
38 were infants under 1 year of age. This age distribution mirrors the trend reported from LMIC  
39 where neonates and young infants form a significant proportion of hospitalized children.[16] In a  
40 study from southern India, infants comprised 69% of total patients presenting to ED with 33%  
41 being within 2 months of age.[17] We observed that respiratory ailments of high acuity leading to  
42 rapid destabilization, were the most common reason for seeking care. Among the post neonatal  
43 children, the leading illness was pneumonia (24.4%), followed by congenital heart diseases  
44 (13.3%) and acute diarrheal disease (11.1%). Most neonates in our study had one or more known  
45 risk factors for increased mortality; one third (33%) were premature, nearly four fifth (78%) were  
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3 LBW and more than half (53%) required resuscitation at birth possibly for birth asphyxia. These  
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5 findings in both the age groups are largely in concordance with published literature although the  
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7 frequencies differ slightly. In a nationally representative mortality survey, the common causes of  
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9 neonatal death were attributed to prematurity/ low birth weight, neonatal infections, birth asphyxia  
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11 and birth trauma.[18] Pneumonia and diarrhea continue to be the leading causes of mortality in  
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13 children aged 1-59 months.[1] Not surprisingly, a significant proportion of congenital heart  
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15 diseases were noted among our BID cases. Improved diagnostics, early detection of lesions and  
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17 better newborn survival are some of the possible reasons for this increased incidence. As the rate  
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19 of child mortality due to preventable diseases declines, congenital heart defects are predicted to  
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21 cause a significant burden on health care systems especially in LMIC. [19, 20]  
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27 Thirdly, the type of healthcare facility, presence of a trained physician and availability of  
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29 resources were important determinants for decision and timing of referral. Most children in our  
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31 study were referred from public sector hospitals with facilities for in-patient wards. However,  
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33 facilities for acute care beyond immediate stabilization were limited. The emergency rooms/wards  
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35 were common for both adults and children and an organized triage system was notably deficient  
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37 despite some having staff assigned for this purpose. There was a wide variation in level of staff  
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39 training and clinical decision making. A hospital-based study in 2001 showed that inadequate staff  
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41 training, inefficient triage, inappropriate emergency management, lack of standard case  
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43 management guidelines and limited resources were the barriers in reducing child mortality at  
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45 district and teaching hospitals in less developed countries.[21] Nearly two decades later, these  
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47 factors continue to remain relevant in absence of sustainable large scale interventions.  
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53 Among all the factors observed in our study, we believe that the weakest link was related  
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55 to the execution of the referral process. Two main reasons recognized for referral to higher level  
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3 of care included progressive severity of illness and need for acute care expertise. However, despite  
4 recognition, many referrals seemed to have been made in haste without aiming for stabilization.  
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6 Missing the 'golden hour' at first health care contact and further transport in a decompensated state  
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8 explains the increased number of children presenting to tertiary care in cardiac arrest.[22] More  
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10 than two thirds (71%) of the referrals were accompanied by inadequately written referral notes.  
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12 Several domains with respect to referral diagnosis, pre-referral vital signs, essential investigations  
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14 and treatment provided were missing. Similar findings were reported by a study from north India  
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16 where crucial details on referral document and pre-referral communication were absent.[23]  
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22 Referral is an ongoing process and transport forms an integral part of this chain.  
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24 Unfortunately, this area is one of the least addressed in the present health care system. The average  
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26 distance travelled, and time taken to travel by a patient to reach the referral center in our study was  
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28 80 km (IQR:25-111.5) and 2 hours respectively. Contrary to many other studies, the commonest  
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30 mode of transportation in our study was ambulance (77%).[23-25] The increased use of ambulance  
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32 could be attributed to more prevalent and free of cost national ambulance service (NAS) which is  
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34 now operational in India. Majority of ambulances were equipped with oxygen and fewer with life  
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36 support drugs and resuscitation equipments. Although a paramedic accompanied the patient in  
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38 63% cases, majority were ill equipped to recognize deterioration and stabilize them. These  
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40 findings call for development of a robust interhospital transport system with joint efforts from both  
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42 referring and referred hospitals and government agencies.  
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48 Our study has some important strengths. It is first of its kind to look at non-disease related  
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50 determinants of brought in dead status at a tertiary care level. We included a sizeable sample.  
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52 Interview from parents and doctors with observational visits to referring hospital added predictive  
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54 quality to the findings. However, a few limitations need mention. We could not enroll all  
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3 consecutive cases during the study period due to declined consent by some parents. Our study  
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5 suffers from the inherent shortcomings of qualitative studies which includes subjectivity and  
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7 limited generalizability.  
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## 10 **Conclusions**

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13 Complications of prematurity, birth asphyxia, sepsis and pneumonia were the common etiologies  
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15 in children brought in dead to tertiary care Emergency Department. Several social and system  
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17 related factors are associated with BID presentation. Streamlining the referral process and linking  
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19 transport to hospital care are potential strategies to reduce decompensated referrals and thereby  
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21 decrease child mortality.  
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## 26 **What is already known?**

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29 Hospital based data have mainly focused on disease specific mortality in children. Complications  
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31 of prematurity, diarrhea and pneumonia are the leading causes of neonatal and child deaths.  
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33 Children who are brought in dead to a hospital in low middle income countries represent deaths  
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35 due to complex interplay of disease related determinants with social and system based factors.  
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## 39 **What this study adds?**

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42 About 3% of Emergency Department admissions were brought in dead; half were neonates.  
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44 Referral and transport was found to be the weakest system; lack of pre-referral communication,  
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46 poor documentation and inadequate transport services to address resuscitation needs were the  
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48 common factors identified in children with decompensated referrals.  
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47 contributing to the study design. PK1 collected the data and with KN completed the data analysis.  
48  
49 MJ and PK2 critically reviewed the interpretation of data. PK1 and KN wrote the first draft and all  
50 authors revised it critically. All authors approved the final version.  
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12 participation in the study  
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21 **Data availability statement:** No additional data available  
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**Table 1: Study population characteristics**

<b>Characteristics</b>	<b>n=100 (%)</b>
<b>Age</b>	
Median (IQR) in months	4 (2-5)
<b>Neonates</b>	55 (55)
0 ≤ 24 hours	21 (21)
>24 hours ≤ 72 hours	16 (16)
> 3days ≤ 7 days	9 (9)
>7 days ≤ 28 days	9 (9)
<b>Post neonatal age</b>	45 (45)
>28 days ≤ 1 Year	22 (22)
>1 Year ≤ 5 Years	14 (14)
>5 Years ≤ 12 Years	9 (9)
<b>Sex</b>	
Male	56(56)
Female	44(44)
<b>Underweight</b>	
Neonates: LBW (<2.5Kg)	45 (78)
Post neonatal children: Weight < 2SD	31(69)
<b>Birth order</b>	
1	46(46)
2	25(25)
3	22(22)
4	06(6)
5	01(1)
<b>Immunization status</b>	
Fully immunized	45(45)
Partial immunized	8(8)
Not immunized	47(47)
<b>Background</b>	
Rural	52 (52)
Urban	48 (48)
<b>Religion</b>	
Hindu	74 (74)
Muslim	8 (8)
Sikh	18 (18)
<b>Socio economic status</b>	
Upper middle class	10 (10)
Lower middle class	21 (21)
Upper lower class	33 (33)
Not known	36 (36)

<b>Highest education of parents</b>	
Graduate/ postgraduate	13 (13)
Intermediate	11 (11)
High school	20 (20)
Middle school	13 (13)
Primary school	5 (5)
Illiterate	2 (2)
Not known	36 (36)
<b>Details of neonates (n=55)</b>	
<b>Place of delivery</b>	
Hospital	49 (89)
Home	6 (11)
<b>Mode of delivery</b>	
Vaginal delivery	41 (74.5)
Emergency LSCS	11 (20)
Elective LSCS	3 (5.5)
<b>Cried immediately after birth</b>	
Yes	23 (42)
No	27 (49)
Weak cry	04 (7.3)
Not Known	01 (2)
<b>Resuscitation at birth</b>	
Yes	29 (52.7)
No	25 (45.5)
Not Known	1 (2)

**Table 2: Common symptoms and referral diagnosis**

<b>Clinical details</b>	<b>Study population (100) n (%)</b>	<b>Neonates (55) n (%)</b>	<b>Post neonatal group (45) n (%)</b>	<b>Duration of symptoms Median (IQR)</b>
<b>Symptoms</b>				
Breathing difficulty	80 (80)	50 (91)	30 (66.6)	1(1-2) days
Fever	21 (21)	0	21 (46.6)	3 (3-6) days
Refusal of feed	17 (17)	10 (18)	7 (15.5)	2 (1-3) days
Vomiting	12 (12)	1 (2)	11 (24.4)	2(1-6.5) days
Cyanosis	11 (11)	6 (11)	5 (11)	1.0(1-3) days
Loose stools	10 (10)	0	10 (18)	2.5(1-6) days
Seizures	5(5)	1 (2)	4 (9)	2.5(1.5-4) days
Jaundice	3(3)	2 (3.6)	1 (2)	3(2-3) days
Cough	7(7)	0	7 (15.5)	4.0(3-6) days
Lethargy	4(4)	0	4 (9)	2.5(1.5-3.5) days
<b>Referral diagnosis</b>				
Respiratory Distress Syndrome	21	21 (38)		
Birth asphyxia	19	19 (34.5)		
Prematurity	18	18 (32.7)		
Meconium Aspiration Syndrome	8	8 (14.5)		
Neonatal jaundice	3	3 (5.45)		
Pneumonia	17	3 (5.4)	14 (31)	
Congenital heart disease	12	6 (11)	6 (13)	
Sepsis	14	11 (20)	3 (6.6)	
Shock	5	3 (5.5)	2 (4.4)	
Acute diarrhea			5 (11)	
Snake envenomation			3 (6.6)	
Seizure			2 (4.4)	

