# Factors that predict the maternal use of oral rehydration solution during diarrhea home treatment for children under 5 in India

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**ABSTRACT**

***Background:*** Worldwide, diarrhea is the second major cause of mortality among children less than 5 years of age and in 2016, diarrheal deaths accounted for 8% of all deaths among under 5 children. In India, around 300,000 children under 5 die due to diarrhea each year. According to 2016 data, case fatality rate of diarrhea among children aged under 5 was 9% in India.

*Aim:* The purpose of this study was to find the determinants of maternal use of ORS during diarrheal episode in children less than 5 years of age in India to contribute to developing effective strategies to increase the ORS usage.

***Methods:*** The study used the National Family Health Survey-4 (2015 – 2016) data. Descriptive analysis evaluated any significant differences in the distribution of categorical variables and continuous variables across the ORS users vs. non-users (outcome variable). For the predictive model, all the variables that were different between the groups at the level of significance $P<0.25$ in descriptive analysis were included into logistic regression analysis, first, one by one (univariate), then together (multivariable) – adding the variables to the model manually and removing insignificant ones by using the level of significance $P<0.05$. For the association model, confounders of the association between dependent variable (ORS usage) and independent variable (type of diarrhea) were identified. Then, the association between ORS usage and type of diarrhea (bloody or non-bloody) was measured in a multivariable model controlling for all the identified confounders.

***Results:*** The significant predictors of ORS usage included child's higher age group (OR=0.39 for 0-59 month olds and OR=0.86 for 6-23.9 months olds compared to 24-59 month olds), mothers' secondary or higher education (OR=1.10) compared to mothers with lower education, urban residence of the household (OR=0.86 for rural residence), high wealth index (OR=1.20),

other than Hindu or Muslim religion (OR=0.67 for Hindus/Muslims), non-backward caste of the household (OR=0.88 for backward classes), lower sequential number of the child in the family (OR=0.95), bloody type of diarrhea (OR=1.28), exposure to mass media (OR=1.31), seeking care from public (OR=4.37) or private (OR=2.24) healthcare facilities as compared to other care-seeking behaviors, amount of food given to the child during diarrhea (OR=0.89 for not decreasing the amount of food), and use of zinc (OR=2.68). In the multivariable logistic regression model, type of diarrhea (bloody and non-bloody) was statistically significantly associated with ORS usage (OR=1.27 for bloody diarrhea) after adjusting for all the identified confounders.

***Conclusion:*** The study findings will help the public health practitioners to develop effective strategies to increase the maternal use of ORS during diarrhea home treatment. Modifiable factors such as exposure to mass media, seeking care from health facility, amount of food given to the child during diarrhea, and use of zinc could be the focus of interventions targeting ORS use. Public health interventions on importance of ORS usage for preventing dehydration should specifically target rural residents, population groups with lower wealth index, lower education, Hindu and Muslim religion, and Scheduled caste/Scheduled tribe/other backward classes. Health education program should focus on the importance in the usage of ORS to fight against dehydration during diarrheal episode.

## BACKGROUND

World Health Organization (WHO) defines diarrhea as "passage of three or more loose or liquid stools per day (or more frequent passage than is normal for the individual)".[1] If untreated, diarrheal disease may lead to severe dehydration caused by significant loss of water and electrolytes (sodium).[1–3] Severe dehydration leads to "lethargy/unconsciousness, sunken eyes, inability to drink or drinking poorly and even death".[1,2] Worldwide, diarrhea is the major leading cause of mortality among children less than 5 years of age.[1,3–5] Although diarrhea is considered as both preventable and treatable[1], every year about 1.7 billion cases are attributable to diarrheal disease worldwide among children less than 5 years of age,[1] and in 2016, diarrheal deaths accounted for 8% of all deaths among under 5 children.[6] According to 2016 data, case fatality rate of diarrhea among children aged under 5 was higher in India (9%) when compared to other low middle income countries such as Armenia (1%), Cambodia (6%), Bangladesh (7%), and Myanmar (8%).[6] In India, around 300,000 children under 5 die due to diarrhea each year.[7] In 2015, the Disability Adjusted Life Years (DALYs) attributable to diarrheal disease was about 9,478,080 in India.[8] A rapid survey among children conducted in India in 2013 – 2014 showed that the prevalence of diarrhea within 15 days period prior to the survey was about 6.5% among children aged under 5 years.[9] E-coli and rotavirus are the most common causes of diarrhea.[1,10]

Oral Rehydration Solution (ORS) is considered as the main treatment for diarrhea,[11–14] and it is considered as a cost-effective treatment.[15] Globally, the cost of one ORS packet was about 10 cents in the year 2016.[16] A study showed that 93% of diarrheal deaths can be prevented by using ORS.[17] A study conducted in two Bangladesh villages showed that diarrhea specific mortality rate among children under 5 was 0.6/100,000 population in one village where ORS usage rate was high and 2.9/100,000 population in another village where ORS usage rate was low.[18] A

study conducted in Egypt showed that after introduction of National Control of Diarrheal Disease Project, ORS usage decreased diarrhea related mortality of children.[19] A study conducted in India showed that diarrhea related mortality rate was lower in the two study areas where ORS usage rate was 68% and 52%, respectively, when compared to the control area where ORS usage was 14%.[20] Nationwide, ORS use in India has increased from 26% in 2005-2006[15] to 51% in 2015-2016.[21] However, when compared to Bangladesh (ORS usage was 77% in 2014),[22] Guinea-Bissau (ORS usage was 67% in 2014),[6] Jamaica (ORS usage was 67% in 2011),[6] Honduras (ORS usage was 60% in 2011-2012),[6] and Myanmar (ORS usage was 62% in 2015-2016),[23] ORS usage rate is still low in India. A cross-sectional survey among parents of children under 5 years of age in Douala, Cameroon, showed that the usage of ORS is statistically significantly associated with parent's educational level, the age of the child and the sequential number of children in the household.[24] Similarly, several studies conducted in India, Pakistan, Northwest Ethiopia, Southern Nigeria and Malaysia showed that ORS usage is statistically significantly associated with mothers' educational level.[25–29] Surveys conducted in India and Kenya showed that there were 62% and 65% of antibiotics usage and 29% and 23% of ORS usage during treatment of diarrhea in Kenya and India respectively. Even though caregivers had positive perception of ORS, they preferred antibiotics during the treatment.[30] A Knowledge, Attitude and Practice (KAP) survey conducted in Pakistan showed that mothers' knowledge on ORS was statistically significantly associated with the practice of ORS usage during a diarrheal episode in a child.[31] A household survey conducted in suburban West African community showed that ORS usage was related to the knowledge on ORS.[32] A study conducted in developing countries showed that about 60% of children less than 5 years of age with diarrhea who sought treatment from health provider. Among them only 40% of children with diarrhea

under 5 years of age were treated with ORS.[33] A study conducted in Egypt and Sub-Saharan Africa showed that children less than 5 years of age who sought advice or treatment from public clinics were more likely to receive ORS when compared to those who received treatment from private clinics or pharmacies.[34,35] A study conducted in Arba Minch District, Southern Ethiopia found that youngest children are more susceptible to diarrheal disease.[36] Studies conducted in Ratmalana, Colombo and urban slum of Rajahmundry, Andhra Pradesh showed that the main sources of information about ORS are electronic media, television, and radio.[37,38]

A cross-sectional survey conducted in Bangladesh, assessing the gap in diarrheal management for children less than 5 years of age, found that child's gender, household income status and urban/rural residence of the household were associated with the ORS usage.[39] Similarly, a study conducted in Pakistan using Demographic Health Survey (DHS) dataset (2012 – 2013) found that socio-economic status and maternal education were associated with ORS usage. Urban/rural residence of the household was not statistically significantly associated with ORS usage.[26] A survey conducted in rural Bangladesh investigating the determinants of ORS usage during diarrhea treatment showed that age of the child, type of diarrhea and maternal education were associated with ORS usage. Mothers used ORS more during watery stool than bloody stool.[40] A Family Planning Survey and National Maternal-Child Health conducted in Honduras to determine the various demographic factors that influence mothers' treatment for diarrhea showed that only age of the child and mother's education were associated with the ORS usage during diarrheal treatment for children less than 5 years of age.[41]

National Family Health survey (NFHS-3, 2005-06) is the third national household survey in India. A study conducted in India using NFHS-3 data found that age of the mother, maternal education, religion, and socio-economic status of the family were associated with the ORS usage

during diarrhea treatment for children aged less than 5 years of age.[42] Hence, based on the literature review, the main factors associated with ORS usage during diarrhea home treatment of under-5 children were maternal education, age of the mother and the child, child's gender, sequential number of child in the household, type of diarrhea, socio-economic status of the family, urban/rural residence of the household, seeking care from public/private/other facility, mothers' knowledge on ORS and religion.

