Indian J Pediatr (2010) 77:1303–1311
DOI 10.1007/s12098-010-0246-3

SYMPOSIUM ON CHILD SURVIVAL-III

Causes of Child Deaths in India, 1985–2008: A Systematic Review of Literature

Chandrakant Lahariya · Christopher R. Sudfeld · Deepankar Lahariya · Shailendra S. Tomar

Received: 11 November 2009 / Accepted: 9 July 2010 / Published online: 6 October 2010

Abstract
Objective To understand the causes of child deaths in order to implement appropriate child survival interventions in the country. We present a systematic review of studies reporting causes of child, infant, and neonatal deaths from India for 1985 to 2008.
Methods PubMed, EMBASE, Google Scholar, and WHO regional databases were searched along with a hand search and personal communication with researchers in child health to obtain studies and reports for the database. Study data was summarized and analyzed using appropriate statistical tools.
Results We identified 28 published/unpublished studies and reports (6 multi-centric and 22 single sites). There was one nation wide study and rest were from 15 unique sites in 9 different states of India. There were differences in study design and cause of death assignment methods between the studies, which made comparisons and synthesis difficult. The median percentage of causes of deaths in neonatal period were sepsis/pneumonia: 24.9% (Q1: 19.6% and Q3: 33.4%); asphyxia: 18.5% (Q1: 14.2% and Q3: 21.9%); and pre-maturity/LBW: 16.8% (Q1: 12.5% and Q3: 26.5%). Amongst the infants, sepsis/pneumonia, asphyxia, and prematurity/low birth weight (LBW) remain substantial causes of deaths. The median proportional contribution of neonatal deaths to total infant deaths was 48.5% (Q1: 36.5–Q3: 57.5%). The proportion of deaths due to infectious diseases like diarrhoea, pneumonia, and measles seem to be greater in infancy, in comparison to that in neonatal period. There was no statistically significant difference in the proportional contribution of neonatal deaths to total deaths occurring during infancy (<1 year) between the two equal periods before and after 1996 (p=0.141). There also was no difference in the proportional contribution by cause of death assignment method (Verbal autopsy vs. other methods; p=0.715) or by study setting (urban vs. rural; p=0.175). The median percentage of neonatal deaths by day 1 is 36.7% (Range: 20.0–58.0%). The median cumulative percentage of neonatal deaths by day 3 was 49.7% (Range 35.0–64.6%), and 70.9% (Range: 46.5–92.3%) by day 7. In addition, the timing of deaths during neonatal period seems to be static during the last 2 decades, with majority of deaths occurring during first week of life.
Conclusions This review demonstrates the need for more studies with consistent methodological rigor investigating the causes of child death in India. We conclude that the structure of neonatal causes of death in India may be different from the rest of the world and that interventions to reduce neonatal deaths in first week of life may rapidly improve child survival in the country.

Keywords Child survival · Epidemiology · India · Health policy · Millennium development goals

C. Lahariya
Department of Community Medicine, G.R. Medical College, Gwalior, India

C. R. Sudfeld
Department of Epidemiology, Harvard School of Public Health, Boston, MA, USA

D. Lahariya · S. S. Tomar
Write Health Society for Community Health Actions, Gwalior, India

C. Lahariya (✉)
B6/5, Second Floor, Opposite NCC Office, Safdarjung Enclave, New Delhi 110029, India
e-mail: c.lahariya@gmail.com

Introduction

More children under 5 years of age die annually in India than any other country of the world [1, 2]. Understanding the causes of these deaths may help in identifying and implementing appropriate, high-impact interventions to improve child survival in the country and achievement of Millennium development Goal 4 [3]. It is unfortunate that, for long, there were no systematic and organized mechanisms to identify and classify the causes of under five deaths in India; however, recently a few large scale surveys/studies were initiated to address this need [4–6].