**Table 3. Details of referral hospitals, pre-referral management and referral process**

<b>Referral details</b>	
<b>Type of referral(n=100)</b>	
Government hospitals	65 (65)
Private hospitals	24 (24)
Came directly from Home	11 (11)
<b>Facility available at referring hospital (n=41)</b>	
OPD	38 (92.6)
In patient ward	36 (87.8)
Emergency Unit	35 (85.4)
Neonatal Ward	30 (73)
NICU	12 (29.3)
PICU	08 (19.5)
Biochemistry/Hematology	35 (85.4)
Xray	33 (80.5)
USG	32 (78)
CT scan	09 (22)
MRI	03 (7)
Ambulance	29 (70.7)
<b>Bed strength (n=41)</b>	
≤ 10	10 (24.5)
11-20	18 (44)
21-50	8 (20)
>50	2 (5)
Not estimated	3 (7.3)
<b>Physician qualification (n=88)</b>	
MBBS	35 (39.7)
MD Internal medicine	1 (1)
Others (Unqualified)	1 (1)
Pediatrician (MD / DCH)	32 (36.5)
MD/DNB trainee	18 (20.4)
Neonatologist (DM)	1 (1)
<b>Respiratory support (n=89)</b>	
Oxygen by Nasal prongs	41 (46)
Continuous positive airway pressure	1 (1)
Bag & tube ventilation	30 (33.7)
Mechanical ventilation	8 (9)
Oxygen driven nebulization	5 (5.6)
Not known	1 (1)
No support	8 (9)
<b>Circulatory support</b>	
Intravenous fluid	59 (66.3)
Vasoactive/inotropic agent infusion	21 (23.6)
Not known	9 (10)

<b>Drugs</b>	
Antibiotics	47 (53)
Vitamin K	19 (21)
Caffeine	3 (3.4)
Calcium gluconate	3 (3.4)
Sodium bicarbonate	1 (1)
Steroids	7 (8)
Antiepileptics	6 (6.7)
Blood transfusion	3 (3.4)
<b>Referral Document</b>	
Present with adequate information	28 (31.4)
Present without adequate information	61 (71)
Referral note not present	0
<b>Reason for referral</b>	
Severity of illness	61 (71)
Need for expertise	35 (39)
Failure of treatment	5 (5.6)
Non-availability of physician	2 (2)
Financial constraints	6 (6.7)
<b>Duration between decision and actual referral</b>	
<2 hours	76 (85.3)
2-4 hours	13 (14.6)
4-6 hours	1 (1)
>6 hours	2 (2)



**Table 4. Details of transport**

<b>Transport</b>	<b>n=100 (%)</b>
<b>Type of transport</b>	
Ambulance	77 (77)
Car	10 (10)
Taxi	07 (7)
Bus	1 (1)
Auto rickshaw	3 (3)
Scooter/bike	1 (1)
Walk	1 (1)
<b>Facilities in ambulance vehicle (n=77)</b>	
Oxygen	76 (98.7)
Resuscitation drugs and equipment	32 (41.5)
Multiparameter monitor	08 (10)
Doctor/paramedical staff	49 (63.6)
<b>Deterioration noted during transit (n=100)</b>	
Yes	62 (62)
No	12 (12)
Could not recognise	26 (26)
<b>Signs of deterioration (n=100)</b>	
Gasping	58 (58)
Fall in BP	1 (1)
Worsening of sensorium	1 (1)
Cyanosis	1 (1)
Vomiting	1 (1)
<b>Intervention done during deterioration (n=100)</b>	
None	35 (35)
Increased flow of O2	18 (18)
IV fluids given	1 (1)
Bag and mask ventilation started	2 (2)
CPR	5 (5)
Suction	1 (1)
<b>Perceived delay during transit (n=100)</b>	
No delay	53 (53)
Poor roads	15 (15)
Heavy traffic	29 (29)
Arranging funds	4 (4)
Use of public transportation	1 (1)
Difficulty in finding transportation	5 (5)
Stopped at other facility	3 (3)
Unfamiliarity with the route	7 (7)
<b>Distance travelled to reach referral centre (in km)</b>	
Median (IQR)	80 (25-111.5)
<b>Time taken to reach referral centre (in minutes)</b>	
Median (IQR)	120(60-180)

# BMJ Paediatrics Open

## Brought in dead cases to a tertiary referral pediatric Emergency Department in India: a prospective qualitative study

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4 **Brought in dead cases to a tertiary referral pediatric Emergency Department**  
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6 **in India: a prospective qualitative study**  
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## ***Abstract***

**Objectives:** Brought in dead (BID) presentation is profoundly related to pre-hospital variables including disease related determinants and social and system related factors. Identifying these factors would help us recognize various gaps in health services.

**Setting:** Tertiary Pediatric Emergency Department (ED) in north India

**Patients:** Children aged 12 years or younger presented in cardiac arrest between April 2016 and March 2017 were prospectively enrolled irrespective of outcome of cardiopulmonary resuscitation (CPR). Data was collected from multiple sources including referral documents, direct interview from parents and field observations at the referring facility.

**Results:** Of 100 BID cases enrolled, 55 were neonates. Low birth weight (n=43,78%) and malnutrition (n=31,69%) were respectively common in neonates and post neonatal children. The most frequent symptom was breathing difficulty (n=80). Common diagnoses included respiratory distress syndrome (n=21,38%), birth asphyxia (n=19,35%) and sepsis (n=11,20%) in neonates and pneumonia (n=11,25%) congenital heart disease (n=6,13%) and acute gastroenteritis (n=5,11%) in post neonatal children. Eighty-nine cases were referred from another health care facility, majority after first health care contact (n=77,87%). Progressive severity of illness (n=61,71%) and lack of expertise for acute care (n=35,39%) were the common reasons for referral. Ambulance (n=77) was the most common mode of transport; median (IQR) distance and duration of travel were 80 (25-111.5) km and 120 (60-180) minutes respectively. Respiratory support during transport included supplemental nasal oxygen (n=41,46%) and bag and tube ventilation (n=30,34%). Clinical deterioration was recognized in 62 children during transport, only 5 received

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3 CPR en-route. Ninety-five children underwent CPR at the referral center, 2 had return of  
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5 spontaneous circulation (ROSC).  
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8 **Conclusion:** Social and system related factors contribute to children presenting to ED in brought-  
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10 in-dead state. Streamlining the referral process and linking transport to hospital care could reduce  
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12 decompensated referrals and thereby decrease child mortality.  
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## Introduction:

Low- and middle-income countries (LMIC) like India face unique challenges in the health care sector. Growing population and limited ability to expand health care resources puts the vulnerable age groups of neonates and young children at high risk for morbidity and mortality. Although global estimates of under-5 mortality have shown a substantial decline over the past two decades, the United Nations' Millennium Development Goal of reducing under-5 deaths by two thirds could not be met in 2015.[1] The failure was mainly due to the slower progress, high mortality rate and low resource and fund allocation in countries from sub-Saharan Africa and south Asia including India. India contributed to nearly 21% of the global under-five child deaths. [2, 3] Under-five mortality is an incisive indicator of a nation's progress and a crucial affirmation of its priorities and values. Therefore, in LMIC with high under 5 mortality, it is imperative to introspect the deficiencies in healthcare delivery as a major portion of these deaths are preventable. Hospital based data have mainly focused on disease specific mortality in children. WHO data and several other studies have listed preterm birth complications, pneumonia, diarrhea and malaria as the top causes for neonatal and child mortality.[2, 4-8] Most child deaths are impacted by a chain of events including social, cultural, environmental, and healthcare related factors and not merely by the medical disease that is usually assigned as the cause of death. Very few studies have explored these system based non-biological factors that are often preventable or modifiable. [6, 9]

Brought in Dead (BID) or Dead on Arrival (DOA) cases are those who are brought to a health facility in cardiac arrest requiring cardiopulmonary resuscitation (CPR).[10, 11] BID presentation at tertiary care level is related to pre-hospital variables including disease related determinants, social and system related factors and referral and transport system. Identifying these factors would place health system within the broader and bigger context of social determinants of

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3 health and help us recognize various gaps in health services. On this premise, we conducted this  
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5 qualitative phenomenology study on BID cases presenting to our Emergency Department (ED) to  
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7 determine disease related and system based causes for such presentations.  
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## 10 **Materials and methods**

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13 *Enrollment:* This prospective qualitative study was conducted in the ED of a tertiary care referral  
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15 hospital in north India between April 2016 and March 2017. Consecutive children aged 12 years  
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17 or younger who presented in cardiac arrest or cardiopulmonary failure were enrolled irrespective  
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19 of outcome of CPR after obtaining written informed consent from parents or guardian. Children  
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21 who sustained trauma in a road traffic accident or natural disasters were excluded. The study was  
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23 approved by the Ethics Committee of the Institute.  
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28 *Patient and public involvement (PPI):* We did not directly involve parents and public in the design  
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30 of the study.  
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34 *Data collection:* The information required for the study was obtained from multiple sources which  
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36 included referral documents, direct interview and field observations. Lead and corresponding  
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38 authors (PK1 and KN) were responsible for conducting semi-structured interviews.  
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40 Parents/guardian were approached for consent shortly after declaration of the outcome of CPR in  
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42 ED. Although no specific relationship was established prior to conducting interviews, the  
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44 participants were informed about the authors' professional background, objectives of the study and  
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46 outlined about the nature of interview. Authors PK1, KN and JM were involved in field visits.  
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48 Data collection began immediately after enrollment and the entire process for each case was  
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50 completed within 4 weeks of enrolment.  
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3 *Interview:* Interview of the parents/guardian was conducted for information regarding their  
4 socioeconomic background, history of presenting illness and caregiver's knowledge and  
5 awareness towards the illness. For this purpose, the actual sequence of events as narrated by the  
6 parents from the point when child had become symptomatic at home to the point of presentation  
7 to ED was noted. A predesigned semi structured questionnaire was used to record the information  
8 (Supplementary file). The questionnaire also included elements described in WHO verbal autopsy  
9 standards.[12] The entire process of interview was completed in 20 – 30 minutes. In situations  
10 where obtaining complete information was not possible immediately, telephonic interview or  
11 home visit at a later point were arranged after parent's consent.  
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24 *Field visits:* Investigators made field visits to the referring hospitals and clinics for direct  
25 observations and assessment of the diagnostic, treatment and transport facilities available at the  
26 center. Treating physicians were interviewed after obtaining informed consent and details  
27 regarding the diagnosis, management and referral process were ascertained. All personal or  
28 individual specific data from the direct interview was de-identified and kept strictly confidential.  
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Using the information obtained, a detailed timeline of events was generated for each patient;  
variables were grouped into three major themes, i) pre-hospital determinants (social and disease  
related factors), ii) health system based factors and iii) referral factors.

During enrollment, we observed that a significant proportion of BID cases were neonates. Data  
saturation was planned to be achieved based on sizeable representation of post neonatal children  
and non-emergence of new referring hospitals. We allowed for iterative adjustments between  
interview and field visits to ensure that the data collected from referring hospitals reflect the  
emergent pattern from interviews.