However, there are no recent national level studies on the factors that predict the maternal use of ORS during diarrheal treatment for children aged less than 5 years in India other than the one conducted based on NFHS-3 reflecting the situation of more than 10 years ago. As the determinants of ORS usage might have changed since the last study conducted using NFHS-3 data, the current study will provide updated results on the issue and a better understanding about the current situation.

***Oral Rehydration Therapy (ORT) program in India***

In 1978, the Diarrheal Disease Control Program was started in India. The objective of the program was to decrease the morbidity and mortality caused by diarrheal disease. Following the Diarrheal Disease Control Program, in 1985 – 1986, the National Oral Rehydration Therapy (NORT) program was launched. The main objective of the program was to make ORS available at the health facilities and in communities. This program also focused on diarrhea management in children less than 5 years of age and on enhancing the use of home available fluids, ORS, and continued feeding by improving mothers' knowledge. In 1992, NORT program became a part of the Child Survival and Safe Motherhood (CSSM) Program.[43,44] This program focused on "national and state level estimates of fertility, infant and child mortality, family planning practices, maternal and child health, and usage of services available to mothers and children".[45]

CSSM program promoted the use of ORT and Recommended Home Solution (RHS) through mass media. Correct management of diarrhea was a major part of the CSSM program. In 1997 – 1998, Reproductive and Child Health (RCH) program was launched by the Government of India. This program was launched to fulfill the needs which were unmet by Family Welfare Services. Every year, ORS was delivered to all sub-centers in the country by RCH program.[45]

Integrated Management of Childhood Illness (IMCI) strategy was introduced by WHO and United Nations Children's Fund (UNICEF) in 1995, and since then, more than 100 countries have implemented IMCI.[46] The main goal of the IMCI strategy has been to manage and prevent 5 childhood diseases ("acute respiratory infections, diarrhea, measles, malaria, and malnutrition").[45] In order to improve the health of the children, the Government of India introduced the IMCI in the country. A modified version of IMCI guidelines were created for India. IMCI was renamed as Integrated Management of Neonatal and Childhood Illnesses (IMNCI).[45]

Evaluation of the RCH program in India was done by comparing pre- and post-1998 period. To evaluate the pre-1998 period of the RCH program, NFHS-1 (1992 – 1993) and NFHS-2 data were used. To evaluate the post-1998 period of the RCH program, NFHS–2 and 3 data were used. Indicators which were available for all the three surveys were used for this evaluation study. The proportion of children with diarrhea who received ORS during NFHS-1 (1992 – 1993) increased from 17.9% to 26.9% during NFHS-2 (1998 – 1999). During the pre-1998 period the annual percentage change was about 1.52 points. The proportion of children with diarrhea who received ORS during NFHS-3 (2005 – 2006) was 26.2%. Hence, the proportion of children with diarrhea who received ORS has not been increased during post-1998 period. This implies that ORS usage was not successfully implemented by RCH program.[47]

### *National Family Health Survey (NFHS-4)*

NFHS-4 (2015 – 2016) is the fourth national household health survey in the series. It was conducted under the leadership of the Ministry of Health and Family Welfare, Indian Government, with the International Institute for Population Sciences, Mumbai. The collected data covered selected characteristics of the population of India, including their health and nutrition at the national level, state level (29 states), district level (640 districts), and 6 union territories. Nationwide representative samples of 601,509 households, 699,686 women aged 15 – 49 years, and 112,122 men aged 15 – 54 years were drawn during the survey. The survey included 243,841 children aged less than 5 years of age based on the household information. Three different questionnaires were used for NFHS-4 survey including the household questionnaire, the women questionnaire, and the men questionnaire. Data on the usage of ORS during the treatment of diarrhea in children aged less than 5 years old were collected from their mothers and covered the period of two weeks before the survey.[21]

### *Aim*

The purpose of this study is to find the determinants of ORS usage during diarrheal episode in children less than 5 years of age in India. This study findings can guide public health practitioners in developing strategies to increase the ORS usage.

### *Research questions*

1. What are the determinants of ORS usage for home treatment of under 5 children with diarrhea?
2. Is there an association between the type of diarrhea (bloody or non-bloody) and the usage of ORS for diarrhea treatment in children less than 5 years of age?

## METHODS

Using the NFHS-4 (2015 – 2016) data, secondary data analysis was conducted. "Household questionnaire"[48] and "Women questionnaire"[49] was used to abstract socio-demographic information of the household and child health information (for the youngest child in the family) for children born within 5 years before the survey.

### *Target population*

Youngest children in the families, aged less than 5 years who were involved in the NFHS-4 survey were the target population for this study. The rationale for selecting the youngest child was: as a women can have more than one child aged under 5, this would have introduced a bias by including in the analysis the same women many times.

### *Inclusion criteria*

- Children aged 0 – 59 months (less than 5 years)
- The youngest child in the family
- Child with reported diarrhea during the last two weeks before the survey

### *Outcome variable*

- Usage of ORS during diarrhea home treatment for children aged less than 5 years of age, for those who reported diarrhea during the last two weeks before the survey

### *Independent variables*

*Type of diarrhea*

A study showed that ORS usage is twice high when the child has watery stool when compared to bloody stool. ORS usage during bloody stool is less, may be due to parents' uncertainty about the cause of the disease.[40,50]

*Seeking care from public/private/other facility*

A study conducted in India using NFHS-3 data showed that mothers of children less than 5 years of age who sought advice or treatment from public health facilities were more likely to receive ORS when compared to those who received treatment from private health facilities.[42,51]

*Mothers' awareness of ORS*

Studies conducted in Jos, Plateau state and Nigeria showed that mothers' knowledge about ORS was statistically significantly associated with ORS usage.[52,53] ORS usage is high among mothers' who have knowledge about ORS when compared to those who do not have knowledge.

*Exposure to media*

A study conducted in Andhra Pradesh and Colombo showed that media was considered as the main source of information on ORS usage during diarrheal episode.[37,38] A meta-analysis showed that ORS usage during diarrhea episode was higher among mothers of children under 5 when they are exposed to mass media when compared to mothers who were not exposed.[54]

*Age of the mother*

NFHS survey includes women aged 15 – 49 years. A study conducted in Jos, Plateau state showed that age of the mother is statistically significantly associated with the ORS usage during diarrheal treatment. ORS usage is better among 21 – 30 and 31 – 40 years old mothers.[52] A Knowledge, Attitude and Practice survey conducted in Gambia showed that maternal age was significantly associated with the ORS usage.[55]

*Age of the child*

A survey conducted in Bangladesh showed that ORS usage is low among children aged less than 7 months. Mothers of children aged less than 7 months stated that, only breast milk should be given before this age and the water and other fluids should be introduced after this age.[40] A study conducted in Cameroon showed that the ORS usage rate was high among the parents of child with higher age when compared to the child with lower age.[24]

*Sex of the child*

A study conducted in India showed that the odds of experiencing a delay in seeking treatment among male children was lower when compared to female children.[56]

*Sequential number of child in the family*

Studies conducted in Cameroon and Western China showed that the ORS usage during diarrheal episode in home-base care were less among caretakers who have more than one child. It was also reported that the usage of ORS in home-base care was less likely among the younger child of the family.[57] However, a study conducted in Cameroon showed an opposite trend that the ORS usage during diarrheal episode were high among parents who have more than one child [24]

*Residence of the household*

The residence of the household was defined as rural or urban. Small towns, large towns, small cities, large cities, and mega cities all were considered as urban. A study conducted in Nigeria and Pakistan showed that residence of the household is associated with the usage of ORS during diarrheal treatment.[26,58] ORS usage was higher among urban mothers when compared to rural mothers.