The last literature review on the causes of child deaths in India was published in 1986 with published data up to 1985 [7]. The majority of studies included in this review were from hospital settings with a focus on causes of perinatal deaths. A number of health interventions have been introduced or expanded since 1985 as a result the pattern and causes of child deaths in India has likely changed thereafter. Consequently, we found it imperative to systematically review studies and reports published after 1985 in order to examine contemporary causes and timing of neonatal, infant, and child deaths in India. The other objective of this review was to provide relevant policy recommendations for implementing and/or expanding child survival interventions in India.

Material and Methods

We systematically reviewed the literature from January 1, 1985 to December 31, 2008 to identify studies from India on causes, and timing of child, infant, and neonatal deaths. This time period was selected because the last review on the causes of child deaths in India was published in 1986, covering studies published prior to 1985. Further, the major child survival initiatives in India started after 1985. To find these studies, we conducted search of PubMed, EMBASE, Google scholar, and from the World Health Organization (WHO) regional databases using combination of the search terms "Child mortality", "Infant mortality", "Neonatal mortality", "India", "Child Health", "Child Survival". Recent government reports and data from known unpublished survey/reports were also included. The inclusion criteria for the studies or the reports was that the study participants were either in defined age group of less than 5 yrs and quantitative data on causes or timing of child, infant or neonatal mortality was presented. All studies meeting these criteria were included in the descriptive analysis, however if nested studies were conducted from the same study population only the larger original study was included in the final statistical analyses. All contributing data was double abstracted and compared for discrepancies. The neonatal period was defined as the first 28 days of life, infancy less than 1 yr old, and childhood under 5 yrs.

We decided to include all the studies, which met our inclusion criteria and present a descriptive analysis of including study location, setting, year, sample size, population studied, and causes of deaths. The causes of death were defined by study authors and median percentages were calculated for major causes of death. The proportional contribution of neonatal deaths occurring during infancy, along with the cumulative percentage of neonatal deaths by day 1, 3, and 7 are also presented. We decided not to use pooled data (means) but preferred the use of median for analyses, since the studies employed different designs and utilized different cause of death definitions.

Additionally, there have likely been changes in the structure of causes of child death due to interventions during the 24 yr study period. In order to statistically test the differences by study year and design, we utilized the Kruskal–Wallis test, a non-parametric method for testing equality of population medians among groups [8]. The study years were dichotomized before and after 1996, which was the midpoint year of the included studies. The study design was dichotomized by verbal autopsy vs. other methods. A p-value <0.05 was considered statistically significant for all analyses. Analyses were conducted using STATA 10.0 Special Edition (STATACORP, College Station, TX).

Results

Our literature review found 28 published/unpublished studies and reports on the causes of under 5, infant, and neonatal deaths in India [9–36]. A descriptive analysis of the studies is presented in Table 1. There were six multicentric [9–12, 24, 34] and 22 single site studies. Multiple studies were conducted on the same study site, during different years; therefore, this review presents data from 15 unique sites. These sites are in nine different states of India, with a majority from Uttar Pradesh, Maharashtra, and New Delhi (summarized in Table 1).

A total of 20 studies presented cause of death for neonatal period. The three major causes of neonatal deaths were sepsis/pneumonia, asphyxia, and prematurity/low birth weight (LBW). The median percentage of deaths due to sepsis/pneumonia was 24.9% (Q1: 19.6% and Q3: 33.4%), due to asphyxia was 18.5% (Q1: 14.2% and Q3: 21.9%), and pre-maturity/LBW together had a median percentage of 16.8% (Q1: 12.5% and Q3: 26.5%). Other notable causes of death include tetanus, and congenital malformations. The proportions of deaths, due to these causes, were variable between

