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Gender Disparity is evident in care-seeking behaviors, but not in treatment outcomes for dehydrating diarrhea among under five children admitted to a diarrheal disease hospital of Dhaka, Bangladesh

Journal:	*BMJ Open*
Manuscript ID	bmjopen-2020-038730
Article Type:	Original research
Date Submitted by the Author:	24-Mar-2020

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Keywords:	Public health < INFECTIOUS DISEASES, Community child health < PAEDIATRICS, Epidemiology < TROPICAL MEDICINE

Title: Gender Disparity is evident in care-seeking behaviors, but not in treatment outcomes for dehydrating diarrhea among under five children admitted to a diarrheal disease hospital of Dhaka, Bangladesh

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Body text word count: 3624

Key words: Gender Disparity; care-seeking behaviors; dehydrating diarrhea; under five children

Abstract

Introduction: Deprivation of access to health and nutrition care relative to male children prevents females from being advantageous to higher survival. We hypothesize that despite economic development and augmented literacy rates, Bangladeshi households are still discriminating against girls in seeking medical care. The study examined gender disparities in diarrheal disease severity and treatment outcomes of under five children.

Setting: A tertiary level diarrheal disease hospital of Dhaka, Bangladesh

Participants: 13,361 under five children

Outcome variables and method: The primary outcome of interest of this analysis was the severity of diarrhea defined as ‘dehydrating diarrhea’, and ‘non-dehydrating diarrhea. Multivariable logistic regression analyses were performed to assess the contribution of ‘gender’ in dehydrating diarrhea on admission to the hospital.

Results: The mean (±SD) age of the children with diarrhea was 5.63 (±3.49) months and more than two-third of them were males. The median distance travelled to come to the hospital for admission was 10 miles (IQR: 6-25) and it was significantly higher for male (9.5 miles [IQR: 6 - 23] than Female children 10 miles [IQR: 6 - 25], P < 0.001. Female children had 11% (Adjusted OR: 1.11, 95% CI: 1.03 – 1.20, p-value: 0.007) more chance of presenting with dehydrating diarrhea than the male children at the time of hospital admission. Almost 20% of children received 2 or more medications and this ratio did not differ by gender. The median duration of hospital stay was 11 hours and it was similar in both the sexes. No gender-based disparity was observed in the pattern of management of diarrhea and hospital outcome of the children.

Conclusion: The study shows that female children have more dehydrating diarrhea when they present to the icddr,b Dhaka hospital. No gender-based disparity was observed in the hospital outcome of the children.

Strengths and limitations of this study

- Data have been collected from an ongoing diarrheal disease surveillance system where a systematic 2% of patients attending the hospital were enrolled
- This analysis was done with data from 13,361 patients less than five years old visiting the icddr,b Dhaka hospital for over a decade (between January 2008 and December 2017).
- Data for this analysis was collected from a specialized-care hospital. Hence we don't know whether these gender-based hospital attendance differences reflect the true gender disparity that might persist within the community.
- If female children with similar severity were taken to a lower-level institutions rather than the tertiary facility, the prognosis and the outcomes could be different

Introduction

Over the last 20 years, under 5 mortality has declined sharply in Bangladesh as a result of a range of public health interventions while the economy of the country remained resilient despite internal and external challenges. [1 2] However, in most parts of the world under 5 mortality is higher among boys than girls.[3] This can be explained by sex difference in the genetic and biological framework, with boys in their perinatal and early infancy being biologically weaker and more vulnerable to infectious diseases and premature deaths than their female counterparts.[4] At the same time, external causes mostly affect boys than girls causing a further increase in mortality.[5] That means in an ideal and equitable resource allocated condition, girls have better chances of survival to age 5 than boys[5 6], but the exception is the South Asian region, where both male and female under 5 mortality rates are equal.[7] Deprivation of

access to health and nutrition care relative to male children prevents females from being advantageous to higher survival.[8] However, there is a knowledge gap regarding the mechanisms that could play an important role in excess mortality.

The most likely explanation can be the sex differences in child-rearing and/or care-seeking behavior. [9] Discrepancies in child rearing practices could affect the nutritional status of the children causing higher incidence and severity of different infections and resulting in higher mortality. On the other hand, differences in healthcare-seeking behavior of the parents would cause a lack of preventive and curative healthcare and particularly the treatment of serious illnesses, ultimately which would directly affect child survival.

Although Bangladesh has achieved the child mortality target of MDG4 (under-five mortality rate is currently 46 per 1000 live births[10]), it is still unacceptably high. Despite different public health interventions in this country around 129,433 under 5 children die every year.[11] Moreover, the Bangladesh Demographic and Health Survey in 2014 reported that proportion of under-five mortality is 9% higher for females (48, compared with 44 per 1,000 live births in males)[12], which indicates that sex of the child may be a factor contributing to higher female child mortality in Bangladesh. This is a common scenario in other countries of South Asian region having the biggest sex disparities. [13,14]

The predilection for a male child is almost worldwide and has been revealed in varying degrees even in the developed world but is predominantly evident in male-dominated societies including Bangladesh. An intensive longitudinal study of 197 children aged 2–60 months in Matlab sub-district in rural Bangladesh observed no significant difference by sex in the incidence of diarrheal disease.[15] One more study in Matlab conducted during 1977–78 reported that visits to a diarrheal treatment facility which was free of cost were 66 percent higher for boys than girls aged 0–4 months even though the diarrheal attack rate was similar.[9] Such a treatment-seeking behavior has been indicated to get changed by the distance of health care center from their residence. A study conducted in rural Teknaf, Bangladesh found that within the first one-mile radius, 90 percent of diarrheal cases irrespective of male and female came to the clinic for treatment, but at two miles the attendance declined to 70 percent for males and 40 percent for females.[16] However, most of these studies were limited to the rural areas of the country; to our knowledge, there are no studies that have investigated intra-household sex-based discrimination in health care seeking for diarrhea in the urban area of Bangladesh.

Globally diarrhea with dehydration is the second leading cause of all under 5 deaths.[7] In Bangladesh prevalence of diarrhea is 6% and accounts for 6% of the total number of under 5 deaths.[10] In this country, only 36% of all diarrheal patients visit a hospital or a health care provider of the locality. Moreover, girls are discriminated against receiving ORS and zinc compared to boys in case of diarrheal episodes [10], which causes further deterioration of the clinical condition. So, we hypothesize that despite economic development and augmented literacy rates particularly that of women in Bangladesh, households are still discriminating against girls in seeking medical care.

The study examined gender disparities in diarrheal disease severity and treatment outcomes for children under the age of five years attending the icddr,b Dhaka hospital.

Materials and methods

Data sources:

Data have been collected from the Diarrheal Disease Surveillance System (DDSS) of icddr,b Dhaka hospital. The DDSS was established in 1979 to collect information on demographics, epidemiological and clinical characteristics of patients. Systematic 2% of patients attending the Dhaka hospital are enrolled in the surveillance system. This analysis was limited to 13,361 patients less than five years old presenting to the icddr,b Dhaka hospital (between January 2008 and December 2017). The Diarrheal Disease

Surveillance System (DDSS) was approved by the Research and Ethical Review Committee of icddr,b. Informed voluntary consent was taken from all participants and was documented in the DDSS database by icddr,b employees. Informed verbal approval from parents, guardians, caregiver or any nearby family member was obtained for minors. Delinked medical reports were used in all data analyses.

Statistical analysis

The primary outcome of interest of this analysis was the severity of diarrhea defined as 'dehydrating diarrhea', and 'non-dehydrating diarrhea'. According to the icddr,b 'Dhaka method' [17], diarrheal dehydration was classified into 'no dehydration', 'some dehydration' and 'severe dehydration'. If a child has any two of the following signs (irritable/restless, sunken eyes, thirst, skin pinch goes back after 2 – 3 seconds) he/she would be considered as a case of 'some dehydration'. If a child meets the criteria of some dehydration and has at least one of the following signs (lethargy/unconscious, inability to drink, unrecordable radial pulse) he/she would be considered as a case of 'severe dehydration'. If a child has none of the above signs, he or she would be considered as a case of 'no dehydration'. In our analysis both the 'some' and 'severe' dehydrated patients were defined as the cases of 'dehydrating diarrhea' and the patients with 'no dehydration' were defined as the cases of 'non-dehydrating diarrhea'.

Anthropometric indices for stunting, wasting and underweight were measured using World Health Organization (WHO) Anthro 2006 software.[18] Underweight was categorized into 'normal WAZ' ($WAZ \geq -2SD$), 'moderate underweight ($WAZ \geq -3SD$ & $< -2SD$)', 'severe underweight ($WAZ < -3SD$). Wasted was categorized into 'normal WHZ' ($WHZ \geq -2SD$), 'moderate wasting' ($WHZ \geq -3SD$ & $< -2SD$) and 'severe wasting' ($WHZ < -3SD$), for stunting LAZ-score less than -2 defined stunting and LAZ-score less than -3 defined severe stunting and rest ($HAZ \geq -2SD$) were normal HAZ.[19] Data were analyzed using STATA/SE version 13.0. To present the categorical variables frequency distribution was used. Mean and standard deviation (SD) were used to report the normally distributed continuous variables and for the non-normal continuous data median and interquartile range were used. In case of categorical variable frequency of an event occurrence across two different groups were compared using Pearson's chi-square test, for the continuous variables, the means and medians across two groups were compared using student's T-tests and Wilcoxon rank-sum tests, respectively.

Multivariable logistic regression analyses were performed to assess the contribution of 'sex' in dehydrating diarrhea on admission after adjusting the confounding variables that were found to be statistically significant (p-value < 0.05) in bivariate analyses. Variables that were used to adjust the multivariable logistic regression analysis were age, nutritional status, parental education, wealth index, positive stool culture, vomiting status, birth order of the child. The associations were stated as odds ratios (OR) with a 95% confidence interval (CI). p<0.05 was set as statistical significance for all the analyses.

Patient and Public Involvement (PPI) statement

No patient or public were involved with the development of research question, designing the study, recruitment of participants, interpretation of the results, and will be involved during disseminating the findings of the paper.

Results

The DDSS recruited a total of 13,361 under-five children between January 2008 to December 2017, and among them, 51.28% of children met the case definition of Dehydrated Diarrhea.

The mean (±SD) age of the children with diarrhea was 5.63 (±3.49) months and more than two-third of them were males (Table 1). Both males and females were of similar age (p >0.05). 14% of the mothers (n=1,845) and 18% of the fathers (n=2,405) had no education, while 65% mothers and 61% fathers had more than 5 years of formal education (Table1). Distribution of parental education status was not significantly different across sex of the children.

The median time duration of diarrhea between onset of illness and admission to icddr,b Dhaka hospital was 9 hours (IQR: 4-15), whereas the median distance travelled to come to the hospital for admission was 10 miles (IQR: 6-25) and it was significantly higher for male children (9.5 miles [IQR: 6 - 23] vs. 10 miles [IQR: 6 - 25] for females and males respectively; P < 0.001) (Table 1). At the time of hospital admission, one-third of the children had dehydrating diarrhea and among these dehydrated patients 35% were females and 33% were males respectively; P = 0.01).