*Mother's education*

A study in Cameroon and Pakistan showed that the usage of ORS is statistically significantly associated with mothers' educational level. ORS usage was high among mothers' who had a higher level of education when compared to the mothers, who had a lower level of education.[24,26]

*Wealth index*

Several studies conducted in Pakistan, South Nigeria and Bankura showed that socio-economic status was statistically significantly associated with the usage of the ORS during diarrheal treatment.[26,59,60] ORS usage was lower among the households with low wealth index when compared to those with high wealth index status.

*Use of antibiotics*

In India antibiotics are most commonly used for the treatment of diarrhea, even though WHO and Indian Organizations do not recommend the use of antibiotics during diarrheal episode.[61,62] A meta-analysis study showed that antibiotic use was associated with the ORS use.[63] According to NFHS-3 report, the use of antibiotics was high among educated mothers and mothers belonging to high socio-economic groups.[64]

*Religion*

The religion of the household was reported as Hindu, Muslim, Christian, Sikh, Buddhist/Neo-Buddhist, Jain, Jewish, Parsi/Zoroastrian and no religion. According to NFHS-3 report, the use of ORS was lower among Hindu and Muslim mothers when compared to mothers of other religions.[64] A study conducted in India using NFHS-3 data showed that religion was statistically significantly associated with the usage of the ORS during diarrheal episode.[42]

*Caste of the household*

Caste of the household was defined as Other Backward Class, Scheduled Tribe, and Scheduled Caste. A study conducted in India using NFHS-3 data found that anemia among children aged less than 5 years of age was statistically significantly associated with the caste of the household.[65] Similarly, this study can find an association between the caste of the household and the ORS usage.

Database guide was created by extracting the questions required for the study (appropriate to the dependent, independent and intervening variables) from the questionnaire used for the NFHS-4 survey, to make the extraction of the needed data from the original database easier.

***Data analysis***

NFHS-4 (2014 – 2015) dataset was used to answer the specific research questions. Data analysis was done using SPSS-22 statistical software. Table 1 describes the variables used in the study. For the outcome (dichotomous) and categorical independent variables, frequencies and proportions were obtained to present their distributions. To summarize the distribution of continuous independent variables, their means and standard deviations were estimated. To evaluate any significant differences in the distribution of categorical variables and continuous variables across the ORS users vs. non-users (outcome variable) we used chi-square test and t-test. Since the outcome variable was dichotomous, data was analyzed using logistic regression. For categorical variables with more than two categories, dummy variables were created. On the log odds scale, linear relationship between the continuous variable and the dependent variable was checked.

For the first research question, all the variables that were different between the groups at the level of significance $P<0.25$ in descriptive analysis were included into logistic regression analysis, first, one by one (univariate), then together (multivariable) – adding the variables to the

model manually and removing insignificant ones by using the level of significance $P<0.05$ with 95% CI. Effect size was applied to odds ratios to keep in the final model only those predictors that tangibly change the odds of the outcome (ORS usage during diarrheal treatment among children less than 5 years of age). Only those categorical variables altering the odds of the outcome by 5% or more ($OR \geq 1.05$ or $OR \leq 0.95$) were included in the final multivariable logistic regression model. Continuous variables were evaluated on an individual basis.

For the second research question, confounders of the association between dependent variable (ORS usage) and independent variable (type of diarrhea) were identified through testing association of all study variables (covariates) with the dependent variables. Variables significantly associated with the dependent variable were further evaluated for their association with the independent variable (type of diarrhea) using series of univariate logistic regression models while applying the conventional significance level of $P<0.05$. Those variables significantly associated with both dependent variable and independent variable of interest was considered as the confounding variables. Then, the association between ORS usage and type of diarrhea (bloody or non-bloody) was measured in a multivariable model controlling for all the identified confounders. Only those confounders that change the odds of the association between ORS usage and type of diarrhea by 10% or more were included in the final adjusted model.

## ETHICAL CONSIDERATIONS

The study protocol was reviewed by the Institutional Review Board of the American University of Armenia. The database used in this study was available to the public and it does not contain any recognizable credentials about the participants. The study did not pose any risk for participants.

## RESULTS

After limiting the original NFHS-4 dataset to the eligible population, a total of 19,060 youngest children in the family with reported diarrhea during the last two weeks before the survey were identified and included in the analysis. Among them, 54.8% were male and 45.2% were female children.

The rate of ORS usage during diarrheal episode among this sample of children was 50.6%. Table 2 provides information about the ORS usage rates during child's diarrheal episode across the States of India. In Uttar Pradesh the ORS usage rate was the lowest - 38.1%, whereas in Odisha the ORS usage rate was the highest - 68.9%.

### *Descriptive analysis*

Out of 16 variables, only age of the mother was not statistically significantly associated with the ORS usage (P=0.591, Table 3).

ORS was more frequently used in the group of children aged 24-59 months, followed by those in the age group of 6-24 months, while in the youngest age group (0-5.9 months of age) ORS usage was less frequent (P<0.001). ORS usage was high among male child than female child (P=0.015). Mothers with secondary or higher education used ORS during their child's diarrhea episode more often than mothers with no or primary education (P<0.001). Among rural resident the usage of ORS was lower as compared to the urban residents (P<0.001). When comparing the household wealth index, ORS usage was high in the richest wealth index households when compared to the poorest wealth index households (P<0.001). ORS usage was low among Hindus or Muslims when compared to all other religions (P<0.001). ORS was more frequently used among non-backward caste when compared to backward castes of the household (P<0.001).

ORS usage was high among mothers' who exposed to mass media as compared to mothers' who did not exposed to mass media (P<0.001). ORS usage was lower among younger children of the family (P<0.001). ORS was more frequently used during bloody diarrhea than during non-bloody diarrhea (P<0.001). Children seeking care from public health or private healthcare facilities were more likely to use ORS when compared to those who did not seek care from any healthcare facility or did not seek care at all (P<0.001). ORS usage was high among those who had antibiotics when compared to those who did not had antibiotics (P<0.001). Children who had much less amount of liquid and food during diarrhea were more likely to use ORS (P<0.001). ORS usage was high among children who had zinc when compared to those who did not had zinc (P<0.01). ORS usage was higher among mothers, who had heard of ORS when compared to those who did not hear about ORS (P<0.001) (see Table 3).

***Predictors of ORS usage in children aged under 5 with diarrhea***

Table 4 presents the univariate logistic regression analysis between the covariates and ORS usage among the youngest children aged under 5. All the variables that were statistically significantly associated with ORS usage in the descriptive analysis were also significant in the univariate logistic regression model.

Table 5 shows the predictive multivariable logistic regression model of ORS usage for children less than 5 years of age with diarrhea. This model includes 12 predictors for ORS usage: age of the child, mothers' education, residence of the household, wealth index, religion, caste of the household, sequential number of child in the family, type of diarrhea, exposure to mass media, seeking care, amount of food given to the child during diarrhea, and use of zinc.