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3 *Statistical analysis:* Authors PK1 and KN compiled, coded and analyzed the data. Majority of the  
4 data were arranged in prefigured deductive codes derived from the semi structured data collection  
5 instrument. This was supplemented by inductive codes emerged from new topics. Descriptive  
6 statistics were used to present the data under different themes. Categorical variables are mainly  
7 presented as proportions. Continuous variables are presented as mean and standard deviations  
8 (normally distributed data) or as median and interquartile range (non-parametric data). Statistical  
9 package for social sciences (SPSS) version 20.0 for Windows (SPSS, IBM, Chicago, IL, USA)  
10 was used for analysis.  
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## 22 **Results**

### 23 *Demographic and social factors*

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28 We screened 4364 admissions during the study period and 137 (3%) children were brought  
29 in dead to ED. Thirty-seven children were excluded due to challenges in obtaining consent or  
30 declined consent. Of 100 BID cases enrolled, more than half (n=55) were neonates. Two thirds of  
31 all neonates (n=37, 67%) presented within first 3 days of life, majority (n=21, 38%) within first 24  
32 hours. More than three fourths of enrolled neonates (n=43, 78%) were low birth weight (< 2.5kg);  
33 12(28%) very low birth weight and 3 (7%) extremely low birth weight babies. Post neonatal infants  
34 (aged 29 days to 1 year) constituted (n=22) about a quarter of all enrolled cases. There was a slight  
35 male predominance with boys:girls ratio of 1.27:1. Among post neonatal children, more than two  
36 thirds (n=31, 69%) were undernourished with weight for age below 2 standard deviation of mean  
37 for the age according to WHO growth standards. Haryana (n=41) and Punjab (n=38) were the two  
38 neighbouring states that accounted for the largest share (79%) of enrolled cases. The proportion of  
39 patients coming from rural background (n=52) and urban areas (n=48) were almost equal. The  
40 distribution of religion in the study cohort to a certain extent is reflective of the distribution in the  
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3 community as most cases were Hindus (n=74), followed by Sikhs (n=18), and Muslims (n=8).  
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5 Information regarding socioeconomic status and education of parents could not be ascertained in  
6  
7 36 cases due to inadequate information and parents' preference to not disclose. Among rest (n=64),  
8  
9 about half belonged to upper lower class (n=33, 51%) and a third to lower middle class (n=21,  
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11 33%) [Table 1].  
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#### 14 15 *Disease related factors* 16 17

18 Clinical symptoms and referral diagnoses are presented in Table 2. The most frequently  
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20 reported symptoms common to all age groups were breathing difficulty (n=80), refusal to feed  
21  
22 (n=17), and cyanosis (n=11). Other symptoms such as fever (n=21), vomiting (n=12) and loose  
23  
24 stools (n=10) were predominantly seen in post neonatal age. The median duration of symptoms  
25  
26 was shorter in neonates as compared to post neonatal age group [1 (1-1) vs 3 (1-4) days]. The  
27  
28 common diagnoses in neonates were respiratory distress syndrome (n=21, 38%), birth asphyxia  
29  
30 (n=19, 35%), sepsis (n=11, 20%) and meconium aspiration syndrome (n=8, 15 %). In post  
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32 neonatal age group, pneumonia (n=11, 25%) was the most frequent illness followed by congenital  
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34 heart disease (n=6, 13%) and acute gastroenteritis (n=5, 11%).  
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#### 39 40 *Health system based factors* 41 42

43 Out of 100 cases, 89 were referred from another health care facility and 11 reached directly  
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45 from home [Table 3]. Majority were referred after first health care contact (n=77, 87%), while 11  
46  
47 (12%) were referred after two health care contacts. One child however had four health facility  
48  
49 visits before being referred. The median (IQR) duration of stay in referring hospital was noted to  
50  
51 be 3 (1-20.5) hours. A total of 41 referring hospitals were identified that served as the last contact  
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53 point for the 89 referred cases. Most (n=26, 63%) hospitals had a bed strength of less than 20.  
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3 While out-patient services (93%), indoor admission wards (88%) and an emergency room (85%)  
4 were commonly available, level II or higher neonatal (29%) and pediatric (19%) acute care  
5 facilities were less prevalent. About a third (n=12, 30%) of all referring hospitals did not have  
6 ambulance services for referral. Of 88 referring physicians interviewed in our study, a little more  
7 than half (n=51, 58%) were either qualified pediatricians (38%) or undergoing training in  
8 pediatrics (20%).

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18 *Pre-referral management and referral process:*

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21 Respiratory support was commonly provided by supplemental oxygen through nasal  
22 prongs (n=41, 46%) or bag and tube ventilation (n=30, 34%). Eight (9%) children received  
23 mechanical ventilation and one child received bubble CPAP. Antibiotics (n=47, 53%) were the  
24 most commonly administered drugs followed by vitamin K (n=19, 21%), steroids (n=7, 8%) and  
25 antiepileptics (6, 7%). Inotropic/vasopressor support was provided in 21 (24%) children through  
26 a peripheral venous access. The common reasons for referral were progressive severity of illness  
27 (n=61, 71%) and lack of expertise for acute care at referring hospital (n=35, 40%). Financial  
28 constraints (n=6, 7%) and lack of specific treatment (n=5, 6%) were less common reasons [Table  
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42 *Transport:*

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45 Of the 100 children, a little over three fourth used ambulance (n=77) to commute from  
46 referring hospital or home. All except one of the ambulances used for transit (n=76, 99%) had  
47 provision for oxygen supply while less than half (n=32, 42%) were equipped with resuscitation  
48 drugs and equipment. A healthcare provider (doctor or paramedic) accompanying a sick child was  
49 noted in a little less than two third of cases (n=49, 64%). The distance travelled by the study  
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3 subjects ranged from 0.3 km to 322 km with the median (IQR) of 80 (25-111.5) km.  
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5 Correspondingly, the time taken to travel the distance ranged from 10 minutes to 540 minutes with  
6  
7 the median (IQR) 120 (60-180) minutes. In 62 cases, clinical deterioration was recognized during  
8  
9 commute; majority were respiratory deterioration in the form of gasping or laboured breathing  
10  
11 (n=58, 94%). Only 5 (8%) children received cardiopulmonary resuscitation during transport [Table  
12  
13 4]. Ninety-five children underwent cardiopulmonary resuscitation on reaching the referral center,  
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15 of which only 2 cases had return of spontaneous circulation (ROSC).  
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## 19 20 **Discussion**

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23 In this observational study in a tertiary referral public health care setting, we could discern  
24  
25 several factors potentially influencing the BID status of children at presentation. Firstly, a  
26  
27 significant proportion of our children belonged to a socially and economically deprived strata  
28  
29 placing them at a disadvantaged position with respect to health seeking. Additionally, most  
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31 parent's education level was till high school or lower. Education level and socioeconomic status  
32  
33 are closely interlinked. The level of education is an important determinant of the total income and  
34  
35 the health perception of the family. Expectedly a reciprocal relationship has been reported between  
36  
37 per capita income and under five mortality.[13] A study from Bangladesh observed an increasing  
38  
39 trend of neonatal and post neonatal mortality with lower educational qualification of the father.[14]  
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41 Biswas *et al* showed that in urban slums of Kolkata the morbidity episode/child/year increased as  
42  
43 the per capita income decreased.[15]  
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49 Secondly, the BID cohort were very young; about half were neonates and another quarter  
50  
51 were infants under 1 year of age. This age distribution mirrors the trend reported from LMIC  
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53 where neonates and young infants form a significant proportion of hospitalized children.[16] In a  
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55 study from southern India, infants comprised 69% of total patients presenting to ED with 33%  
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3 being within 2 months of age.[17] We observed that respiratory ailments of high acuity leading to  
4 rapid destabilization, were the most common reason for seeking care. Among the post neonatal  
5 children, the leading illness was pneumonia (24%), followed by congenital heart diseases (13%)  
6 and acute diarrheal disease (11%). Most neonates in our study had one or more known risk factors  
7 for increased mortality; one third (33%) were premature, nearly four fifth (78%) were LBW and  
8 more than half (53%) required resuscitation at birth possibly for birth asphyxia. These findings in  
9 both the age groups are largely in concordance with published literature although the frequencies  
10 differ slightly. In a nationally representative mortality survey, the common causes of neonatal  
11 death were attributed to prematurity/ low birth weight, neonatal infections, birth asphyxia and birth  
12 trauma.[18] Pneumonia and diarrhea continue to be the leading causes of mortality in children  
13 aged 1-59 months.[1] Not surprisingly, a significant proportion of congenital heart diseases were  
14 noted among our BID cases. Improved diagnostics, early detection of lesions and better newborn  
15 survival are some of the possible reasons for this increased incidence. As the rate of child mortality  
16 due to preventable diseases declines, congenital heart defects are predicted to cause a significant  
17 burden on health care systems especially in LMIC. [19, 20]