Vibrio cholerae was isolated from 4.08% of the cultured stool samples, and Shigella was isolated in 356 (2.66%) children suggesting the presence of invasive diarrhea. About 8.02% of all children were severely stunted, 9.08% of all children were severely underweight, and 6.41% children were severely wasted. In all the categories male children were more malnourished than female children. In bivariate analysis, we found that children with severe underweight had 3 times higher chance of attending the hospital with dehydrating diarrhea compared to the normal-weight children (OR: 3.30; 95% CI: 2.92 – 3.73) (Table 2) and it was 2 times higher among moderately underweight children (OR: 2.04; 95% CI: 1.86 – 2.24). In case of wasting the odds of hospital admissions with dehydrating diarrhea was higher among children who were severely or moderately wasted (OR: 3.13; 95% CI: 2.72 – 3.61; and OR: 2.09; 95% CI: 1.88 – 2.32, respectively) compared to the non-wasted children. A similar trend was seen for the stunted children cohort where the odds of hospital admission was higher in severe stunting (OR: 1.80; 95% CI: 1.58 – 2.04) and moderate stunting (OR: 1.33; 95% CI: 1.20 – 1.47) groups than the non-stunted children. Hospital admissions with dehydrating diarrhea were 41% excess among older children (OR: 1.41; 95% CI: 1.31 – 1.51); 5 times higher for those with a positive *Vibrio cholerae* stool culture (OR: 5.37, 95% CI: 4.44 – 6.50), 30% higher for the *Shigella* positive stool culture patients (OR: 1.3; 95% CI:

1.05 – 1.61), 2 times higher among those with a history of vomiting (OR: 2.18; 95% CI: 2.00 – 2.39); 51% higher for children of 3rd or more birth order and it was 17% higher for the 2nd birth order children (OR: 1.51; 95% CI: 1.37 – 1.67; OR: 1.17; 95% CI: 1.07 – 1.26) compared to the children with the1st birth order. After adjusting for all the significant variables, female children had 11% (Adjusted OR: 1.11, 95% CI: 1.03 – 1.20, p-value: 0.007) more chance of presenting with dehydrating diarrhea than the male children at the time of hospital admission.

Parental education was found to be significantly associated with dehydrating diarrhea. Children having mother with no educational qualification were found to have 2.27 times higher odds of getting admitted with dehydrating diarrhea (OR: 2.27; 95% CI: 2.05 – 2.51) than those who had completed primary education and it is 1.53 times higher when it is less than primary education (OR: 1.53; 95% CI: 1.40 – 1.68). In case of paternal education, the ratio is 2.10 for no formal schooling (OR: 2.10; 95% CI: 1.91 – 2.31) and it is 1.52 for less than primary education (OR: 1.52; 95% CI: 1.39 – 1.66). In case of wealth quintile hospital admissions for dehydrating diarrhea were 2.10, 1.76, 1.59 and 1.31 times higher for the poorest, poor, middle and rich groups respectively compared to the richest group. After adjusting for age group, parental education, positive stool culture for *Vibrio Cholerae* and *Shigella*, vomiting status, wealth quintiles, birth order, being underweight, wasted and stunted it was found that female children had a significantly higher odds of coming to the hospital with dehydrating diarrhea compared to the male children (OR: 1.11, 95% CI: 1.03 – 1.20).

The majority of the children were treated with an antibiotic 11,757 (87.98%) after being admitted in the hospital (Table 3). Almost 20% of children received 2 or more medications and this ratio did not differ by gender. The median duration of hospital stay was 11 hours and it was similar in both the sexes. Illness resolved prior to discharge in 12,447 (93.15%) of children, whereas 879 (6.58%) had their illness continued, 34 (0.26%) left the hospital without the medical advice of a clinician and 3 (0.02%) children died. No gender-based disparity was observed in the hospital outcome of the children.

Discussion:

Conforming to other studies from the South Asian regions and Bangladesh, our study has revealed a discriminating disadvantage of female children in comparison to male children in care-seeking from the hospital due to diarrhea. We have found that parents of male children brought their child to the icddr,b hospital more often than the parents of female children for diarrhea.

We found that in both the age groups (infant and older) a higher number of male children came to the hospital for diarrhea in comparison to the female children. On the other hand, we observed that the chance of female children to be brought to the hospital with dehydrating diarrhea is higher than male children. However, evidence from Bangladesh shows no significant difference in the incidence of diarrhea among the children[15] nor was there any evidence on the difference in severity of diarrhea between sexes among under-five children. Hence, we could not find any literature that could echo our finding. We also observed that older children (12-59 months) had higher odds of developing dehydrating diarrhea which is similar to the other studies in Bangladesh [20]; suggesting that parents might seek health care for their children differently based on age and gender. Possibly more female children with dehydrating diarrhea might already have died at home without their parents seeking hospital care, or parents came to the hospital with their female children only when they develop more serious forms of illness. Or, perhaps parents decided to treat their female children elsewhere rather bringing them to the hospital.

We found that there was no education qualification for a greater percentage of the parents who took their children to the hospital for dehydrating diarrhea. It is possible that parents with higher education take good care of their children which prevents them contracting diarrhea and further more becoming dehydrated than the less educated parents. Further, wealth status was found to be a factor significantly associated with seeking care for female children and dehydrating diarrhea, which is aligned with earlier findings that poor socioeconomic status was significantly associated with poor utilization of health facilities.[21-23] Interestingly, across all family income groups girls were less hospitalized when compared with boys. The finding is contradictory to the available literatures that suggest a declining trend in gender bias with the increase in family income.[23] As far as a policy option to reduce the gender disparity in Bangladesh is concerned, our results suggest that overall improvement of socioeconomic status of the people can reduce the observed discrimination in health care utilization between boys and girls.

Our study demonstrated distance as a significant factor which influenced female children's hospital attendance rate, which was in line with previous studies conducted in Bangladesh.[16] In Bangladesh, when a child suffers from diarrhea or any other diseases, in most of the cases, someone has to accompany the mother while she brings the child to a clinic. This requires considerable physical effort if the distance is too far, on the other hand as the majority of Bangladeshis are conservative Muslims, for mothers with female children travelling presents not only a physical barrier but a social barrier as well. As male children are overvalued, this mindset along with social and physical barrier dominates decision making regarding medical care of female children as the distance of the hospital increases.

Maternal income can also influence the decision-making process of the parents. Our study showed that when mothers were involved in any gainful employment, they were more likely to bring their female children to the hospital. Similarly, one of the influencing factors was family size, because it was evident from the earlier studies that having a smaller family size enabled the parents to spend more time and direct more resources on their ailing child. [24]

Our results showed that among the hospital attended children with the rise of birth order the ratio of children with dehydrated diarrhea increased, which indicates that parents have more preference for children with younger birth order and with the increase in birth order with several small children they are less likely to manage a diarrheal episode perfectly or they might just ignore the incidence.[25]

Deaths from diarrhea can be decreased by 93 per cent for children under five years of age when treated with ORS.[26] Our study shows that about 96% of children were treated with ORS in the icddr,b Dhaka hospital and about 88% of children received at least one antibiotic and a majority of the children got cured following their treatment.

This study shows no gender based disparity in the treatment of children with diarrhea at the icddr,b Dhaka hospital. The stool culture reports did not reveal any difference in the detection of invasive diarrhea in children by sex. Our study does not support the concept that there is a difference in the hospital care of the children by sex rather suggests that it is the difference in the care-seeking behavior of the parents for diarrhea prior to the hospitalization.

Our study also identified older age, malnutrition, invasive diarrhea, low literacy of the parents, poor socioeconomic condition and reporting of vomiting as predictors for having dehydrating diarrhea at the time of hospitalization. This study reports that around a quarter of under-five children who came to the hospital with diarrhea were malnourished, with males were suffering from a more severe form of malnutrition than females. Despite their better nutritional condition, we observed a higher proportion of female children were suffering from dehydrating diarrhea at the time of hospitalization, which is a matter of concern. This may be due to sex discrimination in the care-seeking behavior of the parents at the household levels.

Although there is limited evidence supporting male children parental preferences when deciding to seek care for diarrhea in Bangladesh, studies in other countries with similar results support our findings. There has been a study carried out in Nepal among children under the age of 15 years showed that gender was central in the illness reporting, choice of external care, public provider and amount to be spent and in every situation, male children were privileged over female children.[27] A study conducted in a cluster of four villages in West Bengal, India found that male children had discriminating advantage in treatment-seeking from a qualified physician, travel distance for care and amount of healthcare expenditure.[28] Despite limited evidence, the trend indicates that parents prefer males over females when seeking health care for their children in South Asia.

Although this analysis shows a gap among parents in terms of seeking hospital care for their female children with diarrhea, these findings should be considered within few unavoidable limitations such as study design and data availability. First, data for this analysis was collected from a specialized-care hospital. Hence we don't know whether these gender-based hospital attendance differences reflect the true gender disparity that might persist within the community.

Second, in this study, at the moment of hospital admission, we observed a discrepancy between children's status of dehydration by gender. But, the other pre-existing confounding variables that could modify the odds of the dehydration status could not be explored. Moreover, if female children with similar severity were taken to a lower-level institutions rather than the tertiary facility, the prognosis and the outcomes could be different.[29]

Despite these limitations, we observed that in this study setting, females are hospitalized less which is similar to the previous findings from Bangladesh [30]. Moreover, national data evidences that death rate of female children is higher at the community level of Bangladesh[31], and diarrhea is the second leading cause of under-five mortality worldwide.[7] Out of millions of diarrheal episodes among under-five children in a year only 2 – 3% develop life threatening dehydrating diarrhea.[19] These deaths are preventable by proper access to affordable healthcare, but unfortunately, In the low and middle-income countries like Bangladesh, female children are being punished in terms of survival because of gender inequality in the society.[32] A study conducted across 96 countries to see the association between Gender

Inequality Index (GII) of women and prevalence of malnutrition and mortality among under-five children demonstrates significant positive association, suggesting gender equality as a predictor of the survival of children in the society.[33]

This analysis provides new insights into the severity and outcomes of diarrhea in children within icddr,b Dhaka hospital and evidenced gender-based disparity in the care-seeking behavior of the parents. Further characterizations of incidence, severity of diarrhea, and care seeking practices at the community level along with the real barriers to receive health care from the hospitals would be required to find out the real impact of the sex of the children on the results observed and to exclude parental preference of male child to seek care from the hospital.

Conclusion

The study shows that female children have more dehydrating diarrhea when they present to the icddr,b Dhaka hospital, a specialized care hospital of Bangladesh. Community-based surveys need to be conducted to better understand the differences between the incidence, severity of diarrhea and care seeking practices by gender. Further research into behavioral and household-level factors which might lead to parental preferences for the care of children with diarrhea stratified by age and similar studies in different settings are required to get a profound insight of the role of gender in diarrheal management and outcomes of children attending to the hospitals of Bangladesh.

Acknowledgement: The authors would like to thank all the patients and their parents for sharing their time and providing consent and information necessary for the successful completion of the study. We also acknowledge the contribution of icddr,b's core donors including Government of the People's Republic of Bangladesh, Canada, Sweden and UK for their continuous support and commitment to the icddr,b's research efforts.

Contributorship statement: IM and TA conceived the study. SHK managed the data set and provided technical support. IM analyzed the data, developed the tables/graphs and wrote the initial draft of the manuscript. SD, ASGF and TA critically reviewed the manuscript and gave intellectual inputs. All authors contributed to the final version of the paper.

Funding: No funding was available for this work.

Competing interests: The authors do not have any competing interests to declare.

Patient consent: Informed written consent was obtained from the mother or primary caregiver.

Data sharing statement: The data sets generated and/or analyzed during the current study is not made publicly available. However, data inquires or further suggestions for analyses can be made to the corresponding author.