According to the final model, the odds of ORS use was 61% and 14% lower among children aged from 0 to 5.9 months and from 6 to 24 months, respectively, when compared to children

aged 24 to 59 months. Mothers' with secondary or higher education had 10% higher odds of ORS usage as compared to mothers' with primary or no education. Odds of ORS usage among rural residents was 14% lower than urban residents. Children living in households with high wealth index had 20% higher odds of receiving ORS than those living in households with poor or middle wealth index. Hindu or Muslim households had 33% lower odds of ORS usage when compared to other religion. ORS usage among other backward caste, Scheduled Tribe, or Scheduled tribe households was 12% lower than other castes. Each increase in sequential number of child in the family was associated with 5% lower odds of ORS usage. Mothers exposed to mass media had 31% higher odds of ORS usage as compared to the mothers not exposed to mass media. Children with bloody diarrhea had 28% higher odds of receiving ORS as compared to the children with non-bloody diarrhea. The odds of ORS usage was 337% higher among children whose families sought treatment from a public health facility, and 124% higher among those who sought treatment from a private health facility when compared to those who sought treatment from other (non-medical) sources or did not seek any treatment. The odds of ORS usage was 11% lower among children who had about the same or more than usual amount of food during diarrhea when compared to children who had less than usual amount of food during diarrhea. The odds of ORS usage was 168% higher among children who were given zinc when compared to those who were not. Hosmer-Lemeshow goodness-of-fit test of the fitted model was insignificant (P=0.100), indicating acceptable model fit. Variance Inflation Factor (VIF) was less than 1.5, indicating no collinearity issue between the variables.

***Association between the type of diarrhea and the usage of ORS for diarrhea treatment in children less than 5 years of age***

*Testing for confounders*

Table 6 shows the results of univariate logistic regression analysis between the covariates and the type of diarrhea among the study population.

Only those covariates which were statistically significantly related to both the outcome variable (ORS usage) and the independent variable of interest (type of diarrhea) at the level of significance $P<0.05$ were considered as a confounder. Based on the results demonstrated in tables 4 and 6, confounding variables were mother's exposure to mass media, residence of the household, wealth index, mothers' education, place of seeking care, caste of the household, amount of food given to the child during diarrhea, use of zinc for the diarrhea treatment, age of the child, and sequential number of child in the family.

*Controlled association of interest*

Table 7 shows the association between the dependent and independent variables, after adjusting for all the identified confounders in a multivariable logistic regression analysis.

After adjusting for all the confounders, type of diarrhea (bloody and non-bloody) was statistically significantly associated with the ORS usage during diarrhea treatment in children less than 5 years of age ($P <0.001$). The odds of ORS usage was 27% higher among children with bloody type of diarrhea as compared to the children with non-bloody diarrhea.

## DISCUSSION

### *Predictors of maternal use of ORS*

The identified predictors for the maternal use of ORS during diarrhea home treatment for children under 5 were older age of the child, mothers' higher education, urban residence of the household, other than Hindu or Muslim religion, other than backward caste of the household, higher wealth index, lower sequential number of the child in the family, higher exposure to mass

media, bloody type of diarrhea, seeking care from public or private healthcare settings, adequate (same or more than usually) amount of food given to eat, and use of zinc. After controlling for confounders, ORS usage rate was higher among children with bloody diarrhea when compared to children with non-bloody diarrhea, which is inconsistent with previous studies.[40,50]

In a similar study results with the study conducted in India based on NFHS-3 data, a narrower set of predictors of ORS usage was found: mothers' education, exposure to mass media, seeking care from public health facility, and wealth index were the determinants for the maternal use of ORS during diarrheal treatment for children under 5.

Our study findings demonstrate that various factors can significantly affect the ORS usage during a diarrheal episode. Even though all the mothers of children aged under 5 had awareness about ORS, only 50.6% had used ORS during diarrhea episodes in India. This result was comparable with the study conducted in Iran where 79% of mothers had awareness about ORS but only 19% of them had used ORS.[66] In our study, ORS usage was lower among younger age group (0 to 6 month), which was consistent with the studies conducted in Cameroon[24] and Bangladesh.[40] We found that higher level of mothers' education was positively correlated with the ORS usage. The same result was observed in the studies conducted in Cameroon, Urban slum of Delhi, Pakistan, Northwest Ethiopia, Vietnam, Nepal, and Czech.[67–69] Unlike this, studies conducted in Eastern Ethiopia and Nigeria found that mothers' education was not associated with the ORS usage.[70,71] Among rural resident the usage of ORS was lower as compared to the urban residents, which was consistent with the studies conducted in Bangladesh, Nigeria, and Haiti.[39,71,72] Studies conducted in Pakistan and Eastern Ethiopia indicated that residence of the household was not significantly associated with the ORS usage.[26,70] ORS usage was high among children living in households with high wealth index as compared to the

children living in poor or middle wealth index. The same result was observed in studies conducted in Bankura and Haiti.[60,72] Unlike this, a study conducted in Eastern Ethiopia showed that wealth index of the household was not associated with the ORS usage.[70] In our study, ORS usage was high among children with bloody diarrhea when compared to the children with non-bloody diarrhea, which was consistent with a study conducted in Honduras.[41] Unlike this, studies conducted in Bangladesh and Indonesia found higher usage of ORS among children with non-bloody diarrhea.[40,50] We found that ORS usage was high among children whose families sought treatment from a public health facility or private health facility when compared to other (non-medical) sources or nowhere, which was consistent with the studies conducted in India, Sub-Saharan Africa, and Eastern Ethiopia.[35,51,70] ORS usage during diarrhea episode was higher among mothers of children under 5 who were exposed to mass media when compared to mothers who were not exposed. This finding was consistent with a meta-analysis study and a study conducted in India.[54,73] The lower was the sequential number of the child in the family, the higher was ORS usage. This result was consistent with the other studies conducted in Western China.[57] However, a study conducted in Cameroon showed an opposite trend.[24] Religion of the household was statistically significantly associated with the ORS usage. Unlike this, a study conducted in India and Nigeria found that religion was not associated with ORS usage.[42,71] We found that caste of the household was associated with ORS usage. Another study conducted in India found a relation between anemia among children aged less than 5 years of age and the caste of the household (risk of having anemia was highest among Scheduled caste, high among Scheduled tribe and high among other backward class when compared to other caste).[65] We could not find other studies suggesting an association between ORS usage and the caste of the household, the use of zinc and the amount of food given to the child during diarrhea.

Age of the mother was not statistically significantly associated with the ORS usage. This finding was consistent with studies conducted in Eastern Ethiopia and Nigeria.[70,71] However, this finding was inconsistent with studies conducted in Honduras and Jos, Plateau, which found a positive association between mother's age and the ORS usage.[41,52] We found that the use of antibiotics was not statistically significantly associated with the ORS usage, which was inconsistent with a meta-analysis study.[63] Sex of the child was not statistically significantly associated with the ORS usage. This finding was also inconsistent with studies conducted in Bangladesh and India.[39,56]

***Association with type of diarrhea (bloody and non-bloody diarrhea)***

This study yielded statistically significant association between type of diarrhea and ORS usage after adjusting for all the confounding variables. The ORS usage was high among children with bloody diarrhea when compared to children with non-bloody diarrhea. This result was consistent with studies conducted in Bangladesh and Honduras.[39,41] However, an opposite trend was found in studies conducted in Bangladesh and Indonesia – higher usage of ORS among children with non-bloody diarrhea.[40,50]

***Strengths of the study***

NFHS-4 survey is a nationally representative sampling of the households providing nationally representative data. The analysis was done using weighted sample to ensure the representativeness of the data.

***Limitations of the study***

Statistical approach shows only statistical significance but not clinical significance. There was no data available on the length and/or severity of the diarrhea episode. Misclassification bias

could have place as the study was conducted at one point and some of children with diarrhea might have eventually received ORS (after the interview was conducted). There was no information on the factors that make private health facilities to provide ORS during diarrheal episode less than public facilities do. Possible factors underlying this findings could be lower availability of ORS, poor knowledge among providers in private health facilities, and profit seeking behavior. The data was collected using cross-sectional survey, therefore the study is limited in finding any causal relationship. Recall bias might be an issue because collecting the data on ORS usage retrospectively.

