

Original Research Article

An assessment of factors responsible for diarrhoea deaths of under five children in rural and urban settings of India

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ABSTRACT

Background: Very little scientifically based information is available on cause-specific mortality rates of diarrhoea among all regions and populations wherein an inequitable proportion exists in low-income households, which have fewer resources and less knowledge to manage burden than high-income households. The strategic purpose of the study is to identify gaps in care seeking in order to make changes in approach to address these gaps either directly by working with the community and by doing area specific advocacy to improve service delivery through government channels.

Methods: The study was conducted in nine locations (6 rural and 3 urban) of India. The ethical and confidentiality parameters of conducting verbal autopsies were followed and random sampling methodology was adapted.

Results: Respondents of our study attributed 22% deaths to diarrhoea. From the study, it is revealed that children who passed stool for 5 or more number of times in a day are more likely to die 1.5 times than the children who passed stool for 3 times a day. Children having diarrhoea for 5 days or more than 5 days are more likely to die 1.6 times in comparison to the children who have had diarrhoea for 3 days. Approximately seven of the ten children died within five days of treatment.

Conclusions: Information on diarrheal diseases, its determinants in India and preventive and control strategies in light of recent developments need to be reviewed for better planning and organization of health services within the community.

Keywords: Diarrhoea management, Verbal autopsies, Treatment of diarrhoea, Rural urban diarrhoea cases, Prevalence of diarrhoea

INTRODUCTION

Diarrhoea has evident itself among the leading causes of under-five childhood mortality globally as well as in India. More than 5 lakhs under five children worldwide and over one lakh under five children in India die due to diarrhoea. Approximately 321 children per day aged under-five die due to diarrhoea diseases and around 70 per cent of these children are below two years.¹ However,

proof of evidence suggests that almost all the deaths due to diarrhoea can be averted by preventing and treating dehydration by the use of ORS (oral rehydration solution) and administration of zinc along with adequate nutritional intake by the child during diarrhoea. Other proved vital approaches to prevent diarrhoea are use of safe drinking water, hand-washing, sanitation, immunization and exclusive breastfeeding / appropriate nutrition.²

Diarrhoea is present globally among all regions and populations. However, an inequitable proportion of diarrhoea morbidity and mortality occurs in low-income countries, which have fewer resources and less robust infrastructure to manage burden than high-income countries. Very little scientifically based information is available on cause-specific mortality rates. What information does exist is often out of date not matching the dynamic needs of the community, and not sufficiently disaggregated to differentiate between important populations sub-groups. In India civil registration and death registration certificate systems are hugely underutilized and most people die at home without having had contact with health system. To find the cause of mortalities in these situations, verbal autopsies are considered to be one of the vital tools.

The strategic purpose of the research study is to identify gaps in care seeking in order to make changes in the Stop Diarrhoea Initiative (SDI) project approach to address these gaps either directly by working with the community and by doing area specific advocacy to improve service delivery through government channels.

Objectives

Following are the key research objectives:

- To identify the causes of child deaths by rural and urban variations.
- To identify the factors (health seeking behaviour) that contributed to the death of children due to diarrhoea by rural and urban variations.

METHODS

The Table 1 presents demographic details including appropriate number of under 5 children deaths and number of deaths caused by diarrhoea across the study sites in four states of India including three urban and six rural sites. Basis these calculations, approximate number of deaths due to diarrhoea were calculated which formed universe for the study (Table 1).

In order to reduce the study recall bias, only those households where child deaths had happened in the past six months were considered for the study. To identify the eligible households for in-depth interviews, the team leaders of the investigation teams contacted block primary health centres and tried to get the details of the households. In addition to this approach, the study teams also contacted supervisors of ASHA, ANM and AWW to know where a child death had happened.

A semi structured questionnaire was developed, pretested and translated in different local languages for data collection. The data collection was supervised by the block level project staff and at least ten percent interviews were spot or back checked by the project team. The data collection was primarily done from the deceased child's mothers purely on a volunteering basis. If the mother felt she is willing to speak, the interview was conducted else it was administered to another adult household member. A trained social worker accompanied the team of investigators and in case of need, she used to console the mother. Data collection for the study was done during January–February 2018.