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424 Tables:

425 **Table 1: Characteristics of children with diarrhea at the time of hospital admission**

Characteristics	Total (N=13363)	Female (N=5,144)	Male (N=8,219)	P value
Child age (in years; Mean ± SD)	1.10 ± 0.79	1.10 ± 0.79	1.11 ± 0.79	0.170*
Child age category				
Infant (0 – 11 months)	7,593 (56.83)	2,977 (57.87)	4,616 (56.16)	0.052
Older (12 – 59 months)	5,770 (43.17)	2,167 (42.13)	3,603 (43.84)	Reference
Mother's education, n (%)				
No formal education	1,845 (13.81)	700 (13.6)	1,145 (13.9)	Reference
Up to primary (≤ 5 years of schooling)	2,807 (21.01)	1,087 (21.1)	1,720 (20.9)	0.591
More than primary (>5 years of schooling)	8,711 (65.19)	3,357 (65.3)	5,354 (65.1)	0.632
Father's education, n (%)				
No formal education	2,405 (18.00)	921 (17.90)	1,484 (18.06)	Reference
Up to primary	2,835 (21.22)	1,094 (21.27)	1,741 (21.18)	0.828
More than primary	8,123 (60.79)	3,129 (60.83)	4,994 (60.76)	0.842
Birth order of the child, n (%)				
1st	7,007	2,689 (52.3)	4,318 (52.5)	Reference
2nd	4,163	1,602 (31.1)	2,561 (31.2)	0.91
3rd or more	2,193	853 (16.6)	1,340 (16.3)	0.66
Total number of family members, n (%)				
Up to 4	6,597 (49.37)	2,629 (51.1)	3,968 (48.3)	0.001
5 or more	6,766 (50.63)	2,515 (48.9)	4,251 (51.7)	Reference
Income of the mother, n (%)				
Yes	1,372 (10.27)	570 (11.1)	802 (9.8)	0.014
No	11,991 (89.73)	4,574 (88.9)	7,417 (90.2)	Reference
Wealth Quintile, n (%)**				
Richest	529 (3.96)	226 (42.72)	303 (57.28)	0.003

Rich	4,721 (35.33)	1,882 (39.86)	2,839 (60.14)	0.001
Middle	2,531(18.94)	992 (39.19)	1,539 (60.81)	0.014
Poor	2,951 (22.08)	1,100 (37.28)	1,851 (62.72)	0.280
Poorest	2,631 (19.69)	944 (35.88)	1,687 (64.12)	Reference
Distance of travel, in miles, median (IQR)	10 (6, 25)	9.5 (6, 23)	10 (6, 25)	< 0.001
Duration of diarrhea before arrival, in hours, median (IQR) hours	41 (20,75)	40 (21,74)	41 (20,75)	0.628
Reporting of vomiting in the last 24 hours, n (%)				
No	3,630 (27.16)	1,333 (25.91)	2,297 (27.95)	0.01
Yes	9,733 (72.84)	3,811 (74.09)	5,922 (72.05)	Reference
***Vibrio cholerae*, n (%)**				
Positive	545 (4.08)	209 (4.06)	336 (4.09)	0.943
Negative	12,818 (95.92)	4,935 (95.94)	7,883 (95.91)	Reference
***Shigella*, n (%)**				
Positive	356 (2.66)	146 (2.84)	210 (2.56)	0.323
Negative	13,007 (97.34)	4,998 (97.16)	8,009 (97.44)	Reference
Undernutrition indicators, n (%)				
Normal WAZ (≥ −2SD)	9,745 (73.77)	3,806 (74.72)	5,939 (73.18)	Reference
Moderate underweight (WAZ ≥ −3SD & < −2SD)	2,266 (17.15)	857 (16.82)	1,409 (17.36)	0.277
Severe underweight (WAZ < −3SD)	1,199 (9.08)	431 (8.46)	768 (9.46)	0.037
Normal WHZ (≥ −2SD)	10,643 (80.57)	4,104 (80.57)	6,539 (80.57)	Reference
Moderate wasting (WHZ ≥ −3SD & < −2SD)	1,720 (13.02)	693 (13.60)	1,027 (12.65)	0.172
Severe wasting (WHZ < −3SD)	847 (6.41)	297 (5.83)	550 (6.78)	0.044
Normal HAZ (≥ −2SD)	10,209 (77.28)	4,070 (79.90)	6,139 (75.64)	Reference
Moderate stunting (HAZ ≥ −3SD & < −2SD)	1,941 (14.69)	694 (13.62)	1,247 (15.36)	0.001

Severe stunting (HAZ < −3SD)	1,060 (8.02)	330 (6.48)	730 (8.99)	< 0.001

*Student's' t-Test

** Wealth quintile (composite measure of household's cumulative living standards) was categorized in to 'richest', 'rich', 'middle' 'poor' and 'poorest' based on certain criteria's such as household construction materials, presence of certain assets (radio, television, fan, almirah, cot), presence of electricity and gas, access to the sanitary latrine and the source of drinking water.

Table 2: Risk factors for dehydrating diarrhea in children at the time of hospital admission

Characteristics	**Dehydrating Diarrhea**		**Unadjusted OR (95% CI)**	**P value**	**Adjusted OR (95% CI)**	**P value**
	Dehydration	No Dehydration				
Sex						
Female	1,807 (39.89)	3,337 (37.78)	1.09 (1.01 – 1.17)	0.018	1.11 (1.03 – 1.20)	0.007
Male	2,723 (60.11)	5,496 (62.22)	1.0		1.0	
Child age (months)						
0 - 11	2,320 (51.21)	5,273(59.70)	1.0		1.0	
12 - 59	2,210 (48.79)	3,560 (40.30)	1.41 (1.31 – 1.51)	0.0001	1.20 (1.11 – 1.30)	<0.001
Mother education						
No formal education	893 (19.71)	952 (10.78)	2.27 (2.05 – 2.51)		1.27 (1.11 – 1.46)	<0.001
Up to primary	1,091 (24.08)	1,716 (19.43)	1.53 (1.40 – 1.68)	0.0001	1.11 (1.00 – 1.23)	0.048
More than primary	2,546 (56.20)	6,165 (69.80)	1.0	0.0001	1.0	
Father education						
No formal education	1,107 (24.44)	1,298 (14.69)	2.10 (1.91 – 2.31)	0.0001	1.31 (1.16 – 1.49)	<0.001
Up to primary	1,082 (23.89)	1,753 (19.85)	1.52 (1.39 – 1.66)	0.0001	1.17 (1.06 - 1.31)	0.002
More than primary	2,341 (51.68)	5,782 (65.46)	1.0		1.0	
Shigella infection						
Yes	142 (3.13)	214 (2.42)	1.30 (1.05 – 1.61)	0.016	1.32 (1.04 – 1.67)	0.018

No	4,388 (96.87)	8,619 (97.58)	1.0		1.0	
***Vibrio Cholerae* infection**						
Yes	392 (8.65)	153 (1.73)	5.37 (4.44 – 6.50)	0.0001	3.86 (3.15 – 4.72)	<0.001
No	4,138 (91.35)	8,680 (98.27)	1.0		1.0	
Vomiting						
Yes	3,728 (82.30)	6,005 (67.98)	2.18 (2.00 – 2.39)	0.0001	2.07 (1.89 – 2.28)	<0.001
No	802 (17.70)	2,828 (32.02)	1.0			
Wealth Quintile						
Richest	129 (2.85)	400 (4.53)	1.0			
Rich	1,406 (31.04)	3,315 (37.53)	1.31 (1.06 – 1.61)	0.01	1.22 (0.98 – 1.5)	0.069
Middle	859 (18.96)	1,672 (18.93)	1.59 (1.28 – 1.97)	0.0001	1.31 (1.04 – 1.64)	0.019
Poor	1,071 (23.64)	1,880 (21.28)	1.76 (1.42 – 2.18)	0.0001	1.41 (1.12 – 1.77)	0.003
Poorest	1,065 (23.51)	1,566 (17.73)	2.10 (1.70 – 2.60)	0.0001	1.41 (1.12 – 1.78)	0.003
Birth order						
1st	2,190 (48.34)	4,817 (54.53)	1.0			
2nd	1,446 (31.92)	2,717 (30.76)	1.17 (1.07 – 1.26)	0.0001	1.14 (1.04 – 1.24)	0.003
3rd or more	894 (19.74)	1,299 (14.71)	1.51 (1.37 – 1.67)	0.0001	1.19 (1.07 – 1.33)	0.001
Undernutrition indicators						
Normal WAZ (≥ −2SD)	2,762 (62.00)	6,983 (79.76)	1.0		1.0	
Moderate underweight (WAZ ≥ −3SD & < −2SD)	1,014 (22.76)	1,252 (14.30)	2.04 (1.86 – 2.24)	0.0001	1.59 (1.41 – 1.80)	<0.001
Severe underweight (WAZ < −3SD)	679 (15.24)	520 (5.94)	3.30 (2.92 – 3.73)	0.0001	2.11 (1.72 – 2.58)	<0.001
Wasting						
Normal WHZ (≥ −2SD)	3,164 (71.02)	7,479 (85.43)	1.0			
Moderate Wasting (WHZ ≥ −3SD	808 (18.14)	912 (10.42)	2.09 (1.88 – 2.32)	0.0001	1.37 (1.21 – 1.56)	<0.001

& < −2SD)						
Severe wasting (WHZ < −3SD)	483 (10.84)	364 (4.16)	3.13 (2.72 – 3.61)	0.0001	1.71 (1.42 – 2.07)	<0.001
Stunting						
Normal HAZ (≥ −2SD)	3,232 (72.55)	6,977 (79.69)	1.0			
Moderate stunting (HAZ ≥ −3SD & < −2SD)	741 (16.63)	1,200 (13.71)	1.33 (1.20 – 1.47)	0.0001	0.91 (0.81 – 1.03)	0.533
Severe stunting (HAZ < −3SD)	482 (10.82)	578 (6.60)	1.80 (1.58 – 2.04)	0.0001	0.94 (0.79 – 1.12)	0.145

Table 3: Pattern of management of diarrhea and outcome in hospital by sex

Variables	**Total (N=13,363)**	**Female (N=5,144)**	**Male (N=8,219)**	**P value**
ORS given, n (%)	12,867 (96.30)	4,948 (96.21)	7,919 (96.36)	0.648*
Antibiotic was given, n (%)				0.94***
• No antibiotic	1,606 (12.02)	627 (12.19)	979 (11.91)	
• 1 antibiotic	9,054 (67.75)	3,446 (66.99)	5,608 (68.23)	
• 2 antibiotics	2,257 (16.89)	894 (17.38)	1,363 (16.58)	
• 3 or more antibiotics	446 (3.34)	177 (3.44)	269 (3.27)	
Length of stay in the hospital (hours), Median (IQR)	11(2,26)	11(2,26)	11(2,26)	0.839**
Outcome of the patient, n (%)				0.561***
• Children discharged by doctors after cure	12,447(93.15)	4,814(93.58)	7,633(92.87)	
• Illness continued	879 (6.58)	317(6.16)	562(6.84)	
• Children died in hospital after admission	3(0.02)	1(0.02)	2(0.02)	
• Children left hospital against medical advice	34 (0.26)	12(0.24)	22(0.27)	

* t-test; ** Wilcoxon rank-sum test; *** Pearson's chi-square test

STROBE (Strengthening The Reporting of OBservational Studies in Epidemiology) Checklist

A checklist of items that should be included in reports of observational studies. You must report the page number in your manuscript where you consider each of the items listed in this checklist. If you have not included this information, either revise your manuscript accordingly before submitting or note N/A.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

Section and Item	Item No.	Recommendation	Reported on Page No.
Title and Abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	
Introduction			
Background/Rationale	2	Explain the scientific background and rationale for the investigation being reported	
Objectives	3	State specific objectives, including any prespecified hypotheses	
Methods			
Study Design	4	Present key elements of study design early in the paper	
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	
Participants	6	(*a*) *Cohort study*—Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up *Case-control study*—Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls *Cross-sectional study*—Give the eligibility criteria, and the sources and methods of selection of participants	
		(*b*) *Cohort study*—For matched studies, give matching criteria and number of exposed and unexposed *Case-control study*—For matched studies, give matching criteria and the number of controls per case	
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	

Section and Item	Item No.	Recommendation	Reported on Page No.
Data Sources/ Measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	
Bias	9	Describe any efforts to address potential sources of bias	
Study Size	10	Explain how the study size was arrived at	
Quantitative Variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	
Statistical Methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	
		(*b*) Describe any methods used to examine subgroups and interactions	
		(*c*) Explain how missing data were addressed	
		(*d*) *Cohort study*—If applicable, explain how loss to follow-up was addressed *Case-control study*—If applicable, explain how matching of cases and controls was addressed *Cross-sectional study*—If applicable, describe analytical methods taking account of sampling strategy	
		(*e*) Describe any sensitivity analyses	
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	
		(b) Give reasons for non-participation at each stage	
		(c) Consider use of a flow diagram	
Descriptive Data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	
		(b) Indicate number of participants with missing data for each variable of interest	
		(c) *Cohort study*—Summarise follow-up time (eg, average and total amount)	
Outcome Data	15*	*Cohort study*—Report numbers of outcome events or summary measures over time	
		Case-control study—Report numbers in each exposure category, or summary measures of exposure	
		Cross-sectional study—Report numbers of outcome events or summary measures	

Section and Item	Item No.	Recommendation	Reported on Page No.
Main Results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	
		(*b*) Report category boundaries when continuous variables were categorized	
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	
Other Analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	
Discussion			
Key Results	18	Summarise key results with reference to study objectives	
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	
Generalisability	21	Discuss the generalisability (external validity) of the study results	
Other Information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

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Gender Disparity in care-seeking behaviors and treatment outcomes for dehydrating diarrhea among under five children admitted to a diarrheal disease hospital of Bangladesh: An analysis of hospital-based surveillance data.