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38 Thirdly, the type of healthcare facility, presence of a trained physician and availability of  
39 resources were important determinants for decision and timing of referral. Most children in our  
40 study were referred from public sector hospitals with facilities for in-patient wards. However,  
41 facilities for acute care beyond immediate stabilization were limited. The emergency rooms/wards  
42 were common for both adults and children and an organized triage system was notably deficient  
43 despite some having staff assigned for this purpose. There was a wide variation in level of staff  
44 training and clinical decision making. A hospital-based study in 2001 showed that inadequate staff  
45 training, inefficient triage, inappropriate emergency management, lack of standard case  
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3 management guidelines and limited resources were the barriers in reducing child mortality at  
4 district and teaching hospitals in less developed countries.[21] Nearly two decades later, these  
5 factors continue to remain relevant in absence of sustainable large scale interventions.  
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10 Among all the factors observed in our study, we believe that the weakest link was related  
11 to the execution of the referral process. Two main reasons recognized for referral to higher level  
12 of care included progressive severity of illness and need for acute care expertise. However, despite  
13 recognition, many referrals seemed to have been made in haste without aiming for stabilization.  
14 Missing the 'golden hour' at first health care contact and further transport in a decompensated state  
15 explains the increased number of children presenting to tertiary care in cardiac arrest.[22] More  
16 than two thirds (71%) of the referrals were accompanied by inadequately written referral notes.  
17 Several domains with respect to referral diagnosis, pre-referral vital signs, essential investigations  
18 and treatment provided were missing. Similar findings were reported by a study from north India  
19 where crucial details on referral document and pre-referral communication were absent.[23]  
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34 Referral is an ongoing process and transport forms an integral part of this chain.  
35 Unfortunately, this area is one of the least addressed in the present health care system. The average  
36 distance travelled, and time taken to travel by a patient to reach the referral center in our study was  
37 80 km (IQR:25-111.5) and 2 hours respectively. Contrary to many other studies, the commonest  
38 mode of transportation in our study was ambulance (77%). [23-25] The increased use of  
39 ambulance could be attributed to more prevalent and free of cost national ambulance service (NAS)  
40 which is now operational in India. Majority of ambulances were equipped with oxygen and fewer  
41 with life support drugs and resuscitation equipments. Although a paramedic accompanied the  
42 patient in 63% cases, majority were ill equipped to recognize deterioration and stabilize them.  
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3 These findings call for development of a robust interhospital transport system with joint efforts  
4 from both referring and referred hospitals and government agencies.  
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8 Our study has some important strengths. It is first of its kind to look at non-disease related  
9 determinants of brought in dead status at a tertiary care level. We included a sizeable sample.  
10 Interview from parents and doctors with observational visits to referring hospital added predictive  
11 quality to the findings. However, a few limitations need mention. We could not enroll all  
12 consecutive cases during the study period due to declined consent by some parents. Our data  
13 predominantly reflect information generated from apriori themes. This study suffers from the  
14 inherent shortcomings of qualitative studies which includes subjectivity and limited  
15 generalizability.  
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## 26 27 **Conclusions**

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30 Complications of prematurity, birth asphyxia, sepsis and pneumonia were the common etiologies  
31 in children brought in dead to tertiary care Emergency Department. Several social and system  
32 related factors are associated with BID presentation. Streamlining the referral process and linking  
33 transport to hospital care are potential strategies to reduce decompensated referrals and thereby  
34 decrease child mortality.  
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## 42 43 **What is already known?**

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45 Hospital based data have mainly focused on disease specific mortality in children. Complications  
46 of prematurity, diarrhea and pneumonia are the leading causes of neonatal and child deaths.  
47 Children who are brought in dead to a hospital in low middle income countries represent deaths  
48 due to complex interplay of disease related determinants with social and system based factors.  
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## 55 56 **What this study adds?**



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3 About 3% of Emergency Department admissions were brought in dead; half were neonates.  
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5 Referral and transport was found to be the weakest system; lack of pre-referral communication,  
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7 poor documentation and inadequate transport services to address resuscitation needs were the  
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9 common factors identified in children with decompensated referrals.  
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53 **Contributors:** KN and PK1 were responsible for the conception of the work, with all authors  
54 contributing to the study design. PK1 collected the data and with KN completed the data analysis.  
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3 MJ and PK2 critically reviewed the interpretation of data. PK1 and KN wrote the first draft and all  
4  
5 authors revised it critically. All authors approved the final version.  
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11  
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16 **Patient consent for publication:** All participants provided written informed consent for  
17  
18 participation in the study  
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21 **Ethics approval:** The study was approved by Institute Ethics Committee, PGIMER,  
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23 Chandigarh. Approval No. NK/2588/MD/2433-34  
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26 **Data availability statement:** No additional data available  
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**Table 1: Study population characteristics**

<b>Characteristics</b>	<b>n=100</b>
<b>Age</b>	
Median (IQR) in months	4 (2-5)
<b>Neonates</b>	55
0 ≤ 24 hours	21
>24 hours ≤ 72 hours	16
> 3days ≤ 7 days	9
>7 days ≤ 28 days	9
<b>Post neonatal age</b>	45
>28 days ≤ 1 Year	22
>1 Year ≤ 5 Years	14
>5 Years ≤ 12 Years	9
<b>Sex</b>	
Male	56
Female	44
<b>Underweight</b>	
Neonates: LBW (<2.5Kg)	45 (78%)
Post neonatal children: Weight < 2SD	31 (69%)
<b>Birth order</b>	
1	46
2	25
3	22
4	6
5	1
<b>Immunization status</b>	
Fully immunized	45
Partial immunized	8
Not immunized	47
<b>Background</b>	
Rural	52
Urban	48
<b>Religion</b>	
Hindu	74
Muslim	8
Sikh	18
<b>Socio economic status</b>	
Upper middle class	10
Lower middle class	21
Upper lower class	33
Not known	36

<b>Highest education of parents</b>	
Graduate/ postgraduate	13
Intermediate	11
High school	20
Middle school	13
Primary school	5
Illiterate	2
Not known	36
<b>Details of neonates</b> <span style="float: right;"><b>n=55 (%)</b></span>	
<b>Place of delivery</b>	
Hospital	49 (89)
Home	6 (11)
<b>Mode of delivery</b>	
Vaginal delivery	41 (75)
Emergency LSCS	11 (20)
Elective LSCS	3 (5)
<b>Cried immediately after birth</b>	
Yes	23 (42)
No	27 (49)
Weak cry	4 (7)
Not Known	1 (2)
<b>Resuscitation at birth</b>	
Yes	29 (52)
No	25 (46)
Not Known	1 (2)

**Table 2: Common symptoms and referral diagnosis**

Clinical details	Study population (100)	Neonates (55)	Post neonatal group (45)	Duration of symptoms in days
	n	n (%)	n (%)	Median (IQR)
<b>Symptoms</b>				
Breathing difficulty	80	50 (91)	30 (67)	1(1-2)
Fever	21	0	21 (47)	3 (3-6)
Refusal of feed	17	10 (18)	7 (16)	2 (1-3)
Vomiting	12	1 (2)	11 (24)	2(1-6.5)
Cyanosis	11	6 (11)	5 (11)	1.0(1-3)
Loose stools	10	0	10 (18)	2.5(1-6)
Seizures	5	1 (2)	4 (9)	2.5(1.5-4)
Jaundice	3	2 (4)	1 (2)	3(2-3)
Cough	7	0	7 (16)	4(3-6)
Lethargy	4	0	4 (9)	2.5(1.5-3.5)
<b>Referral diagnosis</b>				
Respiratory Distress Syndrome	21	21 (38)		
Birth asphyxia	19	19 (35)		
Prematurity	18	18 (33)		
Meconium Aspiration Syndrome	8	8 (15)		
Neonatal jaundice	3	3 (5)		
Pneumonia	17	3 (5)	14 (31)	
Congenital heart disease	12	6 (11)	6 (13)	
Sepsis	14	11 (20)	3 (7)	
Shock	5	3 (5)	2 (4)	
Acute diarrhea			5 (11)	
Snake envenomation			3 (7)	
Seizure			2 (4)	

**Table 3. Details of referral hospitals, pre-referral management and referral process**

<b>Referral details</b>	<b>n (%)</b>
<b>Type of referral(n=100)</b>	
Government hospitals	65
Private hospitals	24
Came directly from Home	11
<b>Facility available at referring hospital (n=41)</b>	
OPD	38 (93)
In patient ward	36 (88)
Emergency Unit	35 (85)
Neonatal Ward	30 (73)
NICU	12 (29)
PICU	08 (20)
Biochemistry/Hematology	35 (85)
Xray	33 (81)
USG	32 (78)
CT scan	09 (22)
MRI	03 (7)
Ambulance	29 (71)
<b>Bed strength (n=41)</b>	
≤ 10	10 (25)
11-20	18 (44)
21-50	8 (20)
>50	2 (5)
Not estimated	3 (7)
<b>Physician qualification (n=88)</b>	
MBBS	35 (40)
MD Internal medicine	1 (1)
Others (Unqualified)	1 (1)
Pediatrician (MD / DCH)	32 (37)
MD/DNB trainee	18 (20)
Neonatologist (DM)	1 (1)
<b>Respiratory support (n=89)</b>	
Oxygen by Nasal prongs	41 (46)
Continuous positive airway pressure	1 (1)
Bag & tube ventilation	30 (34)
Mechanical ventilation	8 (9)
Oxygen driven nebulization	5 (6)
Not known	1 (1)
No support	8 (9)
<b>Circulatory support (n=89)</b>	
Intravenous fluid	59 (66)
Vasoactive/inotropic agent infusion	21 (24)
Not known	9 (10)



<b>Drugs (n=89)</b>	
Antibiotics	47 (53)
Vitamin K	19 (21)
Caffeine	3 (3)
Calcium gluconate	3 (3)
Sodium bicarbonate	1 (1)
Steroids	7 (8)
Antiepileptics	6 (7)
Blood transfusion	3 (3)
<b>Referral Document (n=89)</b>	
Present with adequate information	28 (31)
Present without adequate information	61 (71)
Referral note not present	0
<b>Reason for referral (n=89)</b>	
Severity of illness	61 (71)
Need for expertise	35 (39)
Failure of treatment	5 (6)
Non-availability of physician	2 (2)
Financial constraints	6 (7)
<b>Duration between decision and actual referral (n=89)</b>	
<2 hours	73 (82)
2-4 hours	13 (15)
4-6 hours	1 (1)
>6 hours	2 (2)

Table 4. Details of transport

Transport	n (%)
<b>Type of transport (n=100)</b>	
Ambulance	77
Car	10
Taxi	7
Bus	1
Auto rickshaw	3
Scooter/bike	1
Walk	1
<b>Facilities in ambulance vehicle (n=77)</b>	
Oxygen	76 (99)
Resuscitation drugs and equipment	32 (42)
Multiparameter monitor	08 (10)
Doctor/paramedical staff	49 (64)
<b>Deterioration noted during transit (n=100)</b>	
Yes	62
No	12
Could not recognise	26
<b>Signs of deterioration (n=100)</b>	
Gasping	58
Fall in BP	1
Worsening of sensorium	1
Cyanosis	1
Vomiting	1
<b>Intervention done during deterioration (n=100)</b>	
None	35
Increased flow of O <sub>2</sub>	18
IV fluids given	1
Bag and mask ventilation started	2
CPR	5
Suction	1
<b>Perceived delay during transit (n=100)</b>	
No delay	53
Poor roads	15
Heavy traffic	29
Arranging funds	4
Use of public transportation	1
Difficulty in finding transportation	5
Stopped at other facility	3
Unfamiliarity with the route	7
<b>Distance travelled to reach referral centre (in km)</b>	
Median (IQR)	80 (25-111.5)
<b>Time taken to reach referral centre (in minutes)</b>	
Median (IQR)	120 (60-180)

**Brought in dead cases to a tertiary referral pediatric Emergency Department in India: a prospective qualitative study**

Date: .... /..... /..... Time: ... : ... hours

Interviewer:

Main respondent's relationship to the child:

Language of the interview:

Educational status of the respondent:

Are there other people present at the interview? If yes, their relationship:

Enrol No.