***Recommendations***

The ORS usage rate was low even though mothers had awareness about ORS. Therefore, further research should investigate the barriers to ORS use among children under 5 during diarrheal episode. Further research should be focused on factors underlying the difference in ORS usage between public and private health facilities. There could be different factors across the states of India that predicts the ORS usage. Therefore, further research should also investigate the differences in the sets of factors that predicts the ORS usage in states in India with higher and lower ORS usage rates.

Public health interventions on importance of ORS usage for preventing dehydration should specifically target rural residents, population groups with lower wealth index, lower education, Hindu and Muslim religion, and Scheduled caste/Scheduled tribe/other backward classes. Health education activities should also cover proper feeding practices, increasing fluid consumption during diarrheal episode and evidence-based approaches of diarrhea treatment. This can be achieved through health campaigns, mass media and during hospital consultations.

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## APPENDIX

***Table 1: Study variables***

| Variable | Type | Measure |
|---|---|---|
| **Dependent variable** | | |
| Usage of ORS | Binary | 0 = No<br>1 = Yes |
| **Independent variables** | | |
| Type of diarrhea | Nominal | 0 = Bloody<br>1 = Non-bloody |
| Seeking care from the health facility | Nominal | 1 = Public health facility<br>2 = Private health facility<br>3 = Other/nowhere |
| Mothers' awareness of ORS | Binary | 0 = No<br>1 = Yes |
| Exposure to mass media* | Binary | 0 = No<br>1 = Yes |
| Sequential number of child in the family | Numeric (continuous) | 1,2,3,etc. |
| Age of the mother | Numeric (continuous) | Years |
| Age of the child (months) | Nominal | 1 = 0 to 5.9 month<br>2 = 6 to 24 month<br>3 = *24 to 59 month* |
| Gender of the child | Nominal | 0 = Male<br>1 = Female |
| Residence of the household | Nominal | 0 = Urban<br>1 = Rural |
| Mothers' education | Nominal | 0 = No education or primary<br>1 = Secondary or higher |
| Wealth index | Ordinal | 0 = Poor or middle<br>1 = High |
| Use of antibiotics | Binary | 0 = No<br>1 = Yes |
| Religion | Nominal | 1 = Hindu or Muslim<br>0 = Other |
| Caste of the household | Binary | 1 = Scheduled caste, scheduled tribe, or other backward class<br>0 = None of them |

*Responses to the items measuring the exposure to radio, television, and newspaper/magazine was considered as "yes" if the participant reported having exposure almost every day/at least once a week/less than once a week and "no" if the participant reported no exposure at all. Then all the three variables was combined together and the participant was considered as being exposed to media, if the participant's response was assessed as "yes" to at least one of the three questions; otherwise she was considered as not exposed to media.[73]

| Variable | Type | Measure |
|---|---|---|
| Amount of liquids given to the child during diarrhea | Binary | 1 = About the same or more<br>0 = Less than usually |
| Amount of food given to the child during diarrhea | Binary | 1 = About the same or more<br>0 = Less than usually |

***Table 2: ORS usage (during diarrheal episode) rate among children under 5 by States of India based on NFHS-4 data (2015-16)*[*]***

| State/Union Territory | ORS non-user | | ORS user | |
|---|---|---|---|---|
| | *Frequency (n)* | *Percentage (%)* | *Frequency (n)* | *Percentage (%)* |
| **India** | 9406 | 49.4 | 9621 | 50.6 |
| **North** | | | | |
| *Delhi* | 101 | 39.1 | 157 | 60.9 |
| *Haryana* | 143 | 39.1 | 223 | 60.9 |
| *Punjab* | 85 | 35.7 | 153 | 64.3 |
| *Rajasthan* | 416 | 45.0 | 509 | 55.0 |
| *Uttarakhand* | 118 | 43.2 | 155 | 56.8 |
| *Assam* | 72 | 46.8 | 82 | 53.2 |
| *Other states* | 120 | 33.4 | 239 | 66.6 |
| **Central** | | | | |
| *Chhattisgarh* | 154 | 33.9 | 300 | 66.1 |
| *Madhya Pradesh* | 599 | 45.0 | 733 | 55.0 |
| *Uttar Pradesh* | 3264 | 61.9 | 2011 | 38.1 |
| **East** | | | | |
| *Bihar* | 1400 | 54.9 | 1151 | 45.1 |
| *Jharkhand* | 242 | 56.5 | 186 | 43.5 |
| *Odisha* | 220 | 31.1 | 488 | 68.9 |
| *West Bengal* | 311 | 35.7 | 561 | 64.3 |
| **West** | | | | |
| *Gujarat* | 427 | 54.3 | 360 | 45.7 |
| *Maharashtra* | 606 | 38.8 | 957 | 61.2 |
| **South** | | | | |
| *Andhra Pradesh* | 270 | 52.6 | 243 | 47.4 |
| *Karnataka* | 182 | 47.9 | 198 | 52.1 |
| *Kerala* | 71 | 52.6 | 64 | 47.4 |
| *Tamil Nadu* | 370 | 40.1 | 552 | 59.9 |
| *Telangana* | 225 | 44.9 | 276 | 55.1 |

[*] Union Territories (Andaman and Nicobar Islands, Chandigarh, Lakshadweep, Dadra and Nagar Haveli, Daman and Diu, and Puducherry) and the State of Goa were not included in the table because of very small number of under five children with diarrhea sampled from these territories.

***Table 3: Descriptive analysis for categorical and continuous variables (using Chi-square test and ANOVA test) across the two levels of outcome (ORS users vs. non-users) among the youngest children aged under 5 India***

| Variables | ORS non-user | | ORS user | | P-value | Total | |
|---|---|---|---|---|---|---|---|
| | *Number (n)* | *Percentage (%)* | *Number (n)* | *Percentage (%)* | | *Number (n)* | *Percentage (%)* |
| **Age of the child** | | | | | | | |
| *0 to 5.9 month* | 2034 | 21.6 | 1001 | 10.4 | | 3035 | 15.9 |
| *6 to 24 month* | 4682 | 49.8 | 5172 | 53.8 | <0.001 | 9854 | 51.8 |
| *24 to 59 month* | 2691 | 28.6 | 3449 | 35.8 | | 6140 | 32.3 |
| **Sex of the child** | | | | | | | |
| *Male* | 5065 | 53.8 | 5350 | 55.6 | 0.015 | 10415 | 54.7 |
| *Female* | 4341 | 46.2 | 4271 | 44.4 | | 8612 | 45.3 |
| **Mothers' education** | | | | | | | |
| *No education* | 3151 | 33.5 | 2415 | 25.1 | | 5566 | 29.3 |
| *Primary* | 1487 | 15.8 | 1358 | 14.1 | <0.001 | 2845 | 15.0 |
| *Secondary* | 4023 | 42.8 | 4703 | 48.9 | | 8726 | 45.9 |
| *Higher* | 744 | 7.9 | 1146 | 11.9 | | 1890 | 9.9 |
| **Residence of the household** | | | | | | | |
| *Urban* | 2083 | 22.1 | 2918 | 30.3 | <0.001 | 5001 | 26.3 |
| *Rural* | 7323 | 77.9 | 6703 | 69.7 | | 14026 | 73.7 |
| **Wealth Index** | | | | | | | |
| *Poorest* | 2817 | 29.9 | 2206 | 22.9 | | 5023 | 26.4 |
| *Poorer* | 2227 | 23.7 | 1975 | 20.5 | | 4202 | 22.1 |
| *Middle* | 1916 | 20.4 | 1975 | 20.5 | <0.001 | 3891 | 20.4 |
| *Richer* | 1430 | 15.2 | 1895 | 19.7 | | 3325 | 17.5 |
| *Richest* | 1016 | 10.8 | 1570 | 16.3 | | 2586 | 13.6 |
| **Religion of the household** | | | | | | | |
| *Hindu* | 7382 | 78.5 | 7449 | 77.4 | | 14831 | 77.9 |
| *Muslim* | 1747 | 18.6 | 1675 | 17.4 | <0.001 | 3422 | 18.0 |
| *Christian* | 138 | 1.5 | 163 | 1.7 | | 301 | 1.6 |
| *Others* | 140 | 1.5 | 335 | 3.5 | | 475 | 2.5 |