Journal:	*BMJ Open*
Manuscript ID	bmjopen-2020-038730.R1
Article Type:	Original research
Date Submitted by the Author:	05-Jul-2020
Complete List of Authors:	Mahmud, Imteaz; International Centre for Diarrhoeal Disease Research Bangladesh, Nutrition and Clinical Services Division Das, Subhasish; International Centre for Diarrhoeal Disease Research Bangladesh, Nutrition and Clinical Services Division Khan, Soroar ; International Centre for Diarrhoeal Disease Research Bangladesh, Nutrition and clinical Services Division Faruque, Abu; International Centre for Diarrhoeal Disease Research Bangladesh, Nutrition and Clinical Services division Ahmed, Tahmeed; International Centre for Diarrhoeal Disease Research Bangladesh, Nutrition and Clinical Services Division
Primary Subject Heading:	Public health
Secondary Subject Heading:	Global health
Keywords:	Public health < INFECTIOUS DISEASES, Community child health < PAEDIATRICS, Epidemiology < TROPICAL MEDICINE

Title: Gender Disparity in care-seeking behaviors and treatment outcomes for dehydrating diarrhea among under five children admitted to a diarrheal disease hospital of Bangladesh: An analysis of hospital-based surveillance data

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Body text word count: 3624

Key words: Gender Disparity; care-seeking behaviors; dehydrating diarrhea; under five children

Abstract

Introduction: Despite economic development and augmented literacy rates, Bangladeshi households are still discriminating against girls in seeking medical care. We examined gender disparities in diarrheal disease severity and treatment outcomes of under five children.

Setting: A tertiary level diarrheal disease hospital of Dhaka, Bangladesh.

Participants: 13,361 under-5 children admitted to the hospital between January'2008 to December'2017.

Outcome variables and method: The primary outcome of interest of this analysis was the severity of diarrhea defined as 'dehydrating diarrhea', and 'non-dehydrating diarrhea. Multivariable logistic regression analyses were performed to assess the contribution of 'gender' in dehydrating diarrhea on admission to the hospital.

Results: A data of 13,321 children under 5 years of age were analyzed for this study out of which 61.5 % were male and 38.5 % were female. The mean (±SD) age of the children with diarrhea was 5.63 (±3.49) months. The median distance travelled to come to the hospital for admission was 10 miles (IQR: 6-25) and it was significantly higher for male (9.5 miles [IQR: 6 - 23]) than Female children (10 miles [IQR: 6 - 25]), P < 0.001. Female children had 1.11 times higher odds (adjusted OR: 1.11, 95% CI: 1.03 – 1.20, p-value: 0.007) of presenting with dehydrating diarrhea than the male children at the time of hospital admission. Almost 20% of children received 2 or more medications during the period of hospital admission and it did not differ by gender. Median duration of hospital stay was (11 hours) was similar in both the sexes. No gender-based disparity was observed in management of diarrhea and hospital outcome of the children.

Conclusion: We found that female children were more likely to have dehydrating diarrhea when they were presented to the icddr,b Dhaka hospital. No gender-based disparity was observed in the hospital outcome of the children.

Strengths and limitations of this study

- Data have been collected from an ongoing diarrheal disease surveillance system where a systematic 2% of patients attending the hospital were enrolled.
- This analysis was done with data from 13,361 patients less than five years old visiting the icddr,b Dhaka hospital for over a decade (between January 2008 and December 2017).
- We don't know whether these gender-based hospital attendance differences reflect the true gender disparity that might persist within the community, as data for this analysis was collected from a specialized-care hospital. If female children with similar severity were taken to lower-level institutions rather than the tertiary facility, the prognosis and the outcomes could be different.

Introduction

Over the last 20 years, under 5 mortality has declined sharply in Bangladesh as a result of a range of public health interventions while the economy of the country remained resilient despite internal and external challenges. [1 2] However, in most parts of the world under 5 mortality is higher among boys than girls.[3] This can be explained by sex difference in the genetic and biological framework, with boys in their perinatal and early infancy being biologically weaker and more vulnerable to infectious diseases and premature deaths than their female counterparts.[4] At the same time, external causes mostly affect boys than girls causing a further increase in mortality.[5] That means in an ideal and equitable resource allocated condition, girls have better chances of survival to age 5 than boys[5 6], but the exception is the South Asian region, where both male and female under 5 mortality rates are equal.[7] Deprivation of

access to health and nutrition care relative to male children prevents females from being advantageous to higher survival.[8] However, there is a knowledge gap regarding the mechanisms that could play an important role in excess mortality. The most likely explanation can be the sex differences in child-rearing and/or care-seeking behavior. [9]

Although Bangladesh has achieved the child mortality target of MDG4 (under-five mortality rate is currently 46 per 1000 live births)[10], it is still unacceptably high. Despite different public health interventions in this country around 129,433 under 5 children die every year.[11] Moreover, the Bangladesh Demographic and Health Survey (BDHS) in 2014 reported that proportion of under-five mortality is 9% higher for females (48, compared with 44 per 1,000 live births in males)[12], which indicates that sex of the child may be a factor contributing to higher female child mortality in Bangladesh. This is a common scenario in other countries of South Asian region having the biggest sex disparities. [13 14]

The predilection for a male child is almost worldwide and has been revealed in varying degrees even in the developed world but is predominantly evident in male-dominated societies including Bangladesh. An intensive longitudinal study of 197 children aged 2–60 months in Matlab sub-district in rural Bangladesh observed no significant difference by sex in the incidence of diarrheal disease.[15] One more study in Matlab conducted during 1977–78 reported that visits to a diarrheal treatment facility which was free of cost were 66 percent higher for boys than girls aged 0–4 months even though the diarrheal attack rate was similar.[9] Such a treatment-seeking behavior has been indicated to get changed by the distance of health care center from their residence. A study conducted in rural Teknaf, Bangladesh found that within the first one-mile radius, 90 percent of diarrheal cases irrespective of male and female came to the clinic for treatment, but at two miles the attendance declined to 70 percent for males and 40 percent for females.[16]

We hypothesize that despite economic development and augmented literacy rates particularly that of women in Bangladesh, households are still discriminating against girls in seeking medical care. Considering the above mentioned context we examined gender disparities in diarrheal disease severity and treatment outcomes for children under the age of five years attending the icddr,b Dhaka hospital.

Materials and methods

Study design: This is a cross sectional analysis of a hospital-based surveillance system data collected between January'2008 to December'2017.

Setting: icddr,b is located in Dhaka city, the capital of Bangladesh. It primarily conducts research on aetiology, pathogenesis, prevention and treatment of diarrheal disease. It also deals with childhood pneumonia, nutrition, tuberculosis, vaccine, laboratory diagnosis and science, maternal, child, adolescent and mental health. Other than research it operates 2 hospitals in Bangladesh to treat patients with diarrhea, pneumonia, malnutrition and various complications. Around 150,000 patients attend the icddr,b Dhaka hospital each year.

Participants: For this analysis we selected a total of 13,391 children who were under 5 years of age and attended icddr,b Dhaka hospital during the time period of January 2008 to December 2017.

Variables: The primary outcome of interest of this analysis was the severity of diarrhea defined as 'dehydrating diarrhea', and 'non-dehydrating diarrhea'. According to the icddr,b 'Dhaka method' [17], diarrheal dehydration was classified into 'no dehydration', 'some dehydration' and 'severe dehydration'. If a child has any two of the following signs (irritable/restless, sunken eyes, thirst, skin pinch goes back after 2 – 3 seconds) he/she would be considered as a case of 'some dehydration'. If a child meets the criteria of some dehydration and has at least one of the following signs (lethargy/unconscious, inability to drink, un-recordable radial pulse) he/she would be considered as a case of 'severe dehydration'. If a child has none of the above signs, he or she would be considered as a case of ‘no dehydration’. In our analysis both the patients with ‘some’ and ‘severe’ dehydrated patients were defined as the cases of ‘dehydrating diarrhea’ and the patients with ‘no dehydration’ were defined as the cases of ‘non-dehydrating diarrhea’.

Explanatory variables for this analysis were selected after a thorough literature review. Thus we found that reviewing relevant literature we have found that gender of the neonate, birth order, parents’ education and monthly expenditure of the household were associated with the seeking care from a trained health care provider for the neonates. [17, 18]

Data source and data collection: Data used for this analysis were the Diarrheal Disease Surveillance System (DDSS) of icddr,b Dhaka hospital. The DDSS was established in 1979 to collect information on demographics, etiology and clinical characteristics of patients. Among all the patients attending the hospital a systematic 2% of patients of all ages are enrolled in the surveillance system. The DDSS was approved by the Research Review Committee and Ethical Review Committee of icddr,b. Informed voluntary consent was taken from all participants and for the minors informed verbal approval from parents, guardians, caregiver or any nearby family member were obtained and was documented in the DDSS database. Delinked medical reports were used in all data analyses. Data on socio-demographic status, morbidity, disease symptoms and nutritional status was collected and recorded on a web-based data collection tool using pre-tested standard questionnaires and validated tools. Anthropometric indices such as stunting, wasting and underweight were measured using World Health Organization (WHO) Anthro 2006 software.[19] Underweight was categorized into ‘normal WAZ’ (WAZ ≥ -2SD), ‘moderate underweight (WAZ ≥ -3SD & < -2SD)’, ‘severe underweight (WAZ < -3SD). Wasted was categorized into ‘normal WHZ’ (WHZ ≥ -2SD), ‘moderate wasting’ (WHZ ≥ -3SD & < -2SD) and ‘severe

134 wasting' (WHZ < −3SD), for stunting LAZ/HAZ-score less than -2 defined stunting and LAZ/HAZ-score less

135 than -3 defined severe stunting and rest (LAZ/HAZ ≥ −2SD) were normal LAZ/HAZ.[20]

136 **Bias:** All the data collection and anthropometric measurements were performed by the icddr,b staff

137 trained in data collection and anthropometry to prevent information or measurement bias.

138 **Sample size:** For this analysis all the children under 5 years of age included in the DDSS data base

139 between January 2008 and December 2017 were analyzed. A total of 13,361 participants fulfilled the

140 criteria for analyzable dataset.

141 **Statistical methods:** Data were analyzed using STATA/SE version 13.0. Descriptive statistics was carried

142 out to explore the distribution of different variables across the sex of the children. Mean and standard

143 deviation (SD) were used to report the normally distributed continuous variables and for the non-normal

144 continuous data median and interquartile range were used. Pearson's Chi-square test for the categorical

145 variables and Student's T-test and Wilcoxon rank-sum tests were used for the continuous variables.

146 Multivariable logistic regression analyses were performed to assess the contribution of 'sex' in

147 dehydrating diarrhea on admission for the adjustment of the confounding variables. All the co-variates

148 were chosen based on relevant literature and biological plausibility. Variables that were used to adjust

149 in the multivariable logistic regression analysis were age, nutritional status, parental education, wealth

150 index, positive stool culture, vomiting status, and birth order of the child.

151 **Patient and Public Involvement (PPI) statement**

152 No patient or public were involved with the development of research question, designing the study,

153 recruitment of participants, interpretation of the results, and will be involved during disseminating the

154 findings of the paper.