Table 1: Approximate number of under - 5 children deaths due to diarrhoea by project site.

Project Site	Population	Live births per year	No of U-5 deaths	No. of deaths in 6 months	Approx. diarrhoea deaths in the past 6 months
Rural sites					
Gilaula	229,651	6,890	289	145	10
Payagpur	199,059	5,972	251	125	9
Tulsipur	265,359	7,961	334	167	12
Amariya	246,186	7,386	310	155	11
Sitarganj	178,154	5,345	224	112	8
Laksar	214,489	6,435	270	135	9
Urban sites					
Delhi slums (North)	200,000	6,000	252	126	9
Delhi slums (South)	350,000	10,500	441	221	15
Kolkata Ward 58, 65	146,389	4,392	184	92	6
Total	2,029,287	60,879	2,557	1,278	89

Note, calculations derived basis secondary sources: Approx. 3000 live births per 100000 population in a year; Number of infant deaths calculated as 42 per 1000 live births; Diarrhoea death calculated as approx. 7% of under 5 children deaths.

Ethical approval for the study was obtained and the data collection was started only after taking written consent from the respective district health departments for the study sites. As a standard process, study protocol and questionnaire were shared with the respective district level authorities.

The data management was done using MS Excel (for data entry) and SPSS 20.0 for the quantitative data while qualitative data was analysed using content analysis. Data confidentiality was maintained and no information was shared with any persons or agency. The information is only used for the research study.

RESULTS

A sample of 215 deceased children under 5 years of age was covered under the study, of whom, 53% (113) were female and 47% (102) were male children. Three-fourth (76%) of the deceased children were from rural areas. In rural area, the ratio of deceased girls (49%) and boys (50%) was almost equal whereas in urban areas deceased girls were 59% of the total deceased children. Nearly three-fifth (56%) of the deceased children lived in complete Kaccha or partially Kaccha houses. Two-thirds (67%) of households were located in the middle of the village while almost one-third (16%) were on the outer / peripheries of the village.

Caste wise distribution reveals that of the deceased children, 30%, 52% and 18% households belonged to SC/ST, OBC and general category respectively. In case of all deceased boys, 21%, 49% and 30% belonged to SC/ST, OBC and general category respectively whereas in case of all deceased girls, 40%, 54% and 6% belonged to SC/ST, OBC and general category respectively. In urban areas, of the deceased, amongst boys, 41%, 29% and 29% were from SC/ST, OBC and general category respectively whereas in case of deceased girls, 71% and 29% belonged to SC/ST and OBC category respectively. In rural areas, of deceased boys, 15%, 55% and 30% belonged to SC/ST, OBC and general category respectively whereas in case of deceased girls, 28, 63% and 8% were from SC/ST, OBC and general category respectively.

Almost two-third (64%) of the deceased children (boys=66%, girls=63%) were born at the health facility while 36% (boys=34%, girls=37%) were born in their homes. More boys in urban areas (43%) than rural areas (32%) were born at home whereas in case of girls, more rural girls (39%) than urban (33%) were born at home.

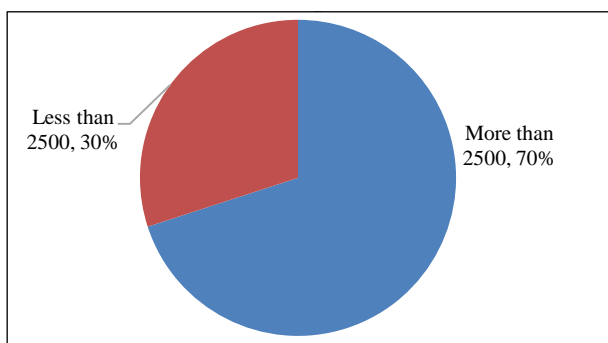


Figure 1: Birth weight of deceased children.

A slightly more than three-fifths (61%) of the deceased children weighed more than 2500 gm at the time of birth which was found to be 70% and 52% for boys and girls respectively. Further, more urban births (64%) than rural (49%) reportedly had deceased children weighed more than 2500 gm at the time of birth. More boys in urban areas (76%) than rural boys (68%) weighed more than

2500 gm whereas in case of girls, more rural girls (60%) than urban girls (30%) weighed more than 2500 gm.