| Variables | ORS non-user | | ORS user | | P-value | Total | |
|---|---|---|---|---|---|---|---|
| | *Number (n)* | *Percentage (%)* | *Number (n)* | *Percentage (%)* | | *Number (n)* | *Percentage (%)* |
| **Caste of the household** | | | | | | | |
| *Scheduled caste* | 2109 | 23.1 | 2172 | 23.4 | | 4281 | 23.2 |
| *Scheduled tribe* | 770 | 8.4 | 989 | 10.6 | <0.001 | 1759 | 9.6 |
| *Other backward* | 4539 | 49.7 | 4099 | 44.1 | | 8638 | 46.9 |
| *None of them* | 1707 | 18.7 | 2030 | 21.9 | | 3737 | 20.3 |
| **Exposure to mass media** | | | | | | | |
| *No* | 3151 | 33.5 | 2112 | 22.0 | <0.001 | 5263 | 27.7 |
| Yes | 6255 | 66.5 | 7509 | 78.0 | | 13764 | 72.3 |
| **Type of diarrhea** | | | | | | | |
| *Non-bloody* | 8675 | 92.3 | 8582 | 89.2 | <0.001 | 17257 | 90.7 |
| *Bloody* | 726 | 7.7 | 1039 | 10.8 | | 1765 | 9.3 |
| **Seeking care** | | | | | | | |
| *Yes, from public health facility* | 1057 | 11.2 | 2572 | 26.7 | | 3629 | 19.1 |
| *Yes, from private health facility* | 4795 | 51.0 | 5488 | 57.0 | <0.001 | 10283 | 54.0 |
| *Other/nowhere* | 3555 | 37.8 | 1562 | 16.2 | | 5117 | 26.9 |
| **Use of antibiotics** | | | | | | | |
| *No* | 7633 | 81.8 | 7525 | 79.1 | <0.001 | 15158 | 80.5 |
| *Yes* | 1693 | 18.2 | 1985 | 20.9 | | 3678 | 19.5 |
| **Amount of liquids given to the child during diarrhea** | | | | | | | |
| *Nothing to drink* | 615 | 6.6 | 378 | 3.9 | | 993 | 5.2 |
| *Much less* | 1736 | 18.6 | 2262 | 23.6 | | 3998 | 21.1 |
| *Somewhat less* | 3312 | 35.4 | 3498 | 36.5 | <0.001 | 6810 | 36.0 |
| *About the same* | 3124 | 33.4 | 2749 | 28.7 | | 5873 | 31.0 |
| *More* | 558 | 6.0 | 696 | 7.3 | | 1254 | 6.6 |
| **Amount of food given to the child during diarrhea** | | | | | | | |
| *Stopped food* | 1639 | 17.6 | 1058 | 11.0 | | 2697 | 14.3 |
| *Much less* | 1651 | 17.7 | 2207 | 23.0 | | 3858 | 20.4 |
| *Somewhat less* | 3098 | 33.3 | 3551 | 37.1 | <0.001 | 6649 | 35.2 |
| *About the same* | 2542 | 27.3 | 2404 | 25.1 | | 4946 | 26.2 |
| *More* | 386 | 4.1 | 357 | 3.7 | | 743 | 3.9 |

| Variables | ORS non-user | | ORS user | | P-value | Total | |
|---|---|---|---|---|---|---|---|
| | *Number (n)* | *Percentage (%)* | *Number (n)* | *Percentage (%)* | | *Number (n)* | *Percentage (%)* |
| **Use of zinc** | | | | | | | |
| *No* | 8143 | 88.6 | 6454 | 69.8 | <0.001 | 14597 | 79.2 |
| *Yes* | 1044 | 11.4 | 2786 | 30.2 | | 3830 | 20.8 |
| **Mothers' awareness of ORS** | | | | | | | |
| *Never heard of ORS* | 2311 | 24.6 | 0 | 0.0 | <0.001 | 2311 | 12.1 |
| *Heard of ORS* | 7095 | 75.4 | 9621 | 100.0 | | 16716 | 87.9 |
| | *Mean* | SD | *Mean* | *SD* | | *Mean* | *SD* |
| **Age of the mother** *(years),* n = 19028 | 26.7 | 5.1 | 26.7 | 4.9 | 0.591 | 26.7 | 4.9 |
| **Sequential number of child in the family,** n = 19028 | 2.3 | 1.4 | 2.1 | 1.2 | <0.001 | 2.2 | 1.3 |

***Table 4: Univariate logistic regression between independent variables and ORS usage during diarrheal treatment among the youngest children aged under 5 as a dependent variable***

| Variables | Odds ratio | Confidence Interval | | P-value |
|---|---|---|---|---|
| | | *Lower* | *Upper* | |
| **Age of the child** | | | | |
| *0 to 5.9 month* | 0.38 | 0.35 | 0.42 | <0.001 |
| *6 to 24 month* | 0.86 | 0.81 | 0.92 | <0.001 |
| *24 to 59 month* | 1 | Reference | | |
| **Sex of the child** | | | | |
| *Female* | 0.93 | 0.88 | 0.99 | 0.015 |
| *Male* | 1 | Reference | | |
| **Age of the mother (years)** | 1.0 | 0.99 | 1.01 | 0.591 |
| **Mothers' education** | | | | |
| *Secondary or higher education* | 1.51 | 1.42 | 1.59 | <0.001 |
| *No education or primary* | 1 | Reference | | |
| **Residence of the household** | | | | |
| *Rural* | 0.65 | 0.61 | 0.69 | <0.001 |
| *Urban* | 1 | Reference | | |
| **Wealth Index** | | | | |
| *High* | 1.60 | 1.51 | 1.70 | <0.001 |
| *Poor or middle* | 1 | Reference | | |
| **Religion** | | | | |
| *Hindu or Muslim* | 0.56 | 0.48 | 0.65 | <0.001 |
| *Other* | 1 | Reference | | |
| **Caste of the household** | | | | |
| *Scheduled caste, Scheduled tribe, or other backward class* | 0.82 | 0.77 | 0.88 | <0.001 |
| *None of them* | 1 | Reference | | |
| **Sequential number of child in the family** | 0.90 | 0.88 | 0.92 | <0.001 |
| **Exposure to mass media** | | | | |
| *Yes* | 1.79 | 1.68 | 1.91 | <0.001 |
| *No* | 1 | Reference | | |
| **Type of diarrhea** | | | | |
| *Bloody* | 1.45 | 1.31 | 1.59 | <0.001 |
| *Non-bloody* | 1 | Reference | | |
| **Seeking care** | | | | |
| *Yes, from public health facility* | 5.54 | 5.05 | 6.08 | <0.001 |
| *Yes, from private health facility* | 2.61 | 2.43 | 2.79 | <0.001 |
| Other/nowhere | 1 | Reference | | |
| **Use of antibiotics** | | | | |
| *Yes* | 1.19 | 1.11 | 1.28 | <0.001 |
| *No* | 1 | Reference | | |
| **Amount of liquids given to the child during diarrhea** | | | | |
| *About the same or more than usually* | 0.86 | 0.81 | 0.92 | <0.001 |

| Variables | Odds ratio | Confidence Interval | | P-value |
|---|---|---|---|---|
| | | *Lower* | *Upper* | |
| *Less than usually* | 1 | Reference | | |
| **Amount of food given to the child during diarrhea** | | | | |
| *About the same or more than usually* | 0.88 | 0.83 | 0.94 | <0.001 |
| *Less than usually* | 1 | Reference | | |
| **Use of zinc** | | | | |
| *Yes* | 3.37 | 3.11 | 3.64 | <0.001 |
| *No* | 1 | Reference | | |