Results

The DDSS recruited a total of 13,361 under-five children between January 2008 to December 2017, and among them 61.5 % were male, 38.5 % were female. 51.28% of children met the case definition of Dehydrated Diarrhea.

The mean (±SD) age of the children with diarrhea was 5.63 (±3.49) months (Table 1). Both males and females were of similar age ($p > 0.05$). The median time duration of diarrhea between onset of illness and admission to icddr,b Dhaka hospital was 9 hours (IQR: 4-15), whereas the median distance travelled to come to the hospital for admission was 10 miles (IQR: 6-25) and it was significantly higher for male children (9.5 miles [IQR: 6 - 23] vs. 10 miles [IQR: 6 - 25] for females and males respectively; $P < 0.001$) (Table 1). At the time of hospital admission, one-third of the children had dehydrating diarrhea and among them 35% were females and 33% were males; $P = 0.01$. *Vibrio cholerae* was isolated from 4.08% of the cultured stool samples, and *Shigella* was isolated in 356 (2.66%) children suggesting the presence of invasive diarrhea. About 8.02% of all children were severely stunted, 9.08% of all children were severely underweight, and 6.41% children were severely wasted. In all the categories male children were significantly more undernourished than female children.

In bivariate analysis, we found that children with severe underweight had 3 times higher odds of attending the hospital with dehydrating diarrhea compared to the normal-weight children (OR: 3.30; 95% CI: 2.92 – 3.73) (Table 2) and it was 2 times higher among moderately underweight children (OR: 2.04; 95% CI: 1.86 – 2.24). In case of wasting the odds of hospital admissions with dehydrating diarrhea was higher among children who were severely or moderately wasted (OR: 3.13; 95% CI: 2.72 – 3.61; and OR: 2.09; 95% CI: 1.88 – 2.32, respectively) compared to the non-wasted children. A similar trend was seen for the stunted children cohort where the odds of hospital admission was higher in severe stunting (OR: 1.80; 95% CI: 1.58 – 2.04) and moderate stunting (OR: 1.33; 95% CI: 1.20 – 1.47) groups than the non-stunted children. The odds of hospital admissions with dehydrating diarrhea were 1.41 times higher among older children (OR: 1.41; 95% CI: 1.31 – 1.51); 5 times higher for those with a positive *Vibrio cholerae* stool culture (OR: 5.37, 95% CI: 4.44 – 6.50), 1.3 times more for the *Shigella* positive stool culture patients (OR: 1.3; 95% CI: 1.05 – 1.61), 2 times higher among those with a history of vomiting (OR: 2.18; 95% CI: 2.00 – 2.39); 1.51 times higher for children of 3rd or more birth order and it was 1.17 times higher for the 2nd birth order children (OR: 1.51; 95% CI: 1.37 – 1.67; OR: 1.17; 95% CI: 1.07 – 1.26) compared to the children with the 1st birth order. Parental education was found to be significantly associated with dehydrating diarrhea. Children having mother with no educational qualification were found to have 2.27 times higher odds of getting admitted with dehydrating diarrhea (OR: 2.27; 95% CI: 2.05 – 2.51) than those who had completed primary education and it was 1.53 times higher when it was less than primary education (OR: 1.53; 95% CI: 1.40 – 1.68). In case of paternal education, the ratio was 2.10 for no formal schooling (OR: 2.10; 95% CI: 1.91 – 2.31) and it was 1.52 for less than primary education (OR: 1.52; 95% CI: 1.39 – 1.66). In case of wealth quintile, the odds of hospital admissions for dehydrating diarrhea were 2.10, 1.76, 1.59 and 1.31 times higher for the poorest, poor, middle and rich groups respectively compared to the richest group. After adjusting for age group, parental education, positive stool culture for *Vibrio Cholerae* and *Shigella*, vomiting status, wealth quintiles, birth order, being underweight, wasted and stunted it was found that female children had a significantly higher odds of coming to the hospital with dehydrating diarrhea compared to the male children (OR: 1.11, 95% CI: 1.03 – 1.20, p-value: 0.007).

The majority of the children were treated with an antibiotic 11,757 (87.98%) after being admitted in the hospital (Table 3). Almost 20% of children received 2 or more medications at the hospital and this ratio did not differ by gender. The median duration of hospital stay was 11 hours and it was similar in both the sexes. Illness resolved prior to discharge in 12,447 (93.15%) of children, whereas 879 (6.58%) had

201 their illness continued, 34 (0.26%) left the hospital without the medical advice of a clinician and 3 (0.02%) children died. No gender-based disparity was observed in the hospital outcome of the children.

203 **Discussion:**

204 Conforming to other studies from the South Asian regions and Bangladesh, our study has revealed a discriminating disadvantage of female children in care-seeking from the hospital due to diarrhea.[21 22]

206 We found that in both the age groups (infant and older) a higher number of male children were brought to the hospital for diarrhea in comparison to the female children. On the other hand, we observed that the chance of female children to be brought to the hospital with dehydrating diarrhea is higher than male children. There could be some explanations: First, male children could have higher incidence rate of diarrhea compared to the female children. A study conducted among the under 5 children of USA between 1997 and 2000 found higher incidence rate of diarrhea among male children.[23] However, evidence from Bangladesh shows no significant difference in the incidence of diarrhea among the children[15], possible reason could be the pathogens. In Bangladesh the majority of the children were infected by the Enterotoxigenic *E.Coli* (ETEC) on the other hand in the USA the majority of the children had viral infection. Second, female children could have more severe form diarrhea compared to the male children, but we could not find any evidence of difference in severity of diarrhea between sexes among under-five children which could echo our findings.

218 We also observed that older children (12-59 months) had higher odds of developing dehydrating diarrhea which is similar to the other studies in Bangladesh [24]; possible explanation could be parents might seek health care for their children differently based on age and gender. A study conducted in West Bengal, India found girls were less likely to receive home fluid or ORS during diarrhoea .[25] The BDHS 2014, reported only 36 percent of all diarrheal patients visit a hospital or a health care provider of the locality and girls are discriminated against receiving ORS and zinc in case of diarrheal episodes in

Bangladesh[10]. Possibly more female children with dehydrating diarrhea might already have died at home without their parents seeking hospital care, or parents came to the hospital with their female children only when they developed more serious forms of illness. Or, perhaps parents decided to treat their female children elsewhere rather than bringing them to the hospital.

We found that wealth status was associated with seeking care for female children having dehydrating diarrhea, which is aligned with earlier findings that poor socioeconomic status was significantly associated with poor utilization of health facilities.[26-28] Interestingly, across all family income groups girls were less hospitalized compared to the boys. The finding is contradictory to the available literatures that suggest a declining trend in gender bias with the increase in family income.[28] Our study demonstrated distance as a significant factor which influenced female children's hospital attendance rate, which was in line with previous studies conducted in Bangladesh.[16] In Bangladesh, when a child suffers from diarrhea or any other diseases, in most of the cases, someone has to accompany the mother while she brings the child to a clinic. This requires considerable physical effort if the distance is too far, on the other hand as the majority of Bangladeshis are conservative Muslims, for mothers with female children travelling presents not only a physical barrier but a social barrier as well. As male children are overvalued, this mindset along with social and physical barrier dominates decision making regarding medical care of female children as the distance of the hospital increases.

Maternal income can also influence the decision-making process of the parents. Our study showed that when mothers were involved in any gainful employment, they were more likely to bring their female children to the hospital. Similarly, one of the influencing factors was family size, because it was evident from the earlier studies that having a smaller family size enabled the parents to spend more time and direct more resources on their ailing child. [29]

Our results showed that among the hospital attended children with the rise of birth order the ratio of children with dehydrated diarrhea increased, which might be due to parental preference more for children with younger birth order and with the increase in birth order with several small children they are less likely to manage a diarrheal episode optimally or they might just ignore the incidence.[30]

Deaths from diarrhea can be decreased by 93 per cent for children under five years of age when treated with ORS.[31] Our study showed that about 96% of children were treated with ORS in the icddr,b Dhaka hospital and about 88% of children received at least one antibiotic and a majority of the children got cured following their treatment.

This study shows no gender based disparity in the treatment of children with diarrhea at the icddr,b Dhaka hospital. The stool culture reports did not reveal any difference in the detection of invasive diarrhea in children by sex. Our study does not support the concept that there is a difference in the hospital care of the children by sex rather suggests that it is the difference in the care-seeking behavior of the parents for diarrhea prior to the hospitalization.

Our study also identified older age, malnutrition, invasive diarrhea, low literacy of the parents, poor socioeconomic condition and reporting of vomiting as predictors for having dehydrating diarrhea at the time of hospitalization. This study reports that around a quarter of under-five children who came to the hospital with diarrhea were undernourished, with males were suffering from a more severe form of undernutrition than females. Despite female children's better nutritional status, we observed a higher proportion of them were suffering from dehydrating diarrhea at the time of hospitalization, which is a matter of concern. This provides further evidence for gender based discrimination in the care-seeking behavior of the parents at the household levels.

Although there is limited evidence supporting male children parental preferences when deciding to seek care for diarrhea in Bangladesh, studies in other countries with similar results support our findings.

There has been a study carried out in Nepal among children under the age of 15 years showed that gender was central in the illness reporting, choice of external care, public provider and amount to be spent and in every situation, male children were privileged over female children.[32] A study conducted in a cluster of four villages in West Bengal, India found that male children had discriminating advantage in treatment-seeking from a qualified physician, travel distance for care and amount of healthcare expenditure.[25] Despite limited evidence, the trend indicates that parents prefer males over females when seeking health care for their children in South Asia.

Although this analysis shows a gap among parents in terms of seeking hospital care for their female children with diarrhea, these findings should be considered within few unavoidable limitations such as study design and data availability. First, data for this analysis was collected from a specialized-care hospital. Hence, we don't know whether these gender-based hospital attendance differences reflect the true gender disparity that might persist within the community. Second, in this study, at the moment of hospital admission, we observed a discrepancy between children's status of dehydration by gender. But, the other pre-existing confounding variables that could modify the odds of the dehydration status could not be explored. Moreover, if female children with similar severity were taken to lower-level institutions rather than the tertiary facility, the prognosis and the outcomes could be different.[33]

Despite these limitations, we observed that in this study setting, females are hospitalized less which is similar to the previous findings from Bangladesh [34]. Moreover, national data evidences that death rate of female children is higher at the community level of Bangladesh[35], and diarrhea is the second leading cause of under-five mortality worldwide.[7] Out of millions of diarrheal episodes among under-five children in a year only 2 – 3% develop life threatening dehydrating diarrhea.[36] These deaths are preventable by proper access to affordable healthcare, but unfortunately, In the low and middle-income countries like Bangladesh, female children are being punished in terms of survival because of gender inequality in the society.[37] A study conducted across 96 countries to see the association between Gender Inequality Index (GII) of women and prevalence of malnutrition and mortality among under-five children demonstrates significant positive association, suggesting gender equality as a predictor of the survival of children in the society.[38]

This analysis provides new insights into the severity and outcomes of diarrhea in children within icddr,b Dhaka hospital and evidenced gender-based disparity in the care-seeking behavior of the parents. Our findings are generalizable as icddr,b Dhaka hospital is known as the largest diarrheal disease hospital in the world, where children from all over the Bangladesh receive treatment and for this analysis we used previous 10-years of surveillance data which made this study robust. Further characterizations of incidence, severity of diarrhea, and qualitative research in terms of parental decision making, care seeking practices at the community level along with the real barriers to receive health care from the hospitals would be required to find out the real impact of the sex of the children on the results observed and to exclude parental preference of male child to seek care from the hospital. As far as a policy option to reduce the gender disparity in Bangladesh is concerned, our results suggest that more establishment of diarrheal disease hospitals especially in hard to reach areas of the country, raising awareness about the danger signs of dehydration and how to prevent them, women's education and empowerment to demonstrate their dynamic role at society level to equip them to take decision for her child can make the real change.