CR No.

Address:

\_\_\_\_\_

\_\_\_\_\_

Mobile No.

\_\_\_\_\_

- Age: years      month      days      hours
- Date of birth- \_\_\_/\_\_\_/\_\_\_ Time of birth:    :    hrs
- Sex:    Male      Female
- Order of birth:
 

1	2	3	4	5
---	---	---	---	---
- Religion:
 

Hindu /Muslim / Sikh / Christian/Others
- Socioeconomic status: (modified Kuppaswamy scale)
 

Education of head of family: (score)      Highest education of parents:

Occupation of head of family: (score)

Monthly income of family: (score)
- Does the family have a BPL (Below Poverty Line) card: Yes / No
- Immunization status: (as per National Immunization Schedule)

.....

Fully immunized / Partial / Unimmunized

- Weight:      Kg      Grams

**Birth details (Neonates)**

Born to G.....P.....

Gestation..... Weeks (on time / early / late / don't know)

Place of delivery: Home  Hospital

Type of Hospital

Nursing home / PHC

- Pediatrician availability

District hospital/Multispecialty hospital

State medical college / PGIMER

Delivery attended by

Untrained Dai / Trained Dai / Nurse / Obstetrician / Others

Mode of Delivery

Vaginal Delivery: Normal  
Instrumental delivery

LSCS: Elective  
Emergency

How much time did the labour and delivery take?.....

Were you informed about drugs to induce labour?.....

Cried immediately after birth: Yes/Weak /No/Don't Know

Able to suckle after birth: Normal/Weak/No/Don't Know

Apgar score (from referral note): 1 minute..... 5 minute..... 10 minute.....

Any Resuscitation: Yes/No Description /details if available.....

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13
- **Description of illness** (open ended, unprompted)

14 Prompt: was there anything else?

15  
16  
17  
18 What was the length of time the child was ill? .....

- 19  
20  
21
- **Disease related Symptoms during illness**

22 During the illness, did she/he have

23  
24

25 Refusal to feed	Yes/No/Don't Know	duration
26		
27 Fever	Yes/No/Don't Know	duration
28		
29 Loose stools	Yes/No/Don't Know	duration
30		
31 Vomiting	Yes/No/Don't Know	duration
32		
33 Fast breathing	Yes/No/Don't Know	duration
34		
35 Cough	Yes/No/Don't Know	duration
36		
37 Chest indrawing	Yes/No/Don't Know	duration
38		
39 Noisy breathing	Yes/No/Don't Know	duration
40		
41 Seizures	Yes/No/Don't Know	duration
42		
43 Bulging fontanelle	Yes/No/Don't Know	duration
44		
45 Altered consciousness	Yes/No/Don't Know	duration
46		
47 Malformation	Yes/No/Don't Know	
48		
49 Complicated delivery	Yes/No/Don't Know	
50		
51 Born early	Yes/No/Don't Know	
52		
53 Very small at birth	Yes/No/Don't Know	
54		
55 any other symptoms		
56		
57 Specify .....		duration
58		
59		
60		

Referred case :  Discontinued care at other hospital:  Came from home

Total number of contacts with health care systems /health care providers since the onset of illness and details:

Names and addresses of the referring hospitals:

.....  
 Date & time of admission:                      Date & time of referral:                      Duration of stay:

.....  
 Date & time of admission:                      Date & time of referral:                      Duration of stay:

.....  
 Date & time of admission:                      Date & time of referral:                      Duration of stay:

Treatment received at the referring facility: (Narrative)

.....  
 .....  
 .....

Pre-referral communication: Yes /No                      Referral note: Yes / No

Referral diagnosis: *Information from parents:*                      *From Referral note:*

Referral information: Complete / Incomplete – Details mentioned:

(Referral document checklist)

- HR:                      /min                      Not Mentioned
- RR:                      /min                      Not Mentioned
- BP:                      ...../..... mmHg                      Not Mentioned
- If hypotensive whether fluid bolus: Yes / No                      Inotropes Yes / No
- If in respiratory distress/failure whether on: Supplemental O<sub>2</sub> / CPAP / PPV\_ BMV/IMV
- SpO<sub>2</sub> %
- Consciousness / GCS                      E                      V                      M                      Not Mentioned
- Pupil:                      size                      reaction                      Not Mentioned
- Blood glucose                      Not Mentioned
- Any other important finding
- Treatment given:                      Not Mentioned
- Drugs:                      Blood components:

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2  
3 • Reason for referral to PGIMER?  
4  
5 .....

6 Severity of illness

7  
8 Need for critical care expertise

9  
10 Failure of treatment

11  
12 Nonavailability of doctors

13  
14 Financial constraints

15  
16 Others (specify).....

- 17  
18  
19 • Duration between first communication on decision of referral and actual referral time:

20 Immediately (within 2 hrs)

21  
22 Some delay (within 2-4 hrs)

23  
24 Great delay (within 4-6 hrs)

25  
26 Severe delay (>6 hrs)

27  
28 Reason for delay.....

- 29  
30 .....
- 31  
32  
33 • Mode of transport used to reach PGIMER (Tick the appropriate)

34 Hospital referral services /Ambulance

35  
36 Own Vehicle

37  
38 Car / Scooter / Bike / Others

39  
40 Private hire

41  
42 Taxi / Auto rickshaw

43  
44 Public transport system

45  
46 Bus / Train

- 47  
48  
49 • If by ambulance whether it was equipped with

50 a. Oxygen Y/N

51  
52 b. Multiparameter monitor Y/N

53  
54 c. Resuscitation equipment / drugs Y/N

55  
56 d. Accompanied by a doctor or para-medical staff: Y/N

- Any deterioration noted during transport: Y/N

If yes, describe.....

- a. Worsening of sensorium/loss of consciousness
- b. Seizure
- c. Gaspings/Worsening of breathing
- d. Fall in blood pressure / loss of pulse
- e. Fall in oxygen saturation
- f. Tachycardia / Bradycardia

If yes what was done to treat? Describe the intervention

.....  
 .....

(Oxygen, Fluids, Drugs, Bag ventilation, Chest compression)

- Travel distance: (From the point of referral to PGIMER) in Kms  
 .....
- Time taken to reach PGIMER from the point of referral (Time of start to arrival time in ED) .....
- Perceived delay in transport?
- If yes, reasons  
 .....  
 .....

**Triage details at PGIMER**

Date & Time of admission:

**Physiological Categorization:**

- Cardiorespiratory failure
- Cardiorespiratory arrest

**CPR**

**ROSC**

**Final diagnosis**



# BMJ Paediatrics Open

## **Brought in dead cases to a tertiary referral pediatric Emergency Department in India: a prospective qualitative study**

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4 **Brought in dead cases to a tertiary referral pediatric Emergency Department**  
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6 **in India: a prospective qualitative study**  
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48 **Key words:** Brought dead, Child death, Mortality, Health system, Transport

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50  
51 **Word count:** 2863

## ***Abstract***

**Objectives:** Brought in dead (BID) presentation is profoundly related to pre-hospital variables including disease related determinants and social and system related factors. Identifying these factors would help us recognize various gaps in health services.

**Setting:** Tertiary Pediatric Emergency Department (ED) in north India

**Patients:** Children aged 12 years or younger presented in cardiac arrest between April 2016 and March 2017 were prospectively enrolled irrespective of outcome of cardiopulmonary resuscitation (CPR). Data was collected from multiple sources including referral documents, direct interview from parents and field observations at the referring facility.

**Results:** Of 100 BID cases enrolled, 55 were neonates. Low birth weight (n=43,78%) and malnutrition (n=31,69%) were respectively common in neonates and post neonatal children. The most frequent symptom was breathing difficulty (n=80). Common diagnoses included respiratory distress syndrome (n=21,38%), birth asphyxia (n=19,35%) and sepsis (n=11,20%) in neonates and pneumonia (n=11,25%) congenital heart disease (n=6,13%) and acute gastroenteritis (n=5,11%) in post neonatal children. Eighty-nine cases were referred from another health care facility, majority after first health care contact (n=77,87%). Progressive severity of illness (n=61,71%) and lack of expertise for acute care (n=35,39%) were the common reasons for referral. Ambulance (n=77) was the most common mode of transport; median (IQR) distance and duration of travel were 80 (25-111.5) km and 120 (60-180) minutes respectively. Respiratory support during transport included supplemental nasal oxygen (n=41,46%) and bag and tube ventilation (n=30,34%). Clinical deterioration was recognized in 62 children during transport, only 5 received

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3 CPR en-route. Ninety-five children underwent CPR at the referral center, 2 had return of  
4  
5 spontaneous circulation (ROSC).  
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7

8 **Conclusion:** Social and system related factors contribute to children presenting to ED in brought-  
9  
10 in-dead state. Streamlining the referral process and linking transport to hospital care could reduce  
11  
12 decompensated referrals and thereby decrease child mortality.  
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## Introduction:

Low- and middle-income countries (LMIC) like India face unique challenges in the health care sector. Growing population and limited ability to expand health care resources puts the vulnerable age groups of neonates and young children at high risk for morbidity and mortality. Although global estimates of under-5 mortality have shown a substantial decline over the past two decades, the United Nations' Millennium Development Goal of reducing under-5 deaths by two thirds could not be met in 2015.[1] The failure was mainly due to the slower progress, high mortality rate and low resource and fund allocation in countries from sub-Saharan Africa and south Asia including India. India contributed to nearly 21% of the global under-five child deaths. [2, 3] Under-five mortality is an incisive indicator of a nation's progress and a crucial affirmation of its priorities and values. Therefore, in LMIC with high under 5 mortality, it is imperative to introspect the deficiencies in healthcare delivery as a major portion of these deaths are preventable. Hospital based data have mainly focused on disease specific mortality in children. WHO data and several other studies have listed preterm birth complications, pneumonia, diarrhea and malaria as the top causes for neonatal and child mortality.[2, 4-8] Most child deaths are impacted by a chain of events including social, cultural, environmental, and healthcare related factors and not merely by the medical disease that is usually assigned as the cause of death. Very few studies have explored these system based non-biological factors that are often preventable or modifiable. [6, 9]