***For the first research question:***

***Table 5: Predictors of ORS usage for children aged under 5 with diarrhea - Multivariable logistic regression model.***

| Variables | Odds ratio | Confidence Interval | | P-value |
|---|---|---|---|---|
| | | *Lower* | *Upper* | |
| **Age of the child (months)** | | | | |
| *0 to 5.9 month* | 0.39 | 0.35 | 0.43 | <0.001 |
| *6 to 24 month* | 0.86 | 0.80 | 0.92 | <0.001 |
| *24 to 59 month* | 1 | Reference | | |
| **Mothers' education** | | | | |
| *Secondary or higher education* | 1.10 | 1.02 | 1.19 | 0.015 |
| *No education or primary* | 1 | Reference | | |
| **Residence of the household** | | | | |
| *Rural* | 0.86 | 0.79 | 0.93 | <0.001 |
| *Urban* | 1 | Reference | | |
| **Wealth Index** | | | | |
| *High* | 1.20 | 1.10 | 1.30 | <0.001 |
| *Poor or middle* | 1 | Reference | | |
| **Religion** | | | | |
| *Hindu or Muslim* | 0.67 | 0.57 | 0.79 | <0.001 |
| *Other religion* | 1 | Reference | | |
| **Caste of the household** | | | | |
| *Scheduled caste, Scheduled tribe, or other backward class* | 0.88 | 0.81 | 0.95 | 0.002 |
| *None of them* | 1 | Reference | | |
| **Sequential number of child in the family** | 0.95 | 0.93 | 0.98 | <0.001 |
| **Exposure to mass media** | | | | |
| *Yes* | 1.31 | 1.21 | 1.42 | <0.001 |
| *No* | 1 | Reference | | |
| **Type of diarrhea** | | | | |
| *Bloody* | 1.28 | 1.14 | 1.43 | <0.001 |
| *Non-bloody* | 1 | Reference | | |
| **Seeking care** | | | | |
| *Yes, from public health facility* | 4.37 | 3.95 | 4.83 | <0.001 |
| *Yes, from private health facility* | 2.24 | 2.07 | 2.42 | <0.001 |
| *Other/nowhere* | 1 | Reference | | |
| **Amount of food given to the child during diarrhea** | | | | |
| *About the same or more than usually* | 0.89 | 0.83 | 0.95 | 0.001 |
| *Less than usually* | 1 | Reference | | |
| **Use of zinc** | | | | |
| *Yes* | 2.68 | 2.47 | 2.91 | <0.001 |
| *No* | 1 | Reference | | |

Note: Hosmer-Lemeshow test was 0.100

**For the second research question:**

***Table 6: Univariate logistic regression analysis between covariates and type of diarrhea among the youngest children aged under 5 as a dependent variable.***

| Variables | Odds ratio | Confidence Interval | | P-value |
|---|---|---|---|---|
| | | *Lower* | *Upper* | |
| **Age of the child (months)** | | | | |
| *0 to 5.9 month* | 0.38 | 0.35 | 0.43 | <0.001 |
| *6 to 24 month* | 0.86 | 0.79 | 0.92 | <0.001 |
| *24 to 59 month* | 1 | Reference | | |
| **Sex of the child** | | | | |
| *Female* | 0.91 | 0.83 | 1.01 | 0.071 |
| *Male* | 1 | Reference | | |
| **Age of the mother (years)** | 1.03 | 1.02 | 1.04 | <0.001 |
| **Mothers' education** | | | | |
| *Secondary or higher education* | 0.64 | 0.58 | 0.71 | <0.001 |
| *No education or primary* | 1 | Reference | | |
| **Residence of the household** | | | | |
| *Rural* | 1.38 | 1.22 | 1.55 | <0.001 |
| *Urban* | 1 | Reference | | |
| **Wealth Index** | | | | |
| *High* | 0.68 | 0.61 | 0.76 | <0.001 |
| *Poor or middle* | 1 | Reference | | |
| **Religion** | | | | |
| *Hindu or Muslim* | 1.25 | 0.96 | 1.64 | 0.102 |
| *Other religion* | 1 | Reference | | |
| **Caste of the household** | | | | |
| *Scheduled caste, Scheduled tribe, or other backward class* | 1.15 | 1.01 | 1.31 | 0.035 |
| *None of them* | 1 | Reference | | |
| **Sequential number of child in the family** | 1.12 | 1.08 | 1.16 | <0.001 |
| **Exposure to mass media** | | | | |
| *Yes* | 0.75 | 0.67 | 0.83 | <0.001 |
| *No* | 1 | Reference | | |
| **Seeking care** | | | | |
| *Yes, from public health facility* | 1.74 | 1.51 | 1.99 | <0.001 |
| *Yes, from private health facility* | 1.12 | 0.99 | 1.26 | 0.080 |
| *Other/nowhere* | 1 | Reference | | |
| **Use of antibiotics** | | | | |
| *Yes* | 1.14 | 1.01 | 1.28 | 0.040 |
| *No* | 1 | Reference | | |
| **Amount of liquids given to the child during diarrhea** | | | | |
| *About the same or more than usually* | 0.69 | 0.62 | 0.77 | <0.001 |
| *Less than usually* | 1 | Reference | | |

| Variables | Odds ratio | Confidence Interval | | P-value |
|---|---|---|---|---|
| | | *Lower* | *Upper* | |
| **Amount of food given to the child during diarrhea** | | | | |
| *About the same or more than usually* | 0.87 | 0.78 | 0.97 | 0.010 |
| *Less than usually* | 1 | Reference | | |
| **Use of zinc** | | | | |
| *Yes* | 1.71 | 1.54 | 1.91 | <0.001 |
| *No* | 1 | Reference | | |

***Table 7: Association between the type of diarrhea and the usage of ORS for diarrhea treatment in children less than 5 years of age.***

| Variables | Odds ratio | Confidence Interval | | P-value |
|---|---|---|---|---|
| | | *Lower* | *Upper* | |
| **Type of diarrhea** | | | | |
| *Bloody* | 1.27 | 1.14 | 1.42 | <0.001 |
| *Non-bloody* | 1 | Reference | | |
| **Age of the child (months)** | | | | |
| *0 to 5.9 month* | 0.38 | 0.35 | 0.43 | <0.001 |
| *6 to 24 month* | 0.86 | 0.79 | 0.92 | |
| *24 to 59 month* | 1 | Reference | | |
| **Mothers' education** | | | | |
| *Secondary or higher education* | 1.11 | 1.03 | 1.19 | 0.010 |
| *No education or primary* | 1 | Reference | | |
| **Residence of the household** | | | | |
| *Rural* | 0.86 | 0.79 | 0.93 | <0.001 |
| *Urban* | 1 | Reference | | |
| **Wealth Index** | | | | |
| *High* | 1.20 | 1.11 | 1.31 | <0.001 |
| *Poor or middle* | 1 | Reference | | |
| **Caste of the household** | | | | |
| *Scheduled caste, Scheduled tribe, or other backward class* | 0.88 | 0.81 | 0.96 | 0.002 |
| *None of them* | 1 | Reference | | |
| **Sequential number of child in the family** | 0.95 | 0.92 | 0.97 | <0.001 |
| **Exposure to mass media** | | | | |
| *Yes* | 1.32 | 1.21 | 1.43 | <0.001 |
| *No* | 1 | Reference | | |
| **Seeking care** | | | | |
| *Yes, from public health facility* | 4.39 | 3.97 | 4.85 | <0.001 |
| *Yes, from private health facility* | 2.23 | 2.07 | 2.41 | <0.001 |
| *Other/nowhere* | 1 | Reference | | |
| **Amount of food given to the child during diarrhea** | | | | |
| *About the same or more than usually* | 0.89 | 0.83 | 0.95 | 0.001 |
| *Less than usually* | 1 | Reference | | |
| **Use of zinc** | | | | |
| *Yes* | 2.69 | 2.47 | 2.92 | <0.001 |
| *No* | 1 | Reference | | |