Conclusion

The study shows that female children were more likely to have dehydrating diarrhea when they were presented to the icddr,b Dhaka hospital, a specialized care hospital of Bangladesh. Community-based surveys need to be conducted to better understand the gender differentials in the incidence, severity of diarrhea and care seeking practices. Further research into behavioral and household-level factors which might lead to parental preferences for the care of children with diarrhea stratified by age and similar studies in different settings are required to get a profound insight into the role of gender in diarrheal management and outcomes of children attending to the hospitals of Bangladesh.

Acknowledgement: The authors would like to thank all the patients and their parents for sharing their time and providing consent and information necessary for the successful completion of the study. We also acknowledge the contribution of icddr,b's core donors including Government of the People's Republic of Bangladesh, Canada, Sweden and UK for their continuous support and commitment to the icddr,b's research efforts.

Contributorship statement: IM and TA conceived the study. SHK managed the data set and provided technical support. IM analyzed the data, developed the tables/graphs and wrote the initial draft of the manuscript. SD, ASGF and TA critically reviewed the manuscript and gave intellectual inputs. All authors contributed to the final version of the paper.

Funding: No funding was available for this work.

Competing interests: The authors do not have any competing interests to declare.

Patient consent: Informed written consent was obtained from the mother or primary caregiver.

Data sharing statement: The data sets generated and/or analyzed during the current study is not made publicly available. However, data inquires or further suggestions for analyses can be made to the corresponding author.

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Tables:

Table 1: Characteristics of children with diarrhea at the time of hospital admission

Characteristics	Total (N=13363)	Female (N=5,144)	Male (N=8,219)	P value
Child age (in years; Mean ± SD)	1.10 ± 0.79	1.10 ± 0.79	1.11 ± 0.79	0.170*
Child age category				
Infant (0 – 11 months)	7,593 (56.83)	2,977 (57.87)	4,616 (56.16)	0.052
Older (12 – 59 months)	5,770 (43.17)	2,167 (42.13)	3,603 (43.84)	Reference
Mother's education, n (%)				
No formal education	1,845 (13.81)	700 (13.6)	1,145 (13.9)	Reference
Up to primary (≤ 5 years of schooling)	2,807 (21.01)	1,087 (21.1)	1,720 (20.9)	0.591
More than primary (>5 years of schooling)	8,711 (65.19)	3,357 (65.3)	5,354 (65.1)	0.632
Father's education, n (%)				
No formal education	2,405 (18.00)	921 (17.90)	1,484 (18.06)	Reference
Up to primary	2,835 (21.22)	1,094 (21.27)	1,741 (21.18)	0.828
More than primary	8,123 (60.79)	3,129 (60.83)	4,994 (60.76)	0.842
Birth order of the child, n (%)				
1st	7,007	2,689 (52.3)	4,318 (52.5)	Reference
2nd	4,163	1,602 (31.1)	2,561 (31.2)	0.91
3rd or more	2,193	853 (16.6)	1,340 (16.3)	0.66
Total number of family members, n (%)				
Up to 4	6,597 (49.37)	2,629 (51.1)	3,968 (48.3)	0.001
5 or more	6,766 (50.63)	2,515 (48.9)	4,251 (51.7)	Reference
Income of the mother, n (%)				
Yes	1,372 (10.27)	570 (11.1)	802 (9.8)	0.014
No	11,991 (89.73)	4,574 (88.9)	7,417 (90.2)	Reference
Wealth Quintile, n (%)**				
Richest	529 (3.96)	226 (42.72)	303 (57.28)	0.003

Rich	4,721 (35.33)	1,882 (39.86)	2,839 (60.14)	0.001
Middle	2,531(18.94)	992 (39.19)	1,539 (60.81)	0.014
Poor	2,951 (22.08)	1,100 (37.28)	1,851 (62.72)	0.280
Poorest	2,631 (19.69)	944 (35.88)	1,687 (64.12)	Reference
Distance of travel, in miles, median (IQR)	10 (6, 25)	9.5 (6, 23)	10 (6, 25)	< 0.001
Duration of diarrhea before arrival, in hours, median (IQR) hours	41 (20,75)	40 (21,74)	41 (20,75)	0.628
Reporting of vomiting in the last 24 hours, n (%)				
No	3,630 (27.16)	1,333 (25.91)	2,297 (27.95)	0.01
Yes	9,733 (72.84)	3,811 (74.09)	5,922 (72.05)	Reference
***Vibrio cholerae*, n (%)**				
Positive	545 (4.08)	209 (4.06)	336 (4.09)	0.943
Negative	12,818 (95.92)	4,935 (95.94)	7,883 (95.91)	Reference
***Shigella*, n (%)**				
Positive	356 (2.66)	146 (2.84)	210 (2.56)	0.323
Negative	13,007 (97.34)	4,998 (97.16)	8,009 (97.44)	Reference
Undernutrition indicators, n (%)				
Normal WAZ	9,745 (73.77)	3,806 (74.72)	5,939 (73.18)	Reference
Moderate underweight	2,266 (17.15)	857 (16.82)	1,409 (17.36)	0.277
Severe underweight (	1,199 (9.08)	431 (8.46)	768 (9.46)	0.037
Normal WHZ	10,643 (80.57)	4,104 (80.57)	6,539 (80.57)	Reference
Moderate wasting	1,720 (13.02)	693 (13.60)	1,027 (12.65)	0.172
Severe wasting	847 (6.41)	297 (5.83)	550 (6.78)	0.044
Normal HAZ	10,209 (77.28)	4,070 (79.90)	6,139 (75.64)	Reference
Moderate stunting	1,941 (14.69)	694 (13.62)	1,247 (15.36)	0.001
Severe stunting	1,060 (8.02)	330 (6.48)	730 (8.99)	< 0.001

430 *Student's' t-Test

** Wealth quintile (composite measure of household's cumulative living standards) was categorized in to 'richest', 'rich', 'middle' 'poor' and 'poorest' based on certain criteria's such as household construction materials, presence of certain assets (radio, television, fan, almirah, cot), presence of electricity and gas, access to the sanitary latrine and the source of drinking water.

Table 2: Risk factors for dehydrating diarrhea in children at the time of hospital admission

Characteristics	**Dehydrating Diarrhea**		**Unadjusted OR (95% CI)**	**P value**	**Adjusted OR (95% CI)**	**P value**
	Dehydration	No Dehydration				
Sex						
Female	1,807 (39.89)	3,337 (37.78)	1.09 (1.01 – 1.17)	0.018	1.11 (1.03 – 1.20)	0.007
Male	2,723 (60.11)	5,496 (62.22)	1.0		1.0	
Child age (months)						
0 - 11	2,320 (51.21)	5,273(59.70)	1.0		1.0	
12 - 59	2,210 (48.79)	3,560 (40.30)	1.41 (1.31 – 1.51)	0.0001	1.20 (1.11 – 1.30)	<0.001
Mother education						
No formal education	893 (19.71)	952 (10.78)	2.27 (2.05 – 2.51)		1.27 (1.11 – 1.46)	<0.001
Up to primary	1,091 (24.08)	1,716 (19.43)	1.53 (1.40 – 1.68)	0.0001	1.11 (1.00 – 1.23)	0.048
More than primary	2,546 (56.20)	6,165 (69.80)	1.0	0.0001	1.0	
Father education						
No formal education	1,107 (24.44)	1,298 (14.69)	2.10 (1.91 – 2.31)	0.0001	1.31 (1.16 – 1.49)	<0.001
Up to primary	1,082 (23.89)	1,753 (19.85)	1.52 (1.39 – 1.66)	0.0001	1.17 (1.06 - 1.31)	0.002
More than primary	2,341 (51.68)	5,782 (65.46)	1.0		1.0	
Shigella infection						
Yes	142 (3.13)	214 (2.42)	1.30 (1.05 – 1.61)	0.016	1.32 (1.04 – 1.67)	0.018
No	4,388 (96.87)	8,619 (97.58)	1.0		1.0	
***Vibrio Cholerae* infection**						
Yes	392 (8.65)	153 (1.73)	5.37 (4.44 –	0.0001	3.86 (3.15 –	<0.001

			6.50)		4.72)	
No	4,138 (91.35)	8,680 (98.27)	1.0		1.0	
Vomiting						
Yes	3,728 (82.30)	6,005 (67.98)	2.18 (2.00 – 2.39)	0.0001	2.07 (1.89 – 2.28)	<0.001
No	802 (17.70)	2,828 (32.02)	1.0			
Wealth Quintile						
Richest	129 (2.85)	400 (4.53)	1.0			
Rich	1,406 (31.04)	3,315 (37.53)	1.31 (1.06 – 1.61)	0.01	1.22 (0.98 – 1.5)	0.069
Middle	859 (18.96)	1,672 (18.93)	1.59 (1.28 – 1.97)	0.0001	1.31 (1.04 – 1.64)	0.019
Poor	1,071 (23.64)	1,880 (21.28)	1.76 (1.42 – 2.18)	0.0001	1.41 (1.12 – 1.77)	0.003
Poorest	1,065 (23.51)	1,566 (17.73)	2.10 (1.70 – 2.60)	0.0001	1.41 (1.12 – 1.78)	0.003
Birth order						
1st	2,190 (48.34)	4,817 (54.53)	1.0			
2nd	1,446 (31.92)	2,717 (30.76)	1.17 (1.07 – 1.26)	0.0001	1.14 (1.04 – 1.24)	0.003
3rd or more	894 (19.74)	1,299 (14.71)	1.51 (1.37 – 1.67)	0.0001	1.19 (1.07 – 1.33)	0.001
Undernutrition indicators						
Normal WAZ	2,762 (62.00)	6,983 (79.76)	1.0		1.0	
Moderate underweight	1,014 (22.76)	1,252 (14.30)	2.04 (1.86 – 2.24)	0.0001	1.59 (1.41 – 1.80)	<0.001
Severe underweight	679 (15.24)	520 (5.94)	3.30 (2.92 – 3.73)	0.0001	2.11 (1.72 – 2.58)	<0.001
Wasting						
Normal WHZ	3,164 (71.02)	7,479 (85.43)	1.0			
Moderate Wasting	808 (18.14)	912 (10.42)	2.09 (1.88 – 2.32)	0.0001	1.37 (1.21 – 1.56)	<0.001
Severe wasting	483 (10.84)	364 (4.16)	3.13 (2.72 – 3.61)	0.0001	1.71 (1.42 – 2.07)	<0.001
Stunting						
Normal HAZ (≥	3,232 (72.55)	6,977 (79.69)	1.0			
Moderate stunting	741 (16.63)	1,200 (13.71)	1.33 (1.20 – 1.47)	0.0001	0.91 (0.81 – 1.03)	0.533
Severe stunting	482 (10.82)	578 (6.60)	1.80 (1.58 – 2.04)	0.0001	0.94 (0.79 – 1.12)	0.145

Table 3: Pattern of management of diarrhea and outcome in hospital by sex

Variables	Total (N=13,363)	Female (N=5,144)	Male (N=8,219)	P value
ORS given, n (%)	12,867 (96.30)	4,948 (96.21)	7,919 (96.36)	0.648*
Antibiotic was given, n (%)				0.94***
• No antibiotic	1,606 (12.02)	627 (12.19)	979 (11.91)	
• 1 antibiotic	9,054 (67.75)	3,446 (66.99)	5,608 (68.23)	
• 2 antibiotics	2,257 (16.89)	894 (17.38)	1,363 (16.58)	
• 3 or more antibiotics	446 (3.34)	177 (3.44)	269 (3.27)	
Length of stay in the hospital (hours), Median (IQR)	11(2,26)	11(2,26)	11(2,26)	0.839**
Outcome of the patient, n (%)				0.561***
• Children discharged by doctors after cure	12,447(93.15)	4,814(93.58)	7,633(92.87)	
• Illness continued	879 (6.58)	317(6.16)	562(6.84)	
• Children died in hospital after admission	3(0.02)	1(0.02)	2(0.02)	
• Children left hospital against medical advice	34 (0.26)	12(0.24)	22(0.27)	