Brought in Dead (BID) or Dead on Arrival (DOA) cases are those who are brought to a health facility in cardiac arrest requiring cardiopulmonary resuscitation (CPR).[10, 11] BID presentation at tertiary care level is related to pre-hospital variables including disease related determinants, social and system related factors and referral and transport system. Identifying these factors would place health system within the broader and bigger context of social determinants of

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3 health and help us recognize various gaps in health services. On this premise, we conducted this  
4  
5 qualitative phenomenology study on BID cases presenting to our Emergency Department (ED) to  
6  
7 determine disease related and system based causes for such presentations.  
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9

## 10 **Materials and methods**

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13 *Enrollment:* This prospective qualitative study was conducted in the ED of a tertiary care referral  
14  
15 hospital in north India between April 2016 and March 2017. Consecutive children aged 12 years  
16  
17 or younger who presented in cardiac arrest or cardiopulmonary failure were enrolled irrespective  
18  
19 of outcome of CPR after obtaining written informed consent from parents or guardian. Children  
20  
21 who sustained trauma in a road traffic accident or natural disasters were excluded. The study was  
22  
23 approved by the Ethics Committee of the Institute.  
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28 *Patient and public involvement (PPI):* We did not directly involve parents and public in the design  
29  
30 of the study.  
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33  
34 *Data collection:* The information required for the study was obtained from multiple sources which  
35  
36 included referral documents, direct interview and field observations. Lead and corresponding  
37  
38 authors (PK1 and KN) were responsible for conducting semi-structured interviews.  
39  
40 Parents/guardian were approached for consent shortly after declaration of the outcome of CPR in  
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42 ED. Although no specific relationship was established prior to conducting interviews, the  
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44 participants were informed about the authors' professional background, objectives of the study and  
45  
46 outlined about the nature of interview. Authors PK1, KN and JM were involved in field visits.  
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48 Data collection began immediately after enrollment and the entire process for each case was  
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50 completed within 4 weeks of enrolment.  
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3 *Interview:* Interview of the parents/guardian was conducted for information regarding their  
4 socioeconomic background, history of presenting illness and caregiver's knowledge and  
5 awareness towards the illness. For this purpose, the actual sequence of events as narrated by the  
6 parents from the point when child had become symptomatic at home to the point of presentation  
7 to ED was noted. A predesigned semi structured questionnaire was used to record the information  
8 (Supplementary file). The questionnaire also included elements described in WHO verbal autopsy  
9 standards.[12] The entire process of interview was completed in 20 – 30 minutes. In situations  
10 where obtaining complete information was not possible immediately, telephonic interview or  
11 home visit at a later point were arranged after parent's consent. Member check at the conclusion  
12 of the interview was not done as we felt it was difficult to perform due to sensitivity of the content  
13 and it demanded additional time.  
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29 *Field visits:* Investigators made field visits to the referring hospitals and clinics for direct  
30 observations and assessment of the diagnostic, treatment and transport facilities available at the  
31 center. Treating physicians were interviewed after obtaining informed consent and details  
32 regarding the diagnosis, management and referral process were ascertained. All personal or  
33 individual specific data from the direct interview was de-identified and kept strictly confidential.  
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41 Using the information obtained, a detailed timeline of events was generated for each patient;  
42 variables were grouped into three major themes, i) pre-hospital determinants (social and disease  
43 related factors), ii) health system based factors and iii) referral factors.  
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49 During enrollment, we observed that a significant proportion of BID cases were neonates. Data  
50 saturation was planned to be achieved based on sizeable representation of post neonatal children  
51 and non-emergence of new information related to social, health system and referral factors. We  
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3 allowed for iterative adjustments between interview and field visits to ensure that the data collected  
4  
5 from referring hospitals reflect the emergent pattern from interviews.  
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8  
9 *Statistical analysis:* Authors PK1 and KN compiled, coded and analyzed the data. Majority of the  
10  
11 data were arranged in prefigured deductive codes derived from the semi structured data collection  
12  
13 instrument. This was supplemented by inductive codes emerged from new topics. Descriptive  
14  
15 statistics were used to present the data under different themes. Categorical variables are mainly  
16  
17 presented as proportions. Continuous variables are presented as mean and standard deviations  
18  
19 (normally distributed data) or as median and interquartile range (non-parametric data). Statistical  
20  
21 package for social sciences (SPSS) version 20.0 for Windows (SPSS, IBM, Chicago, IL, USA)  
22  
23 was used for analysis.  
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## 26 27 **Results**

### 28 29 *Demographic and social factors*

30  
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33 We screened 4364 admissions during the study period and 137 (3%) children were brought  
34  
35 in dead to ED. Thirty-seven children were excluded due to challenges in obtaining consent or  
36  
37 declined consent. Of 100 BID cases enrolled, more than half (n=55) were neonates. Two thirds of  
38  
39 all neonates (n=37, 67%) presented within first 3 days of life, majority (n=21, 38%) within first 24  
40  
41 hours. More than three fourths of enrolled neonates (n=43, 78%) were low birth weight (< 2.5kg);  
42  
43 12(28%) very low birth weight and 3 (7%) extremely low birth weight babies. Post neonatal infants  
44  
45 (aged 29 days to 1 year) constituted (n=22) about a quarter of all enrolled cases. There was a slight  
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47 male predominance with boys:girls ratio of 1.27:1. Among post neonatal children, more than two  
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49 thirds (n=31, 69%) were undernourished with weight for age below 2 standard deviation of mean  
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51 for the age according to WHO growth standards. Haryana (n=41) and Punjab (n=38) were the two  
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3 neighbouring states that accounted for the largest share (79%) of enrolled cases. The proportion of  
4 patients coming from rural background (n=52) and urban areas (n=48) were almost equal. The  
5 distribution of religion in the study cohort to a certain extent is reflective of the distribution in the  
6 community as most cases were Hindus (n=74), followed by Sikhs (n=18), and Muslims (n=8).  
7 Information regarding socioeconomic status and education of parents could not be ascertained in  
8 36 cases due to inadequate information and parents' preference to not disclose. Among rest (n=64),  
9 about half belonged to upper lower class (n=33, 51%) and a third to lower middle class (n=21,  
10 33%) [Table 1].  
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### 22 *Disease related factors*

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25 Clinical symptoms and referral diagnoses are presented in Table 2. The most frequently  
26 reported symptoms common to all age groups were breathing difficulty (n=80), refusal to feed  
27 (n=17), and cyanosis (n=11). Other symptoms such as fever (n=21), vomiting (n=12) and loose  
28 stools (n=10) were predominantly seen in post neonatal age. The median duration of symptoms  
29 was shorter in neonates as compared to post neonatal age group [1 (1-1) vs 3 (1-4) days]. The  
30 common diagnoses in neonates were respiratory distress syndrome (n=21, 38%), birth asphyxia  
31 (n=19, 35%), sepsis (n=11, 20%) and meconium aspiration syndrome (n=8, 15 %). In post  
32 neonatal age group, pneumonia (n=11, 25%) was the most frequent illness followed by congenital  
33 heart disease (n=6, 13%) and acute gastroenteritis (n=5, 11%).  
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### 46 *Health system based factors*

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49 Out of 100 cases, 89 were referred from another health care facility and 11 reached directly  
50 from home [Table 3]. Majority were referred after first health care contact (n=77, 87%), while 11  
51 (12%) were referred after two health care contacts. One child however had four health facility  
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3 visits before being referred. The median (IQR) duration of stay in referring hospital was noted to  
4 be 3 (1-20.5) hours. A total of 41 referring hospitals were identified that served as the last contact  
5 point for the 89 referred cases. Most (n=26, 63%) hospitals had a bed strength of less than 20.  
6  
7 While out-patient services (93%), indoor admission wards (88%) and an emergency room (85%)  
8 were commonly available, level II or higher neonatal (29%) and pediatric (19%) acute care  
9 facilities were less prevalent. About a third (n=12, 30%) of all referring hospitals did not have  
10 ambulance services for referral. Of 88 referring physicians interviewed in our study, a little more  
11 than half (n=51, 58%) were either qualified pediatricians (38%) or undergoing training in  
12 pediatrics (20%).  
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#### 24 *Pre-referral management and referral process:*

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27 Respiratory support was commonly provided by supplemental oxygen through nasal  
28 prongs (n=41, 46%) or bag and tube ventilation (n=30, 34%). Eight (9%) children received  
29 mechanical ventilation and one child received bubble CPAP. Antibiotics (n=47, 53%) were the  
30 most commonly administered drugs followed by vitamin K (n=19, 21%), steroids (n=7, 8%) and  
31 antiepileptics (6, 7%). Inotropic/vasopressor support was provided in 21 (24%) children through  
32 a peripheral venous access. The common reasons for referral were progressive severity of illness  
33 (n=61, 71%) and lack of expertise for acute care at referring hospital (n=35, 40%). Financial  
34 constraints (n=6, 7%) and lack of specific treatment (n=5, 6%) were less common reasons [Table  
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#### 50 *Transport:*

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52 Of the 100 children, a little over three fourth used ambulance (n=77) to commute from  
53 referring hospital or home. All except one of the ambulances used for transit (n=76, 99%) had  
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3 provision for oxygen supply while less than half (n=32, 42%) were equipped with resuscitation  
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5 drugs and equipment. A healthcare provider (doctor or paramedic) accompanying a sick child was  
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7 noted in a little less than two third of cases (n=49, 64%). The distance travelled by the study  
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9 subjects ranged from 0.3 km to 322 km with the median (IQR) of 80 (25-111.5) km.  
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11 Correspondingly, the time taken to travel the distance ranged from 10 minutes to 540 minutes with  
12  
13 the median (IQR) 120 (60-180) minutes. In 62 cases, clinical deterioration was recognized during  
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15 commute; majority were respiratory deterioration in the form of gasping or laboured breathing  
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17 (n=58, 94%). Only 5 (8%) children received cardiopulmonary resuscitation during transport [Table  
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19 4]. Ninety-five children underwent cardiopulmonary resuscitation on reaching the referral center,  
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21 of which only 2 cases had return of spontaneous circulation (ROSC).  
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## 27 Discussion