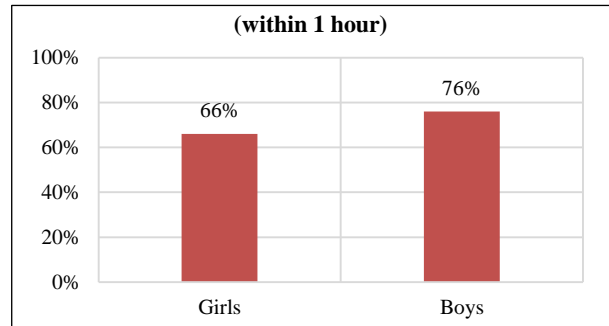


Figure 2: Deceased children breastfed immediately after birth.

Nearly three-fourths (71%) of the deceased children (girls=66%, boys=76%) were breastfed within 1 hour of birth which varied from 74% in rural areas to 57% in urban areas. In case of boys, more urban boys (82%) than rural (74%) were breastfed within 1 hour of birth while in case of girls, it varied from 74% in rural to 30% in urban.

Measles was injected to 88 percent of all the deceased children (boys=84%, girls=91%) which was found to be same for both urban and rural areas (88% each). Amongst boys, it was reported to be 85% and 80% for rural and urban boys respectively while in case of girls, it was universal (100%) for urban girls and 90% for rural girls.

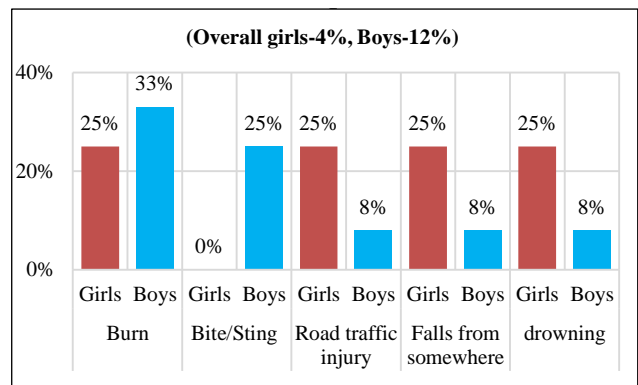


Figure 3: Deceased children met an accident before death.

Almost one-tenths (8%) of the deceased children (boys=12%, girls=4%) met an accident before death. Of those who met with an accident, 31% had burn (boys=33%, girls=25%), 19% had bite/sting (boys=25%, girls=0%), 13% each for road traffic injury (boys=8%, girls=25%), fall from somewhere (boys=8%, girls=25%) and drowning (boys=8%, girls=25%).

Various conditions were probed for all the deceased children and it was reported that more than half children (54%) had fever (boys=55%, girls=53%) (rural=52%, urban=59%). Other than fever, respondents mentioned

convulsions (10%) (boys=13%, girls=8%) (rural=11%, urban=8%); unconsciousness during illnesses (10%) (boys=10%, girls=10%) (rural=11%, urban=8%); stiffness of the whole body (16%) (boys=14%, girls=18%) (rural=19%, urban=6%); stiff neck (10%) (boys=14%, girls=7%) (rural=12%, urban=4%); breathing difficulties (32%) (boys=36%, girls=29%) (rural=31%, urban=37%); abdominal problem (28%) (boys=29%, girls=27%) (rural=31%, urban=18%) and skin turned yellow (23%) (boys=22%, girls=25%) (rural=22%, urban=20%) for the deceased children.

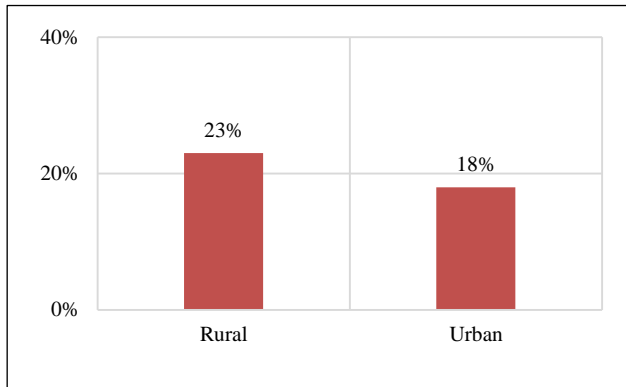


Figure 4: Mortality due to diarrhoea.