Table 1 Summary of Studies with Cause of Death Data

Study (Publication year)	Ref No	Location	Setting	Study period	Type of study	Method adopted	Age and number of subjects (deaths)	Causes of deaths
SRS (2009)	9	Nationwide	Rural and urban	2000–2003	Cross-sectional	Verbal autopsy	21,658	**U5:** The peri-natal causes contribute to more than 1/3rd and the respiratory infections and diarrhea diseases to another 1/3rd **Infant:** Peri-natal causes (46.3%) and respiratory infection (21.8%)
ICMR (2008)	10	5 districts in 5 states	Rural	2003	Cross-sectional	Verbal autopsy	2,218 infant including 1,521 neonates	**Neonatal** (161 analysed): Sepsis, pneumonia, or meningitis (32.8%), birth asphyxia (22.3%), and prematurity (16.8%)
INCLEN (Unpublished)	11	16 districts in 8 States	Rural	2007	Cross-sectional	Verbal autopsy	1,489 U5 including 642 neonatal	**Neonatal:** Infections (34%) birth asphyxia (22.9%), LBW (2.7%), prematurity (7.2%), congenital malformations (5.3%), and miscellaneous (18%) **Post neonatal:** Pneumonia/ARI (33%), diarrhea (26%) and sepsis and menigitis (6.4%)
Baqui (2006)	12	Barabanki and Unnao	Rural	Not given	Cross-sectional	Verbal autopsy	618 neonatal	**Neonatal:** Prematurity (26.5%); sepsis or pneumonia (24.9%), birth asphyxia and injuries (13.8%), congenital abnormality (6.4%), tetanus (4.0%), diarrhea (1.6%) and unidentified causes (22.3%)
Bang (2005)	13	Gadchiroli	Rural	1995–1996	Prospective cohort	Cause of death assigned by a neonatologist	40 neonatal	**Neonatal:** Sepsis/pneumonia (52.5%), asphyxia (20.0%), prematurity (15.0%), hypothermia (2.5%), and other/not known 4 (10.0%)
Singhal (1990)	14	Gorakhpur	Urban slums	1983–1984	Prospective cohort	Medical officer assigned cause of death	50 neonatal	**Neonatal:** Infection (52.0%), respiratory distress (18.0%), prematurity (8.0%), birth asphyxia (6.0%), hyperbilirubinemia (6.0%), and other (4.0%)
Vaid (2007)	15	Vellore	Urban	1995–2003	Case Report	Health record	219 infant including 119 neonates	**Infant:** Gastroenteritis (23.3%), perinatal asphyxia (17.3%), ARI (10.3%), congenital anomalies (9.6%), prematurity (9.1%), aspiration pneumonia (8.2%), fever/septicemia (4.6%), miscellaneous (13.2%)
Thora (1986)	16	Jabalpur	Urban slums	1985	Prospective cohort	Health record and questionnaire	65 infant including 38 neonatal	**Neonatal:** Prematurity (35.3%), RDS (23.5%), birth asphyxia (20.6%), Septicemia (20.5%) **Post neonatal:** Bronchopneumonia (46.4%), malnutrition (25.0%), diarrhea/dehydration (21%), infectious disease (7.1%)
Soudarssanane (1992)	17	Pondicherry	Rural and Urban	1989	Retrospective cohort	Health record	222 infant including 77 neonatal	**Neonatal period:** Prematurity (22.3%), birth asphyxia (17.7%), LBW (15.2%), ARI (8.8%), congenital anomalies (8.8%), fever (5.1%) and unknown (7.8%) **Post neonatal period:** ARI (33.6%), diarrhea (30.1%), fever (9.8%), measles (7.7%), meningitis/encephalitis (5.6%), malnutrition (4.1%) and unknown (2.8%)
Hirve (1997)	18	Pune	Rural	1987–1989	Prospective cohort	Pediatrician assigned cause	286 U5D including 247 infant	**Infant:** Preterm and LBW (24%), diarrhea (13%), ARI (11%), birth asphyxia (11%), other infections (8%), congenital anomalies (5%), miscellaneous (11%), and unknown (16%) **Child (1 through 5 years):** Diarrhea (27%). injuries (18%), sepsis and ARI (23%), measles (8%), miscellaneous (21%) and unknown (3%)