* t-test; ** Wilcoxon rank-sum test; *** Pearson's chi-square test

STROBE (Strengthening The Reporting of OBservational Studies in Epidemiology) Checklist

A checklist of items that should be included in reports of observational studies. You must report the page number in your manuscript where you consider each of the items listed in this checklist. If you have not included this information, either revise your manuscript accordingly before submitting or note N/A.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

Section and Item	Item No.	Recommendation	Reported on Page No.
Title and Abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	
Introduction			
Background/Rationale	2	Explain the scientific background and rationale for the investigation being reported	
Objectives	3	State specific objectives, including any prespecified hypotheses	
Methods			
Study Design	4	Present key elements of study design early in the paper	
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	
Participants	6	(*a*) *Cohort study*—Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up *Case-control study*—Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls *Cross-sectional study*—Give the eligibility criteria, and the sources and methods of selection of participants	
		(*b*) *Cohort study*—For matched studies, give matching criteria and number of exposed and unexposed *Case-control study*—For matched studies, give matching criteria and the number of controls per case	
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	

Section and Item	Item No.	Recommendation	Reported on Page No.
Data Sources/ Measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	
Bias	9	Describe any efforts to address potential sources of bias	
Study Size	10	Explain how the study size was arrived at	
Quantitative Variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	
Statistical Methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	
		(*b*) Describe any methods used to examine subgroups and interactions	
		(*c*) Explain how missing data were addressed	
		(*d*) *Cohort study*—If applicable, explain how loss to follow-up was addressed *Case-control study*—If applicable, explain how matching of cases and controls was addressed *Cross-sectional study*—If applicable, describe analytical methods taking account of sampling strategy	
		(*e*) Describe any sensitivity analyses	
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	
		(b) Give reasons for non-participation at each stage	
		(c) Consider use of a flow diagram	
Descriptive Data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	
		(b) Indicate number of participants with missing data for each variable of interest	
		(c) *Cohort study*—Summarise follow-up time (eg, average and total amount)	
Outcome Data	15*	*Cohort study*—Report numbers of outcome events or summary measures over time	
		Case-control study—Report numbers in each exposure category, or summary measures of exposure	
		Cross-sectional study—Report numbers of outcome events or summary measures	

Section and Item	Item No.	Recommendation	Reported on Page No.
Main Results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	
		(*b*) Report category boundaries when continuous variables were categorized	
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	
Other Analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	
Discussion			
Key Results	18	Summarise key results with reference to study objectives	
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	
Generalisability	21	Discuss the generalisability (external validity) of the study results	
Other Information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

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BMJ Open

Gender disparity in care-seeking behaviors and treatment outcomes for dehydrating diarrhea among under five children admitted to a diarrheal disease hospital of Bangladesh: An analysis of hospital-based surveillance data.

Journal:	*BMJ Open*
Manuscript ID	bmjopen-2020-038730.R2
Article Type:	Original research
Date Submitted by the Author:	04-Aug-2020
Complete List of Authors:	Mahmud, Imteaz; International Centre for Diarrhoeal Disease Research Bangladesh, Nutrition and Clinical Services Division Das, Subhasish; International Centre for Diarrhoeal Disease Research Bangladesh, Nutrition and Clinical Services Division Khan, Soroar ; International Centre for Diarrhoeal Disease Research Bangladesh, Nutrition and clinical Services Division Faruque, Abu; International Centre for Diarrhoeal Disease Research Bangladesh, Nutrition and Clinical Services division Ahmed, Tahmeed; International Centre for Diarrhoeal Disease Research Bangladesh, Nutrition and Clinical Services Division
Primary Subject Heading:	Public health
Secondary Subject Heading:	Global health
Keywords:	Public health < INFECTIOUS DISEASES, Community child health < PAEDIATRICS, Epidemiology < TROPICAL MEDICINE

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Title: Gender disparity in care-seeking behaviors and treatment outcomes for dehydrating diarrhea among under five children admitted to a diarrheal disease hospital of Bangladesh: An analysis of hospital-based surveillance data

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Body text word count: 3624

Key words: Gender Disparity; care-seeking behaviors; dehydrating diarrhea; under five children

Abstract

Introduction: Despite economic development and augmented literacy rates, Bangladeshi households are still discriminating against girls in seeking medical care. We examined gender disparities in diarrheal disease severity and treatment outcomes of under five children.

Setting: A tertiary level diarrheal disease hospital of Dhaka, Bangladesh.

Participants: 13,361 under-5 children admitted to the hospital between January'2008 to December'2017.

Outcome variables and method: The primary outcome of interest of this analysis was the severity of diarrhea defined as 'dehydrating diarrhea', and 'non-dehydrating diarrhea. Multivariable logistic regression analyses were performed to assess the association of 'gender' in dehydrating diarrhea on admission to the hospital.

Results: A data of 13,321 children under 5 years of age were analyzed for this study out of which 61.5 % were male and 38.5 % were female. The mean (±SD) age of the children with diarrhea was 5.63 (±3.49) months. The median distance travelled to come to the hospital for admission was 10 miles (IQR: 6-25) and it was significantly higher for male (10 miles [IQR: 6 - 25]) than Female children (9.5 miles [IQR: 6 - 23]), P < 0.001. Female children had 1.11 times higher odds (adjusted OR: 1.11, 95% CI: 1.03 – 1.20, p-value: 0.007) of presenting with dehydrating diarrhea than the male children at the time of hospital admission. Almost 20% of children received 2 or more medications during the period of hospital admission and it did not differ by gender. Median duration of hospital stay was (11 hours) was similar in both the sexes. No gender-based disparity was observed in management of diarrhea and hospital outcome of the children.

Conclusion: We found that female children were more likely to have dehydrating diarrhea when they were presented to the icddr,b Dhaka hospital. No gender-based disparity was observed in the hospital outcome of the children.

Strengths and limitations of this study

- Data have been collected from an ongoing diarrheal disease surveillance system where a systematic 2% of patients attending the hospital were enrolled.
- This analysis was done with data from 13,361 patients less than five years old visiting the icddr,b Dhaka hospital for over a decade (between January 2008 and December 2017).
- We don't know whether these gender-based hospital attendance differences reflect the true gender disparity that might persist within the community, as data for this analysis was collected from a specialized-care hospital. If female children with similar severity were taken to lower-level institutions rather than the tertiary facility, the prognosis and the outcomes could be different.

Introduction

Over the last 20 years, under 5 mortality has declined sharply in Bangladesh as a result of a range of public health interventions while the economy of the country remained resilient despite internal and external challenges. [1 2] However, in most parts of the world under 5 mortality is higher among boys than girls.[3] This can be explained by sex difference in the genetic and biological framework, with boys in their perinatal and early infancy being biologically weaker and more vulnerable to infectious diseases and premature deaths than their female counterparts.[4] At the same time, external causes mostly affect boys than girls causing a further increase in mortality.[5] That means in an ideal and equitable resource allocated condition, girls have better chances of survival to age 5 than boys[5 6], but the exception is the South Asian region, where both male and female under 5 mortality rates are equal.[7] Deprivation of

access to health and nutrition care relative to male children prevents females from being advantageous to higher survival.[8] However, there is a knowledge gap regarding the mechanisms that could play an important role in excess mortality. The most likely explanation can be the sex differences in child-rearing and/or care-seeking behavior. [9]

Although Bangladesh has achieved the child mortality target of MDG4 (under-five mortality rate is currently 46 per 1000 live births)[10], it is still unacceptably high. Despite different public health interventions in this country around 129,433 under 5 children die every year.[11] Moreover, the Bangladesh Demographic and Health Survey (BDHS) in 2014 reported that proportion of under-five mortality is 9% higher for females (48, compared with 44 per 1,000 live births in males)[12], which indicates that sex of the child may be a factor contributing to higher female child mortality in Bangladesh. This is a common scenario in other countries of South Asian region having the biggest sex disparities. [13 14]

The predilection for a male child can be seen in many countries in varying degrees[15]. In Bangladesh, a study done in Matlab conducted during 1977–78 reported that visits to a diarrheal treatment facility which was free of cost were 66 percent higher for boys than girls aged 0–4 months even though the diarrheal attack rate was similar.[9] Such a treatment-seeking behavior has been indicated to get changed by the distance of health care center from their residence. A study conducted in rural Teknaf, Bangladesh found that within the first one-mile radius, 90 percent of diarrheal cases irrespective of male and female came to the clinic for treatment, but at two miles the attendance declined to 70 percent for males and 40 percent for females.[16]

We hypothesize that despite economic development and augmented literacy rates particularly that of women in Bangladesh, households are still discriminating against girls in seeking medical care.

Considering the above mentioned context we examined gender disparities in diarrheal disease severity and treatment outcomes for children under the age of five years attending the icddr,b Dhaka hospital.

Materials and methods

Study design: This is a cross sectional analysis of a hospital-based surveillance system data collected between January'2008 to December'2017.

Setting: icddr,b is located in Dhaka city, the capital of Bangladesh. It primarily conducts research on aetiology, pathogenesis, prevention and treatment of diarrheal disease. It also deals with childhood pneumonia, nutrition, tuberculosis, vaccine, laboratory diagnosis and science, maternal, child, adolescent and mental health. Other than research it operates 2 hospitals in Bangladesh to treat patients with diarrhea, pneumonia, malnutrition and various complications. Around 150,000 patients attend the icddr,b Dhaka hospital each year.

Participants: For this analysis we selected a total of 13,391 children who were under 5 years of age and attended icddr,b Dhaka hospital during the time period of January 2008 to December 2017.

Variables: The primary outcome of interest of this analysis was the severity of diarrhea defined as 'dehydrating diarrhea', and 'non-dehydrating diarrhea'. According to the icddr,b 'Dhaka method' [17], diarrheal dehydration was classified into 'no dehydration', 'some dehydration' and 'severe dehydration'. If a child has any two of the following signs (irritable/restless, sunken eyes, thirst, skin pinch goes back after 2 – 3 seconds) he/she would be considered as a case of 'some dehydration'. If a child meets the criteria of some dehydration and has at least one of the following signs (lethargy/unconscious, inability to drink, un-recordable radial pulse) he/she would be considered as a case of 'severe dehydration'. If a child has none of the above signs, he or she would be considered as a case of 'no dehydration'. In our analysis both the patients with 'some' and 'severe' dehydrated patients were defined as the cases of 'dehydrating diarrhea' and the patients with 'no dehydration' were defined as the cases of 'non-dehydrating diarrhea'.

Explanatory variables for this analysis were selected after a thorough literature review. Thus we have found that gender of the neonate, birth order, parents' education and monthly expenditure of the household were associated with the seeking care from a trained health care provider for the neonates.[17 18]

Data source and data collection: Data used for this analysis were the Diarrheal Disease Surveillance System (DDSS) of icddr,b Dhaka hospital. The DDSS was established in 1979 to collect information on demographics, etiology and clinical characteristics of patients. Among all the patients attending the hospital a systematic 2% of patients of all ages are enrolled in the surveillance system. The DDSS was approved by the Research Review Committee and Ethical Review Committee of icddr,b. Informed voluntary consent was taken from all participants and for the minors informed verbal approval from parents, guardians, caregiver or any nearby family member were obtained and was documented in the DDSS database. Delinked medical reports were used in all data analyses. Data on socio-demographic status, morbidity, disease symptoms and nutritional status was collected and recorded on a web-based data collection tool using pre-tested standard questionnaires (supplementary file 1) and validated tools. Anthropometric indices such as stunting, wasting and underweight were measured using World Health Organization (WHO) Anthro 2006 software.[19] Underweight was categorized into 'normal WAZ' (WAZ $\geq$ $-$2SD), 'moderate underweight (WAZ $\geq$ $-$3SD & < $-$2SD)', 'severe underweight (WAZ < $-$3SD). Wasted was categorized into 'normal WHZ' (WHZ $\geq$ $-$2SD), 'moderate wasting' (WHZ $\geq$ $-$3SD & < $-$2SD) and 'severe wasting' (WHZ < $-$3SD), for stunting LAZ/HAZ-score less than -2 defined stunting and LAZ/HAZ-score less than -3 defined severe stunting and rest (LAZ/HAZ $\geq$ $-$2SD) were normal LAZ/HAZ.[20]

Bias: All the data collection and anthropometric measurements were performed by the icddr,b staff trained in data collection and anthropometry to prevent information or measurement bias.