Of the total deaths reviewed under verbal autopsy, respondent's attributed 22% mortality due to diarrhoea which was found to be 18% and 23% in urban and rural areas respectively. The percentage remained the same 22 percent for both the boys and girls. Amongst boys, in rural and urban areas, 22% and 21% deaths respectively were attributed to diarrhoea whilst in case of girls, diarrhoea was reported to be the cause by 24% and 17% of rural and urban areas respectively.

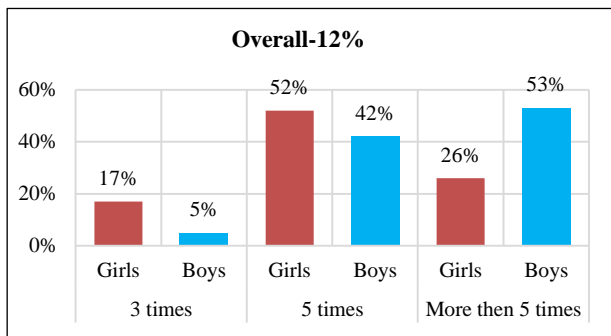


Figure 5: Stool passed in day.

Regarding number of times stool passed in a day, overall -12%, 48% and 38% of the children who died due to diarrhoea reportedly passed stool thrice (girls=17%, boys=5%), five times (girls=52%, boys=42%) and more than five times (girls=26%, boys=53%) respectively. In case of urban areas, 56% and 44% had passed stool five times and more than five times respectively whilst in case of rural areas, 15%, 46% and 36% reportedly passed stool

thrice, five times and more than five times respectively. More rural boys (60%) had passed stool more than 5 times in a day as compared to urban boys (25%) whereas in case of girls three-fifths (60%) of the urban girls reportedly had passed stool more than 5 times in a day as compared to rural girls (17%).

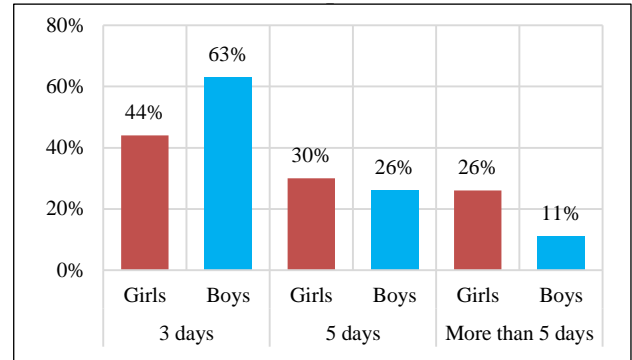


Figure 6: Children having diarrhoea for number of days.

When probed regarding "how many days was the child having diarrhoea", overall, 52% (girls=44%, boys=63%), 26% (girls and boys=26%) and 19% (girls=26%, boys=11%) of the children had diarrhoea for 3 days, 5 days and for more than 5 days respectively. By geographic distribution, in urban areas, 33%, 44%, 22% of the children had diarrhoea for 3 days, 5 days and for more than 5 days respectively whilst in case of rural areas, 58%, 21% and 18% had diarrhoea for 3 days, 5 days and for more than 5 days respectively. Gender and geography wise analysis reveals that 67% of the rural boys had diarrhoea died in 3 days which was found to be 50% in urban areas whilst in case of girls, half of them died in 3 days across urban and rural areas.