Table 1 (continued)

Study (Publication year)	Ref No	Location	Setting	Study period	Type of study	Method adopted	Age and number of subjects (deaths)	Causes of deaths
Awasthy (1996)	19	Lucknow	Urban slums	1993–1994	Case report	Health record	71 U5	**U5:** Fever (21.1%), pneumonia (19.7%), diarrhea (18.3%), neonatal causes (16.9%), measles (11.3%), malnutrition (4.3%), tetanus (2.8%), and others (5.6%)
Nandan (2005)	20	Agra	Rural	2002	Retrospective participatory study	Verbal autopsy (social audit of deaths)	749 U5 including 302 neonatal	**Neonatal:** Prematurity and LBW (33.6%), birth asphyxia (13.5%), hypothermia (12.6%), pneumonia (12.6%), congenital anomalies (9.7%), tetanus (5.7%), diarrhea (3.4%), and sepsis (3.3%) **Post neonatal:** Diarrhea (21.9%), severe malnutrition (20.4%), pneumonia (16.6%), measles (7.8%), cholera (7.8%), typhoid (4.7%), fever (4.2%), and unknown (5.7%)
Bhandari (2002)	21	New Delhi	Urban slums	1995–1996	Sub-study of a Randomised controlled trial	Verbal autopsy	162 infant including 57 neonatal	**Neonatal:** Pneumonia (28.1%), birth asphyxia (19.3%), prematurity (15.8%), congenital malformations (10.5%), diarrhea (8.8%), and others (17.5%) **Post neonatal:** Diarrhea (33.3%), meningitis/sepsis (18.1%), diarrhea and pneumonia (17.2%), pneumonia (16.2%), and others (15.2%)
Srivastava (2001)	22	Patna	Rural and Urban	1994–1996	Cross-sectional	Verbal autopsy	1000 neonatal	**Neonatal:** Prematurity (25.4%), birth asphyxia/injuries (23.3%), sepsis (20.8%), RDS (4.4%), multiple pregnancy (4.0%), pneumonia (3.7%), congenital malformation (3.3%), sudden death (2.0%), and other (10.5%)
Chaturvedi (1986)	23	Wardha	Hospital	1984–1985	Prospective cohort	Pre-designed Hospital record	144 neonatal	**Neonatal:** Birth anoxia and/or IVH (51.2%), Septicemia or meningitis (23.6%), congenital anomalies (8.3%), aspiration pneumonia (4.2%)
Gupta (1999)	24	Calcutta and Raipur	Urban slums	1997	Retrospective cohort	Questionnaire based	123 infant	**Infant:** diarrhea (23.7%), malaria/fever (18.7%), malformation/ prematurity/LBW (18.7%), ARI (14.6%), malnutrition (7.3%), measles/rashes (7.3%), and unknown (5.7%)
Bhardwaj (1993)	25	Aligarh	Rural	1987–1988	Prospective cohort	Questionnaire based	13 Neonatal deaths	**Neonatal:** Breech (23.0%), congenital defect (15.4%), asphyxia (15.4%), prematurity (15.4%), jaundice (7.7%), meningitis (7.7%) and fetal distress (7.7%)
Garg (1993)	26	Meerut	Rural	1991	Cross sectional survey	Questionnaire	111 infants	**Neonatal deaths:** Tetanus (21.4%), septicemia (21.4%), diarrhea (11.9%), prematurity (9.5%), and congenital anomalies (9.5%), pneumonia (7.2%), asphyxia (2.4%), meningitis (2.4%), burn (2.4%) and unspecified (9.5%)
Ravi Kumar (1996)	27	Pondicherry	Hospital	1992–1993	Case report	Hospital record	235 early neonatal	**Early neonatal:** Birth asphyxia (24.2%), prematurity (22.5%), meconium aspiration (11.9%) septicemia (11.5%) RDS (10.2%), congenital anomalies (8.9%), and others (8.9%)
Ravi Kumar (1996)	27	Pondicherry	Hospital	1984–1985	Case report	Hospital record	127 early neonatal	**Early neonatal:** Birth asphyxia (17.9%), septicemia (25.8%), meconium aspiration (14.8%), RDS (8.5%), prematurity (8.8%), congenital anomalies (10.1%) and other (9.4%)