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30 In this observational study in a tertiary referral public health care setting, we could discern  
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32 several factors potentially influencing the BID status of children at presentation. Firstly, a  
33  
34 significant proportion of our children belonged to a socially and economically deprived strata  
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36 placing them at a disadvantaged position with respect to health seeking. Additionally, most  
37  
38 parent's education level was till high school or lower. Education level and socioeconomic status  
39  
40 are closely interlinked. The level of education is an important determinant of the total income and  
41  
42 the health perception of the family. Expectedly a reciprocal relationship has been reported between  
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44 per capita income and under five mortality.[13] A study from Bangladesh observed an increasing  
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46 trend of neonatal and post neonatal mortality with lower educational qualification of the father.[14]  
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48 Biswas *et al* showed that in urban slums of Kolkata the morbidity episode/child/year increased as  
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50 the per capita income decreased.[15]  
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3 Secondly, the BID cohort were very young; about half were neonates and another quarter  
4 were infants under 1 year of age. This age distribution mirrors the trend reported from LMIC  
5 where neonates and young infants form a significant proportion of hospitalized children.[16] In a  
6 study from southern India, infants comprised 69% of total patients presenting to ED with 33%  
7 being within 2 months of age.[17] We observed that respiratory ailments of high acuity leading to  
8 rapid destabilization, were the most common reason for seeking care. Among the post neonatal  
9 children, the leading illness was pneumonia (24%), followed by congenital heart diseases (13%)  
10 and acute diarrheal disease (11%). Most neonates in our study had one or more known risk factors  
11 for increased mortality; one third (33%) were premature, nearly four fifth (78%) were LBW and  
12 more than half (53%) required resuscitation at birth possibly for birth asphyxia. These findings in  
13 both the age groups are largely in concordance with published literature although the frequencies  
14 differ slightly. In a nationally representative mortality survey, the common causes of neonatal  
15 death were attributed to prematurity/ low birth weight, neonatal infections, birth asphyxia and birth  
16 trauma.[18] Pneumonia and diarrhea continue to be the leading causes of mortality in children  
17 aged 1-59 months.[1] Not surprisingly, a significant proportion of congenital heart diseases were  
18 noted among our BID cases. Improved diagnostics, early detection of lesions and better newborn  
19 survival are some of the possible reasons for this increased incidence. As the rate of child mortality  
20 due to preventable diseases declines, congenital heart defects are predicted to cause a significant  
21 burden on health care systems especially in LMIC. [19, 20]  
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47 Thirdly, the type of healthcare facility, presence of a trained physician and availability of  
48 resources were important determinants for decision and timing of referral. Most children in our  
49 study were referred from public sector hospitals with facilities for in-patient wards. However,  
50 facilities for acute care beyond immediate stabilization were limited. The emergency rooms/wards  
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3 were common for both adults and children and an organized triage system was notably deficient  
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5 despite some having staff assigned for this purpose. There was a wide variation in level of staff  
6  
7 training and clinical decision making. A hospital-based study in 2001 showed that inadequate staff  
8  
9 training, inefficient triage, inappropriate emergency management, lack of standard case  
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11 management guidelines and limited resources were the barriers in reducing child mortality at  
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13 district and teaching hospitals in less developed countries.[21] Nearly two decades later, these  
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15 factors continue to remain relevant in absence of sustainable large scale interventions.  
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20 Among all the factors observed in our study, we believe that the weakest link was related  
21  
22 to the execution of the referral process. Two main reasons recognized for referral to higher level  
23  
24 of care included progressive severity of illness and need for acute care expertise. However, despite  
25  
26 recognition, many referrals seemed to have been made in haste without aiming for stabilization.  
27  
28 Missing the 'golden hour' at first health care contact and further transport in a decompensated state  
29  
30 explains the increased number of children presenting to tertiary care in cardiac arrest.[22] More  
31  
32 than two thirds (71%) of the referrals were accompanied by inadequately written referral notes.  
33  
34 Several domains with respect to referral diagnosis, pre-referral vital signs, essential investigations  
35  
36 and treatment provided were missing. Similar findings were reported by a study from north India  
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38 where crucial details on referral document and pre-referral communication were absent.[23]  
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44 Referral is an ongoing process and transport forms an integral part of this chain.  
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46 Unfortunately, this area is one of the least addressed in the present health care system. The average  
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48 distance travelled, and time taken to travel by a patient to reach the referral center in our study was  
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50 80 km (IQR:25-111.5) and 2 hours respectively. Contrary to many other studies, the commonest  
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52 mode of transportation in our study was ambulance (77%). [23-25] The increased use of  
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54 ambulance could be attributed to more prevalent and free of cost national ambulance service (NAS)  
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3 which is now operational in India. Majority of ambulances were equipped with oxygen and fewer  
4 with life support drugs and resuscitation equipments. Although a paramedic accompanied the  
5 patient in 63% cases, majority were ill equipped to recognize deterioration and stabilize them.  
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7 These findings call for development of a robust interhospital transport system with joint efforts  
8 from both referring and referred hospitals and government agencies.  
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15 Our study has some important strengths. It is first of its kind to look at non-disease related  
16 determinants of brought in dead status at a tertiary care level. We included a sizeable sample.  
17 Interview from parents and doctors with observational visits to referring hospital added predictive  
18 quality to the findings. However, a few limitations need mention. We could not enroll all  
19 consecutive cases during the study period due to declined consent by some parents. Our data  
20 predominantly reflect information generated from apriori themes. This study suffers from the  
21 inherent shortcomings of qualitative studies which includes subjectivity and limited  
22 generalizability.  
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### 34 **Conclusions**

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37 Complications of prematurity, birth asphyxia, sepsis and pneumonia were the common etiologies  
38 in children brought in dead to tertiary care Emergency Department. Several social and system  
39 related factors are associated with BID presentation. Streamlining the referral process and linking  
40 transport to hospital care are potential strategies to reduce decompensated referrals and thereby  
41 decrease child mortality.  
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### 49 **What is already known?**

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52 Hospital based data have mainly focused on disease specific mortality in children. Complications  
53 of prematurity, diarrhea and pneumonia are the leading causes of neonatal and child deaths.  
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3 Children who are brought in dead to a hospital in low middle income countries represent deaths  
4 due to complex interplay of disease related determinants with social and system based factors.  
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### 7 8 **What this study adds?** 9

10 About 3% of Emergency Department admissions were brought in dead; half were neonates.  
11 Referral and transport was found to be the weakest system; lack of pre-referral communication,  
12 poor documentation and inadequate transport services to address resuscitation needs were the  
13 common factors identified in children with decompensated referrals.  
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5 **Contributors:** KN and PK1 were responsible for the conception of the work, with all authors  
6 contributing to the study design. PK1 collected the data and with KN completed the data analysis.  
7  
8 MJ and PK2 critically reviewed the interpretation of data. PK1 and KN wrote the first draft and all  
9 authors revised it critically. All authors approved the final version.  
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14  
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19  
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21  
22

23 **Patient consent for publication:** All participants provided written informed consent for  
24 participation in the study  
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28 **Ethics approval:** The study was approved by Institute Ethics Committee, PGIMER,  
29 Chandigarh. Approval No. NK/2588/MD/2433-34  
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33 **Data availability statement:** No additional data available  
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**Table 1: Study population characteristics**

<b>Characteristics</b>	<b>n=100</b>
<b>Age</b>	
Median (IQR) in months	4 (2-5)
<b>Neonates</b>	55
0 ≤ 24 hours	21
>24 hours ≤ 72 hours	16
> 3days ≤ 7 days	9
>7 days ≤ 28 days	9
<b>Post neonatal age</b>	45
>28 days ≤ 1 Year	22
>1 Year ≤ 5 Years	14
>5 Years ≤ 12 Years	9
<b>Sex</b>	
Male	56
Female	44
<b>Underweight</b>	
Neonates: LBW (<2.5Kg)	45 (78%)
Post neonatal children: Weight < 2SD	31 (69%)
<b>Birth order</b>	
1	46
2	25
3	22
4	6
5	1
<b>Immunization status</b>	
Fully immunized	45
Partial immunized	8
Not immunized	47
<b>Background</b>	
Rural	52
Urban	48
<b>Religion</b>	
Hindu	74
Muslim	8
Sikh	18
<b>Socio economic status</b>	
Upper middle class	10
Lower middle class	21
Upper lower class	33
Not known	36

<b>Highest education of parents</b>	
Graduate/ postgraduate	13
Intermediate	11
High school	20
Middle school	13
Primary school	5
Illiterate	2
Not known	36
<b>Details of neonates</b> <span style="float: right;"><b>n=55 (%)</b></span>	
<b>Place of delivery</b>	
Hospital	49 (89)
Home	6 (11)
<b>Mode of delivery</b>	
Vaginal delivery	41 (75)
Emergency LSCS	11 (20)
Elective LSCS	3 (5)
<b>Cried immediately after birth</b>	
Yes	23 (42)
No	27 (49)
Weak cry	4 (7)
Not Known	1 (2)
<b>Resuscitation at birth</b>	
Yes	29 (52)
No	25 (46)
Not Known	1 (2)

**Table 2: Common symptoms and referral diagnosis**

Clinical details	Study population (100)	Neonates (55)	Post neonatal group (45)	Duration of symptoms in days
	n	n (%)	n (%)	Median (IQR)
<b>Symptoms</b>				
Breathing difficulty	80	50 (91)	30 (67)	1(1-2)
Fever	21	0	21 (47)	3 (3-6)
Refusal of feed	17	10 (18)	7 (16)	2 (1-3)
Vomiting	12	1 (2)	11 (24)	2(1-6.5)
Cyanosis	11	6 (11)	5 (11)	1.0(1-3)
Loose stools	10	0	10 (18)	2.5(1-6)
Seizures	5	1 (2)	4 (9)	2.5(1.5-4)
Jaundice	3	2 (4)	1 (2)	3(2-3)
Cough	7	0	7 (16)	4(3-6)
Lethargy	4	0	4 (9)	2.5(1.5-3.5)
<b>Referral diagnosis</b>				
Respiratory Distress Syndrome	21	21 (38)		
Birth asphyxia	19	19 (35)		
Prematurity	18	18 (33)		
Meconium Aspiration Syndrome	8	8 (15)		
Neonatal jaundice	3	3 (5)		
Pneumonia	17	3 (5)	14 (31)	
Congenital heart disease	12	6 (11)	6 (13)	
Sepsis	14	11 (20)	3 (7)	
Shock	5	3 (5)	2 (4)	
Acute diarrhea			5 (11)	
Snake envenomation			3 (7)	
Seizure			2 (4)	