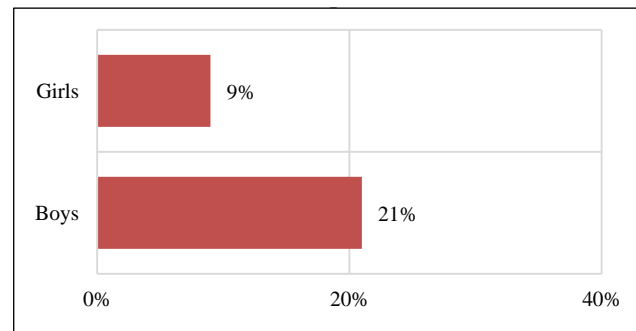


Figure 7: Children with blood in stool.

Overall, 14% of deceased children had blood in the stool (boys=21%, girls=9%) which was reported only in rural areas by nearly one-fifths (18%) of the children. Vomiting along with diarrhoea was reported by three-fifths (60%) of the deceased children. This was reported by 78% (girls=100%, girls=50%) and 55% (girls=44%, boys=67%) of urban and rural deceased children respectively.

One-thirds (overall=34%, girls=36%, boys=32%) of the deceased children were visited by ANM or ASHA at the house. In urban areas, overall one-thirds (33%) of the deceased children were visited which was found to be 40% and 25% for girls and boys respectively. Whereas in case of rural areas (34%) which was 35% and 33% for girls and boys respectively. Three-fifth (75%) of the children were visited on day 2 or beyond, which was 88% and 68% for boys and girls respectively which varied from 80% in rural areas to 60% in urban areas.

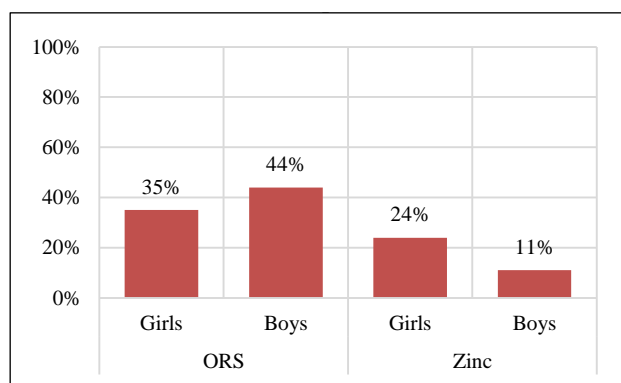


Figure 8: Deceased children receiving ORS and zinc.

Of the total children visited, 39% (girls=35%, boys=44%) and 19% (girls=24%, boys=11%) deceased children received ORS and Zinc respectively from visiting ASHA or ANM. In urban areas, 60% (girls=50%, boys=100%) of the children received ORS whilst in case of rural areas it was found to be 33% (girls=31%, boys=38%). Regarding Zinc, 40% children (girls=50%, boys=0%) in urban areas received while this was found to be 14% in rural areas received Zinc (girls=15%, boys=13%). Of those who received ORS or Zinc, only 40% children

More than two-fifths (total=42%, girls=47%, boys=33%) of the deceased children households reportedly did not receive any counselling on feeding, danger signs and referral which was found to be 29% and 100% for rural and urban areas respectively. Of the diarrheal deceased cases, 65% (n=28) received any sort of treatment (including self and provider based treatment). Of those who sought treatment, 61%, 46%, 36% and 32% sought treatment at the level of private facility, district hospital, self-treatment & RMP (both 36%) and primary health centre respectively.

Of the total children who sought treatment / services from a health provider / facility, 100%, 89%, 69% accessed services / treatment within first 3 days of getting diarrhoea from a RMP (n=10), PHC (n=9), DH (n=13) respectively. Further, out of children who got treatment, 71% got outpatient (OPD) treatment while rest had inpatient (IPD) treatment. Regarding, cases which were referred to a higher health facility almost 25%, 22%, 25% and 20% of the children got referred at the level of district level, PHC, private hospital and RMP level respectively.

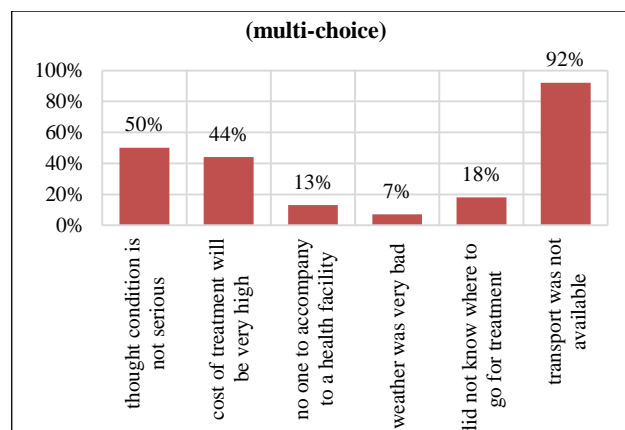


Figure 9: Reasons for seeking no treatment.