Awasthy (1998)	28	Lucknow	Urban slums	1995–1996	Cross-sectional	Verbal autopsy	1171 U5 including 205 neonatal	**U5 deaths:** Pneumonia (23.4%), diarrhea (20.9%), Malnutrition and anemia (11.4%), prematurity (11.3%), fever (5.2%), tetanus (2.9%), measles (2.7%), and miscellaneous (6.6%)
Phukan (1998)	29	Dirugarh	Hospital/ Rural	1994	Case report	Hosptial record and interview	113 neonatal	**Neonatal:** Immaturity (21.2%), fever/sepsis (13.3%), breathing disorder (12.4%), neonatal tetanus (11.5%), diarrhea (8.8%), congenital disorder (6.2%), perinatal hypoxia (5.3%), bacterial sepsis (5.3%), birth injury/prematurity (5.3%), and unknown (10.6%)
Kapoor (1996)	30	Lucknow	Urban slums	1992–1993	Cross sectional survey	Verbal autopsy	21 early neonatal	**Early neonatal:** Prematurity (38%), infections (33.0%), asphyxia (18.0%), jaundice (4.8%), and congenital anomalies (4.8%)
Chavan (1992)	31	Satara (MH)	Hospital	1987–1990	Retrospective	Health record	37 early neonatal	**Neonatal:** Asphyxia (40.5%), prematurity (29.7%), bacterial infection (27.0%), and congenital malformation (2.9%)
Sarna (1991)	32	New Delhi	Hospital	1988	Case Report	Hospital record	328 Neonatal deaths	**Neonatal:** Respiratory distress (29.3%), sepsis (24.3%), asphyxia (16.2%), congenital anomalies (10.4%), extreme LBW (3.6%), and miscellaneous (19.5%)
Suguna Bai (1991)	33	Trivandrum	Hospital	1986–1987	Case report	Hospital Record	256 early neonatal deaths	**Early Neonatal:** Birth asphyxia (31.3%), prematurity (15.6%), congenital anomalies (8.4%), and infections (7.2%)
Tandon (1987)	34	9 sites nationwide	Rural and urban	1984–1985	Cross-sectional	Questionnaire	241 infant	**Infant:** Fever (32.4%), diarrhea (20.3%), prematurity and LBW (13.7%), tetanus (7.9%), respiratory infections (7.5%), and other (14.9%)
Singhal (1986)	35	Gorakhpur	Urban slums	1983–1984	Prospective cohort	Medical officer assigned cause of death	296 under 6 years including 91 infant	**Infant:** Diarrhea (36.3%), respiratory infection (24.2%), tetanus (15.4%), neonatal factors (13.4%), malnutrition (2.2%) and other (8.8%) 1–6 years: Diarrhea (50.2%), respiratory infection (32.7%), measles (2.9%) and other (5.9%)
Singh (1990)	36	New Delhi	Hospital	1972–1986	Case report	Hospital autopsy record	331 neonatal	**Neonatal:** Infection (27.2%), hyeline membrane disease (20.2%), congenital malformation (19.6%), perinatal anoxia (14.5%), birth trauma (2.7%), and unknown (3.9%)

studies. For example tetanus caused 21.4% of death in one study, while in others no deaths were attributable to tetanus [10, 26, 31].