**Table 3. Details of referral hospitals, pre-referral management and referral process**

<b>Referral details</b>	<b>n (%)</b>
<b>Type of referral(n=100)</b>	
Government hospitals	65
Private hospitals	24
Came directly from Home	11
<b>Facility available at referring hospital (n=41)</b>	
OPD	38 (93)
In patient ward	36 (88)
Emergency Unit	35 (85)
Neonatal Ward	30 (73)
NICU	12 (29)
PICU	08 (20)
Biochemistry/Hematology	35 (85)
Xray	33 (81)
USG	32 (78)
CT scan	09 (22)
MRI	03 (7)
Ambulance	29 (71)
<b>Bed strength (n=41)</b>	
≤ 10	10 (25)
11-20	18 (44)
21-50	8 (20)
>50	2 (5)
Not estimated	3 (7)
<b>Physician qualification (n=88)</b>	
MBBS	35 (40)
MD Internal medicine	1 (1)
Others (Unqualified)	1 (1)
Pediatrician (MD / DCH)	32 (37)
MD/DNB trainee	18 (20)
Neonatologist (DM)	1 (1)
<b>Respiratory support (n=89)</b>	
Oxygen by Nasal prongs	41 (46)
Continuous positive airway pressure	1 (1)
Bag & tube ventilation	30 (34)
Mechanical ventilation	8 (9)
Oxygen driven nebulization	5 (6)
Not known	1 (1)
No support	8 (9)
<b>Circulatory support (n=89)</b>	
Intravenous fluid	59 (66)
Vasoactive/inotropic agent infusion	21 (24)
Not known	9 (10)

<b>Drugs (n=89)</b>	
Antibiotics	47 (53)
Vitamin K	19 (21)
Caffeine	3 (3)
Calcium gluconate	3 (3)
Sodium bicarbonate	1 (1)
Steroids	7 (8)
Antiepileptics	6 (7)
Blood transfusion	3 (3)
<b>Referral Document (n=89)</b>	
Present with adequate information	28 (31)
Present without adequate information	61 (71)
Referral note not present	0
<b>Reason for referral (n=89)</b>	
Severity of illness	61 (71)
Need for expertise	35 (39)
Failure of treatment	5 (6)
Non-availability of physician	2 (2)
Financial constraints	6 (7)
<b>Duration between decision and actual referral (n=89)</b>	
<2 hours	73 (82)
2-4 hours	13 (15)
4-6 hours	1 (1)
>6 hours	2 (2)



Table 4. Details of transport

Transport	n (%)
<b>Type of transport (n=100)</b>	
Ambulance	77
Car	10
Taxi	7
Bus	1
Auto rickshaw	3
Scooter/bike	1
Walk	1
<b>Facilities in ambulance vehicle (n=77)</b>	
Oxygen	76 (99)
Resuscitation drugs and equipment	32 (42)
Multiparameter monitor	08 (10)
Doctor/paramedical staff	49 (64)
<b>Deterioration noted during transit (n=100)</b>	
Yes	62
No	12
Could not recognise	26
<b>Signs of deterioration (n=100)</b>	
Gasping	58
Fall in BP	1
Worsening of sensorium	1
Cyanosis	1
Vomiting	1
<b>Intervention done during deterioration (n=100)</b>	
None	35
Increased flow of O <sub>2</sub>	18
IV fluids given	1
Bag and mask ventilation started	2
CPR	5
Suction	1
<b>Perceived delay during transit (n=100)</b>	
No delay	53
Poor roads	15
Heavy traffic	29
Arranging funds	4
Use of public transportation	1
Difficulty in finding transportation	5
Stopped at other facility	3
Unfamiliarity with the route	7
<b>Distance travelled to reach referral centre (in km)</b>	
Median (IQR)	80 (25-111.5)
<b>Time taken to reach referral centre (in minutes)</b>	
Median (IQR)	120 (60-180)

**Brought in dead cases to a tertiary referral pediatric Emergency Department in India: a prospective qualitative study**

Date: .... /..... /..... Time: ... : ... hours

Interviewer:

Main respondent's relationship to the child:

Language of the interview:

Educational status of the respondent:

Are there other people present at the interview? If yes, their relationship:

Enrol No.

CR No.

Address:

\_\_\_\_\_

\_\_\_\_\_

Mobile No.

\_\_\_\_\_

- Age: years      month      days      hours
- Date of birth- \_\_\_/\_\_\_/\_\_\_ Time of birth:    :    hrs
- Sex:    Male      Female
- Order of birth:
 

1	2	3	4	5
---	---	---	---	---
- Religion:
 

Hindu /Muslim / Sikh / Christian/Others
- Socioeconomic status: (modified Kuppaswamy scale)
 

Education of head of family: (score)      Highest education of parents:

Occupation of head of family: (score)

Monthly income of family: (score)
- Does the family have a BPL (Below Poverty Line) card: Yes / No
- Immunization status: (as per National Immunization Schedule)

.....

Fully immunized / Partial / Unimmunized

- Weight:      Kg      Grams

**Birth details (Neonates)**

Born to G.....P.....

Gestation..... Weeks (on time / early / late / don't know)

Place of delivery: Home  Hospital

Type of Hospital

Nursing home / PHC

- Pediatrician availability

District hospital/Multispecialty hospital

State medical college / PGIMER

Delivery attended by

Untrained Dai / Trained Dai / Nurse / Obstetrician / Others

Mode of Delivery

Vaginal Delivery: Normal  
Instrumental delivery

LSCS: Elective  
Emergency

How much time did the labour and delivery take?.....

Were you informed about drugs to induce labour?.....

Cried immediately after birth: Yes/Weak /No/Don't Know

Able to suckle after birth: Normal/Weak/No/Don't Know

Apgar score (from referral note): 1 minute..... 5 minute..... 10 minute.....

Any Resuscitation: Yes/No Description /details if available.....

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13
- **Description of illness** (open ended, unprompted)

14 Prompt: was there anything else?

15  
16  
17  
18 What was the length of time the child was ill? .....

- 19  
20  
21
- **Disease related Symptoms during illness**

22 During the illness, did she/he have

23  
24

25 Refusal to feed	Yes/No/Don't Know	duration
26		
27 Fever	Yes/No/Don't Know	duration
28		
29 Loose stools	Yes/No/Don't Know	duration
30		
31 Vomiting	Yes/No/Don't Know	duration
32		
33 Fast breathing	Yes/No/Don't Know	duration
34		
35 Cough	Yes/No/Don't Know	duration
36		
37 Chest indrawing	Yes/No/Don't Know	duration
38		
39 Noisy breathing	Yes/No/Don't Know	duration
40		
41 Seizures	Yes/No/Don't Know	duration
42		
43 Bulging fontanelle	Yes/No/Don't Know	duration
44		
45 Altered consciousness	Yes/No/Don't Know	duration
46		
47 Malformation	Yes/No/Don't Know	
48		
49 Complicated delivery	Yes/No/Don't Know	
50		
51 Born early	Yes/No/Don't Know	
52		
53 Very small at birth	Yes/No/Don't Know	
54		
55 any other symptoms		
56		
57 Specify .....		duration
58		
59		
60		

Referred case :  Discontinued care at other hospital:  Came from home

Total number of contacts with health care systems /health care providers since the onset of illness and details:

Names and addresses of the referring hospitals:

.....  
 Date & time of admission:                      Date & time of referral:                      Duration of stay:

.....  
 Date & time of admission:                      Date & time of referral:                      Duration of stay:

.....  
 Date & time of admission:                      Date & time of referral:                      Duration of stay:

Treatment received at the referring facility: (Narrative)

.....  
 .....  
 .....

Pre-referral communication: Yes /No                      Referral note: Yes / No

Referral diagnosis: *Information from parents:*                      *From Referral note:*

Referral information: Complete / Incomplete – Details mentioned:

(Referral document checklist)

- HR:                      /min                      Not Mentioned
- RR:                      /min                      Not Mentioned
- BP:        ...../..... mmHg                      Not Mentioned
- If hypotensive whether fluid bolus: Yes / No                      Inotropes Yes / No
- If in respiratory distress/failure whether on: Supplemental O<sub>2</sub> / CPAP / PPV\_ BMV/IMV
- SpO<sub>2</sub>    %
- Consciousness / GCS    E    V    M                      Not Mentioned
- Pupil:                      size                      reaction                      Not Mentioned
- Blood glucose                      Not Mentioned
- Any other important finding
- Treatment given:                      Not Mentioned
- Drugs:                      Blood components:

- 1  
2  
3 • Reason for referral to PGIMER?  
4  
5 .....

6 Severity of illness

7  
8 Need for critical care expertise

9  
10 Failure of treatment

11  
12 Nonavailability of doctors

13  
14 Financial constraints

15  
16 Others (specify).....

- 17  
18  
19 • Duration between first communication on decision of referral and actual referral time:

20 Immediately (within 2 hrs)

21  
22 Some delay (within 2-4 hrs)

23  
24 Great delay (within 4-6 hrs)

25  
26 Severe delay (>6 hrs)

27  
28 Reason for delay.....

- 29  
30 .....
- 31  
32  
33 • Mode of transport used to reach PGIMER (Tick the appropriate)

34 Hospital referral services /Ambulance

35  
36 Own Vehicle

37  
38 Car / Scooter / Bike / Others

39  
40 Private hire

41  
42 Taxi / Auto rickshaw

43  
44 Public transport system

45  
46 Bus / Train

- 47  
48  
49 • If by ambulance whether it was equipped with

50 a. Oxygen Y/N

51  
52 b. Multiparameter monitor Y/N

53  
54 c. Resuscitation equipment / drugs Y/N

55  
56 d. Accompanied by a doctor or para-medical staff: Y/N

- Any deterioration noted during transport: Y/N

If yes, describe.....

- a. Worsening of sensorium/loss of consciousness
- b. Seizure
- c. Gaspings/Worsening of breathing
- d. Fall in blood pressure / loss of pulse
- e. Fall in oxygen saturation
- f. Tachycardia / Bradycardia

If yes what was done to treat? Describe the intervention

.....

.....

(Oxygen, Fluids, Drugs, Bag ventilation, Chest compression)

- Travel distance: (From the point of referral to PGIMER) in Kms  
.....
- Time taken to reach PGIMER from the point of referral (Time of start to arrival time in ED) .....
- Perceived delay in transport?
- If yes, reasons  
.....  
.....

**Triage details at PGIMER**

Date & Time of admission:

**Physiological Categorization:**

Cardiorespiratory failure

Cardiorespiratory arrest

**CPR**

**ROSC**

**Final diagnosis**