Nearly two-thirds (63%) of all the diarrheal deaths happened at home while remaining died at a facility. Regarding reasons for seeking no treatment, “thought condition is not serious” was reported by 50%, cost of treatment will be very high (44%), “no one to accompany to a health facility (13%)”, “weather was very bad (7%)”, “did not know where to go for treatment (18%)”, “transport was not available (92%)”.

DISCUSSION

Diarrhoea is present globally among all regions and populations. However, an inequitable proportion of diarrhoea morbidity and mortality occurs in low-income countries, which have fewer resources and less robust infrastructure to manage burden than high-income countries.³ Young age, low socioeconomic status, poor maternal literacy, presence of under-five sibling in the family, birth weight, inadequate breastfeeding, malnutrition, poor sanitation and hygiene practices of the mother are associated with a higher incidence of diarrheal diseases in young children.⁴ Children belonging to poor socioeconomic status had a higher diarrheal incidence than the better socioeconomic group.⁵ The study found that four of the five deceased children belonged to other backward class or scheduled tribe or scheduled caste. In urban areas nearly half of the deceased children belonged to schedule caste whereas in rural areas nearly half of them belonged to other backward class. More than half of the deceased children dwelled in kuchha or partial kuchha houses. As mentioned by Walia et al, poor socioeconomic status and poor sanitation were important factors responsible for high diarrhoea morbidity due to ease of transmission of infection.⁶

Das reported the prevalence of 10.9% and 14.9% among children of illiterate mothers and mothers with primary level of educational status respectively.⁷ Mothers’ literacy influences hygienic practices, feeding habits and sanitation which, in turn, were important determinants of recurrent diarrhoea. Educational status of the mother showed a positive correlation with the incidence of diarrheal diseases.⁸ Studies have shown that families with

more than one child had an attack rate for diarrheal diseases that was 22-70% higher than in houses with just one child <5 year old. In our study 30% of the respondents have three or more number of children.

The majority of children having diarrhoea belonged to the age group 1 month to 24 months (86%). Similar finding was observed by Negi in his study; diarrhoea prevalence was 60.24% among the children of age group 10–25 months.⁹ However, in his study conducted in urban slums, Lal reported that 42.6% children suffering from diarrhoea were in the 6 to 12 months age group and only 26.4% were above one year old.¹⁰ This difference in the most affected age group could be explained on the basis of a difference in study areas, feeding practices and sanitary conditions.

Childhood wasting (low weight-for-height score), unsafe water, and unsafe sanitation are the leading risk factors for diarrhoea, responsible for 80.4%, 72.1%, and 56.4% of diarrhoea deaths in children younger than 5 years, respectively.¹¹ Though the nutritional status of children is a well-known determinant of diarrhea, frequency of diarrhea was not significantly greater in those who were underweight or stunted compared with well-nourished children in a few studies.¹² In our study we found that 71% of the deceased children were breastfed within one hour of birth and more than 60% deceased children were exclusively breastfed for six months. Children are at almost three times greater risk of death from diarrhoea if not breastfed.¹³ In India, despite 73% institutional delivery through which mothers are encouraged to breastfeed their children, only 37% of children are exclusively breastfed. This is mainly due to low levels of awareness among mothers and caregivers of the benefits of breast milk for the development and protection of children from diseases.

Measles vaccination coverage and vitamin A supplementation among children under five is also insufficient. Diarrhoea is one of the most common causes of death associated with measles worldwide. According to WHO about 2-5% of diarrhoea episodes in the first five years of life are measles-related. This includes both with-measles and post-measles diarrhoea. The Lancet's child survival series in 2003 and 2013 has validated this association, confirming the efficacy and effectiveness of measles vaccination for diarrhoea prevention and control.¹⁴ In our study, 88% of the deceased children received measles vaccination.