Only six studies presented data on cause of infant (<1 yr) deaths [11, 15, 18, 24, 34, 35]. Sepsis/pneumonia, asphyxia, and prematurity/low birth weight (LBW) remain substantial causes of deaths due to a large proportion of infant deaths occurring during the neonatal period. However, the proportion of deaths due to infectious diseases like diarrhea, pneumonia, and measles seem to be greater, in comparison to the neonatal period. A total of five studies had data on cause of child deaths (<5 years) in India [9, 18, 19, 28, 35]. Statistical analyses were not possible for both causes of infant and under five deaths; due to the small number of studies in each group and since researchers in these studies used varying definitions and groupings of cause of death. However, a descriptive analysis suggests further increases in the proportion of deaths due to infectious diseases during childhood (<5 yrs) compared to that in the period of infancy.

Table 2 presents study data on the proportional contribution of neonatal deaths (first 28 days) to total deaths occurring during infancy (<1 yr). Two additional studies, which provided timing of neonatal deaths but not cause of death, were also included in this table [37, 38]. Analysis of all studies determined the median proportional contribution of neonatal deaths to total infant deaths was 48.5% (Q1: 36.5% and Q3: 57.5%). In order to investigate if neonatal contribution to infant deaths was changing overtime, we utilized the Kruskal–Wallis test for medians. We dichotomized year of study before and after 1996 as that was the midpoint year of our review. There was no significant difference in the proportional contribution of neonatal deaths to total deaths occurring during infancy (<1 yr) between the two periods (p=0.141). Based on a descriptive analysis of the data, there seems to be some indication that the proportion may actually be increasing with time; however, we may have lacked sample size to determine a difference. There also was no difference in the proportional contribution by cause of death assignment method (Verbal autopsy vs. other methods; p=0.715) or by study setting (urban vs. rural; p=0.175).

The specific timing of neonatal deaths by day is also presented in Table 2. The median percentage of neonatal deaths by day 1 is 36.7% (Range: 20.0–58.0%). The median cumulative percentage of neonatal deaths by day 3 was 49.7% (Range 35.0–64.6%) and 70.9% (Range: 46.5–92.3%) by day 7.

Table 2 Proportion and timing of neonatal deaths

Study	Ref No.	Study Years	Number Neonatal Deaths	Proportion of infant deaths occuring during neonatal period	Cumulative Percentage of Neonatal Deaths by Day		
					Day 1	Day 3	Day 7
ICMR	10	2003	1,521	68.6%	39.3%	56.8%	74.1%
INCLEN	11	2007	642	60.4%	34.1%	45.9%	69.7%
Baqui	12	2006	618	NA	31.8%	49.7%	70.7%
Bang	13	1995-1996	40	NA		35.0%	57.0%
Singhal	14	1983-1984	50	NA	20.0%		50.0%
Vaid	15	1995-2003	119	54.3%			
Thora	16	1985	38	58.5%			71.0%
Soudarssanane	17	1989	79	35.6%			72.6%
Hirve	18	1987-1989	153	61.9%			
Awasthy	19	1995-1996	205	28.0%			
Nandan	20	2002	302	53.6%			
Bhandari	21	1995-1996	52	35.2%			
Srivastava	22	1994-1996	1,000	NA			58.4%
Chaturvedi	23	1984-1985	144	NA	43.7%	64.6%	84.7%
Gupta	24	1997	67	54.5%			46.5%
Bharadwaj	25	1987-1988	13	NA			92.3%
Garg	26	1991	42	37.8%			
Bamji	37	1998-2003	12	NA	58.0%		
Neilsen	38	1995	53	NA			82.9%

Discussion

Multi-centric studies utilizing standardized tools to investigate child deaths in India were not conducted until the year 2000. Previous studies are characterized by small sample size and substantial variation in design and cause assignment methods, which makes comparisons between these early studies difficult and often unreasonable. The availability of comparable data is essential for accurate impact assessment of ongoing interventions and child survival programs. This scenario seems to be changing during the last decade, when not only study focus became multi-centric but more rigorous and tools like verbal autopsy were utilized [9–12, 39]. These recent surveys and studies likely provide a more accurate cause of child death structure for India compared to earlier institutional based studies which may not be representative of the general population [6, 9].