***Database guide***

**Introduction**

The criteria used to select the sample are

- ***Children aged less than 5 years of age***

  215. In what month and year was (NAME) born? PROBE: What is his/her birthday?

  MONTH ☐☐

  YEAR ☐☐☐☐

- ***Child with reported diarrhea during the last two weeks before the survey***

  516. Has (NAME) had diarrhoea in the last 2 weeks?

  YES ——————— 1

  NO ——————— 2

  DON'T KNOW ——————— 8

- ***The youngest child in the household*** *(the variables on the youngest child are denoted in the dataset as varnam$1).*

**HOUSEHOLD QUESTIONNAIRE**

**Household schedule:**

STATE ———————

CITY/TOWN/VILLAGE ———————

MEGA CITY/LARGE CITY/SMALL CITY/LARGETOWN/SMALL TOWN/RURAL ———

(MEGA CITY=1, LARGE CITY=2, SMALL CITY=3, LARGE TOWN=4, SMALL TOWN=5, RURAL=6)

34. What is the religion of the head of the household?

HINDU _____ 01

MUSLIM _____ 02

CHRISTIAN _____ 03

OTHER _____ 96
(Specify)

36. Is this a scheduled caste, a scheduled tribe, other backward class, or none of them?

SCHEDULED CASTE _____ 1

SCHEDULED TRIBE _____ 2

OTHER BACKWARD CLASS _____ 3

NONE OF THEM _____ 4

DON'T KNOW _____ 8

58. Does this household have a BPL card?

YES _____ 1

NO _____ 2

DON'T KNOW _____ 8

**WOMAN QUESTIONNAIRE**

**Section-1: Respondent's background**

102. In what month and year were you born?

MONTH 

DON'T KNOW MONTH _____ 98

YEAR | | | | |

DON'T KNOW YEAR _____ 9998

105. Have you ever attended school?

YES _____ 1

NO _____ 2 →109

106. What is the highest standard you completed?

STANDARD _____

110. Do you read a newspaper or magazine almost every day, at least once a week, less than once a week or not at all?

ALMOST EVERY DAY _____ 1

AT LEAST ONCE A WEEK _____ 2

LESS THAN ONCE A WEEK _____ 3

NOT AT ALL _____ 4

111. Do you listen to the radio almost every day, at least once a week, less than once a week or not at all?

ALMOST EVERY DAY _____ 1

AT LEAST ONCE A WEEK _____ 2

LESS THAN ONCE A WEEK _____ 3

NOT AT ALL _____ 4

112. Do you watch television almost every day, at least once a week, less than once a week or not at all?

ALMOST EVERY DAY _____ 1

AT LEAST ONCE A WEEK _____ 2

LESS THAN ONCE A WEEK _____ 3

NOT AT ALL _____ 4

**Section-2: Reproduction**

209. CHECK 208:

Just to make sure that I have this right: you have had in TOTAL _____ births during your life. Is that correct?

PROBE AND CORRECT 201-208 AS NECESSARY

213. Is (NAME) a boy or a girl?

BOY _____ 1

GIRL _____ 2

215. In what month and year was (NAME) born? PROBE: What is his/her birthday?

MONTH | | |

YEAR | | | | |

**Section-5: Child immunizations and health**

517. Was there any blood in the stools?

YES _____ 1

NO _____ 2

DON'T KNOW _____ 8

518. Now I would like to know how much (NAME) was given to drink (including breastmilk) during the diarrhoea. Was (he/she) given less than usual to drink, about the same amount, or more than usual to drink? IF LESS, PROBE: Was (he/she) given much less than usual to drink or somewhat less?

MUCH LESS _____ 1

SOMEWHAT LESS _____ 2

ABOUT THE SAME _____ 3

MORE _____ 4

NOTHING TO DRINK _____ 5

DON'T KNOW _____ 8

519. When (NAME) had diarrhoea, was (he/she) given less than usual to eat, about the same amount, more than usual, or nothing to eat? IF LESS, PROBE: Was (he/she) given much less than usual to eat or somewhat less?

MUCH LESS _____ 1

SOMEWHAT LESS _____ 2

ABOUT THE SAME _____ 3

MORE _____ 4

STOPPED FOOD _____ 5

NEVER GAVE FOOD _____ 6

DON'T KNOW _____ 8

520. Did you seek advice or treatment for the diarrhoea from any source?

YES _____ 1

NO _____ 2 → (SKIP TO 525)

521. Where did you seek advice or treatment? Anywhere else? RECORD ALL SOURCES MENTIONED. IF UNABLE TO DETERMINE IF A HOSPITAL, HEALTH CENTRE, OR CLINIC IS PUBLIC OR PRIVATE HEALTH SECTOR, WRITE THE NAME OF THE PLACE(S).

**PUB. HEALTH SECTOR**

GOVT./MUNICIPAL HOSPITAL _____ A

VAIDYA/HAKIM/HOMEOPATH (AYUSH) _____ B

GOVT. DISP _____ C

UHC/UHP/UFWC _____ D

CHC/RUR. HOSP/BLOCK PHC _____ E

PHC/ADDITIONAL PHC _____ F

SUB-CENTRE/ANM _____ G

GOVT. MOBILE CLINIC _____ H

CAMP _____ I

ANGANWADI/ICDS CENTRE _____ J

ASHA _____ K

OTHER PUBLIC HEALTH SECTOR _____ L

NGO/TRUST HOSP./ CLINIC _____ M

**PVT. HEALTH SECTOR**

PVT. HOSPITAL _____ N

PVT. DOCTOR/CLINIC _____ O

PVT. PARAMEDIC _____ P

VAIDYA/HAKIM/HOMEOPATH (AYUSH) _____ Q

PHARMACY/DRUGSTORE _____ R

OTHER PRIVATE HEALTH SECTOR _____ S

**OTHER SOURCE**

SHOP _____ T

TRADITIONAL HEALER _____ U

FRIEND/RELATIVE _____ V

OTHER _____ X
(Specify)

523. Where did you first seek advice or treatment? USE LETTER CODE FROM 521.

FIRST PLACE ___ ☐

525. Was he/she given any of the following to drink at any time since he/she started having the diarrhoea:

| | | YES | NO | DK |
|---|---|---|---|---|
| a. A fluid made from a special packet called [LOCAL NAME FOR ORS PACKET]? | Fluid from ORS PKT _____ | 1 | 2 | 8 |
| b. Gruel made from rice [OR OTHER LOCAL GRAIN]? | GRUEL _____ | 1 | 2 | 8 |

526. Was (he/she) given zinc at any time since (he/she) started having diarrhoea?

YES _____ 1

NO _____ 2

DON'T KNOW _____ 8

527. Was anything (else) given to treat the diarrhoea?

YES _____ 1

NO _____ 2

DON'T KNOW _____ 8

528. What (else) was given to treat the diarrhoea? Anything else?

**PILL OR SYRUP**

ANTIBIOTIC _____ A

ANTIMOTILITY _____ B

OTHER (NOT ANTI-BIOTIC ANTI-MOTILTY, OR ZINC _____ C

UNKNOWN PILL OR SYRUP _____ D

**INJECTION**

ANTIBIOTIC _____ E

NON-ANTIBIOTIC _____ F

UNKNOWN INJECTION _____ G

INTRAVENOUS (IV) _____ H

HOME REMEDY/HERBAL MEDICINE _____ I

OTHER _____ X
(Specify)

550. Have you ever heard of a special product called [LOCAL NAME FOR ORS PACKET] you can get for the treatment of diarrhoea?

YES _____ 1

NO _____ 2

IF SHE HAS NEVER HEARD OF ORS, SHOW GOVERNMENT

AND COMMERCIAL ORS PACKETS AND ASK:

Have you ever seen a packet like one of these before?