In a decade to 2015, India's efforts to tackle diarrhoea-a disease easily preventable through sanitation, safe drinking water and hygiene--have led to a 52% fall in deaths of children below the age of four, but the prevalence of diarrhoea, at 9.2%, has remained high, according to national health data. Of the total deceased, respondents of our study attributed 22% deaths to diarrhoea wherein for rural respondents diarrhoea was accountable for 23% mortality and for urban diarrhoea

was accountable for 18% mortality of children. Nearly four of the five deceased children, passed stool for 5 or more number of times in a day. From our study, it is revealed that children who passed stool for 5 or more number of times in a day are more likely to die 1.5 times than the children who passed stool for 3 times a day. The study also revealed that presence of blood in stool and vomiting along with diarrhoea in deceased children were risk factors associated with mortality due to diarrhoea. One of the ten deceased children, had blood in stool and three of the ten deceased child reported vomiting along with diarrhoea. In urban area none of the deceased child reported to have blood in stool. Urban areas deceased children reporting more vomiting along with diarrhoea in comparison to rural deceased children.

The decline in deaths is driven by improved treatment cover even as fewer affected children are given increased diet and fluids, vital to fight diarrhoea, data from the National Family Health Survey 2015-16 (NFHS-4), show. In our study we found that the deceased children received treatment varying from one day to nine days. In rural areas, deceased boys in comparison to deceased girls had access to treatment for more number of days whereas more number of deceased girls received access to treatment within two days. More than 80 percent of the deceased children had diarrhoea for three or more number of days and of these more than half of them had diarrhoea for 5 or more number of days. Of the total deceased, overall girls in comparison to boys had suffered approximately three times more from diarrhoea for 5 days or more than 5 days. Urban deceased boys in comparison to rural deceased boys suffered approximately 1.5 times of diarrhoea for 5 more number of days whereas urban girls in comparison to rural girls had suffered 1.6 times of more from diarrhoea for 5 or more number of days. Children having diarrhoea for 5 days or more than 5 days had 1.6 times of mortality in comparison to the children who have had diarrhoea for 3 days.

As per the Government of India (GoI) guidelines, Accredited Social Health Activists (ASHAs) are not only trained in identification of diarrhoea cases, but also in its treatment using ORS and Zinc supplementation. In the study, hardly one fourth of the deceased children were visited by ASHA or ANM at the household level. Of the visited, in urban areas ANM or ASHA visited all the deceased children within two days whereas in rural areas of the visited, only half of the deceased children were visited within two days. Less than one fifth of the deceased children received ORS and hardly 13.6% of deceased children received Zinc from visiting ANM or ASHA. Hardly half of the respondents received any counseling on feeding, danger signs and referral from visiting ANM or ASHA. In our study we found that none of the deceased boys in urban or rural areas received Zinc for treatment. Studies have shown that 100% uptake of oral rehydration salt (ORS) reduces diarrhoea mortality by 93%, whilst Zinc contributes to 23% reduction in deaths from diarrhoea.^{15,16} Treatment of diarrhoea using

both ORS and Zinc is significantly low in India. A UNICEF report in 2009 indicated that only 1.3% children with diarrhoea were treated with Zinc and only 39% of children with diarrhoea in rural areas and 52% in urban areas were treated with ORS. The National Family Health Survey (NFHS) three showed that more than 60% of mothers are aware of ORS. However, there is a big gap between knowledge and practice which results in poor uptake of ORS. Similarly, lack of adequate training in Oral Rehydration Therapy (ORT) has also been cited as a barrier to the use of ORS and Zinc.

CONCLUSION

The epidemiology of diarrhoea disease is changing. Expansion of access to the measles and rotavirus vaccine, improvement of child growth and wellbeing, and provision of universal access to safe water and sanitation are necessary to reduce further the preventable disease burden due to diarrhoea. Information on diarrheal diseases, its determinants in India and preventive and control strategies in light of recent developments need to be reviewed for better planning and organization of health services within the community.

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