In this review, we were not able to assess trends in infant or child deaths due to a lack of methodologically similar data. It is expected that the recent advancements in design and analysis of cause of child death research in India discussed above will help in generating more comparable data, which in turn can be utilized for programmatic decision making.

On the other hand, there were a sufficient number of neonatal death studies, which employed reasonably similar cause of death definitions, to perform statistical analyses (Table 2). The studies reviewed in this article did not find any statistically significant change in the proportionate contribution of neonatal deaths to total infant deaths overtime. Similarly, there was no difference in the proportionate contribution of neonatal deaths between rural and urban areas. Both of these findings are contrary to the recent reported findings from two large scale surveys and a trend analysis of SRS data from India [4, 5, 40, 41]. We hypothesize that these differences may be due to methodological differences in older studies, where perinatal mortality was commonly studied and a large proportion of neonatal deaths were likely reported as still birth. Secondly, the majority of studies published in the 1980's and 1990's were conducted at academic institutions and hospitals, which may not be representative of the general Indian population. Global estimates on the causes of neonatal deaths, published in the year 2005, reported that neonatal deaths contributes to 37% of the all under five deaths [43]; however the National Family Health Survey-3 and a recent review article published data from SRS and RCGI, suggest that proportional contribution of neonatal deaths to the under five mortality rate (U5MR) in India is much higher than global proportion [4, 40]. We could not analyze the proportional contribution of neonatal deaths to the under five deaths in this review, since most studies with data on children under five did not present data specific to neonates.

This review also provides vital insight to the causes of neonatal deaths in India. Across all studies, the median percentage of neonatal deaths attributed to sepsis/pneumonia was 24.9%, while asphyxia was 18.5% and pre-maturity and Low Birth weight (LBW) together was 16.8%. Though estimates of the causes of under five deaths in India have recently became available [42], a separate analysis on causes of neonatal deaths is not available. Globally, preterm birth (28%), sepsis/pneumonia (26%), asphyxia (23%), congenital anomalies (8%), neonatal tetanus (7%), diarrhea (3%) are the most common causes of neonatal deaths [43]. This review and another article in this supplement suggest that the proportionate contribution from major causes of neonatal deaths in India i.e. pre-term births, sepsis or pneumonia and birth asphyxia, is slightly different than that in the rest of the world [4]. Furthermore, it is interesting to note that the timing of neonatal deaths seems to have remained strikingly constant during the last two decades with a majority occurring during the early neonatal period [10–26]. These findings are corroborated by the recent SRS survey report [9].

Authors in the past have also reported limited use of data for decision making in child survival, especially for the neonatal period [44]. It is time for accurate country specific child survival data to become regularly available for decision making in India. Our findings insist that more attention be placed on survival through the early neonatal period. The recently announced '*Navjat Shishu Suraksha Karyakram*' and the platform of '*Janani Suraksha Yojana*' may provide appropriate strategies to improve early neonatal survival in the country [45, 46].

Conclusions

During the last decade, there had been a few multi-centric studies and a national wide survey, which have provided valuable insight into the causes and timings of child deaths in India. Our review demonstrates the importance of continuing the methodological rigour and large sample sizes in future studies and surveys. Secondly, the review suggests that the causes of neonatal deaths in India may be different from the rest of the world. Our findings demand that neonatal survival interventions be prioritized in India and established upon country specific data. Thirdly, the majority of neonatal deaths still occur in early neonatal period in India, which is an important indication that continuum of care needs to be ensured throughout the country. The findings of this review may be useful for the program managers and policy makers to make informed decisions to ensure that India achieve MDG4 on time.

The views expressed in this article are those of the authors and does not reflects the views of the organizations with whom they have been affiliated in the past or present. The author's affiliation reflects the affiliation at the time of writing this article. The first author was at the G.R. Medical College, Gwalior at the time of data retrieval and writing the first draft of this manuscript.

Conflicts of interest None.

Role of Funding Source No funding was received for this work by any named author.

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