Sample size: For this analysis all the children under 5 years of age included in the DDSS data base between January 2008 and December 2017 were analyzed. A total of 13,361 participants fulfilled the criteria for analyzable dataset.

Statistical methods: Data were analyzed using STATA/SE version 13.0. Descriptive statistics was carried out to explore the distribution of different variables across the sex of the children. Mean and standard deviation (SD) were used to report the normally distributed continuous variables and for the non-normal continuous data median and interquartile range were used. Pearson's Chi-square test for the categorical variables and Student's T-test and Wilcoxon rank-sum tests were used for the continuous variables.

Multivariable logistic regression analyses were performed to assess the contribution of 'sex' in dehydrating diarrhea on admission for the adjustment of the confounding variables. All the co-variates were chosen based on relevant literature and biological plausibility. Variables that were used to adjust in the multivariable logistic regression analysis were age, nutritional status, parental education, wealth index, positive stool culture, vomiting status, and birth order of the child.

Patient and Public Involvement (PPI) statement

Patients or the public were not involved in the design, or conduct, or reporting, or dissemination plans of our research.

Results

The DDSS recruited a total of 13,361 under-five children between January 2008 to December 2017, and among them 61.5 % were male, 38.5 % were female. 51.28% of children met the case definition of Dehydrated Diarrhea.

The mean (±SD) age of the children with diarrhea was 5.63 (±3.49) months (Table 1). Both males and females were of similar age (p >0.05). The median time duration of diarrhea between onset of illness and admission to icddr,b Dhaka hospital was 41 hours (IQR: 20 - 75), whereas the median distance travelled to come to the hospital for admission was 10 miles (IQR: 6 - 25) and it was significantly higher for male (10 miles [IQR: 6 - 25]) than female children (9.5 miles [IQR: 6 - 23]) , p-value < 0.001) (Table 1). At the time of hospital admission, one-third of the children had dehydrating diarrhea and among them 35% were females and 33% were males; P = 0.01. *Vibrio cholerae* was isolated from 4.08% of the cultured stool samples, and *Shigella* was isolated in 356 (2.66%) children suggesting the presence of invasive diarrhea. About 8.02% of all children were severely stunted, 9.08% of all children were severely underweight, and 6.41% children were severely wasted. In all the categories male children were significantly more undernourished than female children.

In bivariate analysis, we found that children with severe underweight had 3 times higher odds of attending the hospital with dehydrating diarrhea compared to the normal-weight children (OR: 3.30; 95% CI: 2.92 – 3.73) (Table 2) and it was 2 times higher among moderately underweight children (OR: 2.04; 95% CI: 1.86 – 2.24). In case of wasting the odds of hospital admissions with dehydrating diarrhea was higher among children who were severely or moderately wasted (OR: 3.13; 95% CI: 2.72 – 3.61; and OR: 2.09; 95% CI: 1.88 – 2.32, respectively) compared to the non-wasted children. A similar trend was seen for the stunted children cohort where the odds of hospital admission was higher in severe stunting (OR: 1.80; 95% CI: 1.58 – 2.04) and moderate stunting (OR: 1.33; 95% CI: 1.20 – 1.47) groups than the non-stunted children. The odds of hospital admissions with dehydrating diarrhea were 1.41 times higher among older children (OR: 1.41; 95% CI: 1.31 – 1.51); 5 times higher for those with a positive *Vibrio cholerae* stool culture (OR: 5.37, 95% CI: 4.44 – 6.50), 1.3 times more for the *Shigella* positive stool culture patients (OR: 1.3; 95% CI: 1.05 – 1.61), 2 times higher among those with a history of vomiting (OR: 2.18; 95% CI: 2.00 – 2.39); 1.51 times higher for children of 3rd or more birth order and it was 1.17 times higher for the 2nd birth order children (OR: 1.51; 95% CI: 1.37 – 1.67; OR: 1.17; 95% CI: 1.07 – 1.26) compared to the children with the 1st birth order. Parental education was found to be significantly associated with dehydrating diarrhea. Children having mother with no educational qualification were found to have 2.27 times higher odds of getting admitted with dehydrating diarrhea (OR: 2.27; 95% CI: 2.05 – 2.51) than those who had completed primary education and it was 1.53 times higher when it was less than primary education (OR: 1.53; 95% CI: 1.40 – 1.68). In case of paternal education, the ratio was 2.10 for no formal schooling (OR: 2.10; 95% CI: 1.91 – 2.31) and it was 1.52 for less than primary education (OR: 1.52; 95% CI: 1.39 – 1.66). In case of wealth quintile, the odds of hospital admissions for dehydrating diarrhea were 2.10, 1.76, 1.59 and 1.31 times higher for the poorest, poor, middle and rich groups respectively compared to the richest group. After adjusting for age group, parental education, positive stool culture for *Vibrio Cholerae* and *Shigella*, vomiting status, wealth quintiles, birth order, being underweight, wasted and stunted it was found that female children had a significantly higher odds of coming to the hospital with dehydrating diarrhea compared to the male children (OR: 1.11, 95% CI: 1.03 – 1.20, p-value: 0.007).

The majority of the children were treated with an antibiotic 11,757 (87.98%) after being admitted in the hospital (Table 3). Almost 20% of children received 2 or more medications at the hospital and this ratio did not differ by gender. The median duration of hospital stay was 11 hours and it was similar in both the sexes. Illness resolved prior to discharge in 12,447 (93.15%) of children, whereas 879 (6.58%) had their illness continued, 34 (0.26%) left the hospital without the medical advice of a clinician and 3 (0.02%) children died. No gender-based disparity was observed in the hospital outcome of the children.

Discussion:

Conforming to other studies from the South Asian regions and Bangladesh, our study has revealed a discriminating disadvantage of female children in care-seeking from the hospital due to diarrhea.[21 22]

We found that in both the age groups (infant and older) a higher number of male children were brought to the hospital for diarrhea in comparison to the female children. On the other hand, we observed that the chance of female children to be brought to the hospital with dehydrating diarrhea is higher than male children. There could be some explanations: First, male children could have higher incidence rate of diarrhea compared to the female children. A study conducted among the under 5 children of USA between 1997 and 2000 found higher incidence rate of diarrhea among male children.[23] However, evidence from Bangladesh shows no significant difference in the incidence of diarrhea among the children[15], possible reason could be the pathogens. In Bangladesh the majority of the children were infected by the Enterotoxigenic *E.Coli* (ETEC) on the other hand in the USA the majority of the children had viral infection. Second, female children could have more severe form diarrhea compared to the male children, but we could not find any evidence of difference in severity of diarrhea between sexes among under-five children which could echo our findings.

We also observed that older children (12-59 months) had higher odds of developing dehydrating diarrhea which is similar to the other studies in Bangladesh [24]; possible explanation could be parents might seek health care for their children differently based on age and gender. A study conducted in West Bengal, India found girls were less likely to receive home fluid or ORS during diarrhoea .[25] The BDHS 2014, reported only 36 percent of all diarrheal patients visit a hospital or a health care provider of the locality and girls are discriminated against receiving ORS and zinc in case of diarrheal episodes in Bangladesh[10]. Possibly more female children with dehydrating diarrhea might already have died at home without their parents seeking hospital care, or parents came to the hospital with their female children only when they developed more serious forms of illness. Or, perhaps parents decided to treat their female children elsewhere rather than bringing them to the hospital.

We found that wealth status was associated with seeking care for female children having dehydrating diarrhea, which is aligned with earlier findings that poor socioeconomic status was significantly associated with poor utilization of health facilities.[26-28] Interestingly, across all family income groups girls were less hospitalized compared to the boys. The finding is contradictory to the available literatures that suggest a declining trend in gender bias with the increase in family income.[28] Our study demonstrated distance as a significant factor which influenced female children's hospital attendance rate, which was in line with previous studies conducted in Bangladesh.[16] In Bangladesh, when a child suffers from diarrhea or any other diseases, in most of the cases, someone has to accompany the mother while she brings the child to a clinic. This requires considerable physical effort if the distance is too far, on the other hand as the majority of Bangladeshis are conservative Muslims, for mothers with female children travelling presents not only a physical barrier but a social barrier as well. As female children are undervalued, this mindset along with social and physical barrier dominates decision making regarding medical care of female children as the distance of the hospital increases.

Maternal income can also influence the decision-making process of the parents. Our study showed that when mothers were involved in any gainful employment, they were more likely to bring their female children to the hospital. This can be explained by the four hierarchical steps of household decision making on child health care of which the 3rd and 4th steps are the "choice of the provider" and "health care expenditure"[29]. This study also echoed our findings that mothers with gainful employment had superior economic and demographic status that empowered them to take decision regarding choice of health care and expenditure for their children[29].

244 Similarly, one of the influencing factors was family size, because it was evident from the earlier studies that having a smaller family size enabled the parents to spend more time and direct more resources on their ailing child. [30]

Our results showed that among the hospital attended children with the rise of birth order the ratio of children with dehydrated diarrhea increased, which might be due to parental preference more for children with younger birth order and with the increase in birth order with several small children they are less likely to manage a diarrheal episode optimally or they might just ignore the incidence.[31]

Deaths from diarrhea can be decreased by 93 per cent for children under five years of age when treated with ORS.[32] Our study showed that about 96% of children were treated with ORS in the icddr,b Dhaka hospital and about 88% of children received at least one antibiotic and a majority of the children got cured following their treatment.

This study shows no gender based disparity in the treatment of children with diarrhea at the icddr,b Dhaka hospital. The stool culture reports did not reveal any difference in the detection of invasive diarrhea in children by sex. Our study does not support the concept that there is a difference in the hospital care of the children by sex rather suggests that it is the difference in the care-seeking behavior of the parents for diarrhea prior to the hospitalization.

Our study also identified older age, malnutrition, invasive diarrhea, low literacy of the parents, poor socioeconomic condition and reporting of vomiting as predictors for having dehydrating diarrhea at the time of hospitalization. This study reports that around a quarter of under-five children who came to the hospital with diarrhea were undernourished, with males were suffering from a more severe form of undernutrition than females. Despite female children’s better nutritional status, we observed a higher proportion of them were suffering from dehydrating diarrhea at the time of hospitalization, which is a

266 matter of concern. This provides further evidence for gender based discrimination in the care-seeking behavior of the parents at the household levels.

268 Although there is limited evidence supporting male children parental preferences when deciding to seek care for diarrhea in Bangladesh, studies in other countries with similar results support our findings. There has been a study carried out in Nepal among children under the age of 15 years showed that gender was central in the illness reporting, choice of external care, public provider and amount to be spent and in every situation, male children were privileged over female children.[33] A study conducted in a cluster of four villages in West Bengal, India found that male children had discriminating advantage in treatment-seeking from a qualified physician, travel distance for care and amount of healthcare expenditure.[25] Despite limited evidence, the trend indicates that parents prefer males over females when seeking health care for their children in South Asia.

277 Although this analysis shows a gap among parents in terms of seeking hospital care for their female children with diarrhea, these findings should be considered within few unavoidable limitations such as study design and data availability. First, data for this analysis was collected from a specialized-care hospital. Hence, we don't know whether these gender-based hospital attendance differences reflect the true gender disparity that might persist within the community. Second, in this study, at the moment of hospital admission, we observed a discrepancy between children's status of dehydration by gender. But, the other pre-existing confounding variables that could modify the odds of the dehydration status could not be explored. Moreover, if female children with similar severity were taken to lower-level institutions rather than the tertiary facility, the prognosis and the outcomes could be different.[34]

286 Despite these limitations, we observed that in this study setting, females are hospitalized less which is similar to the previous findings from Bangladesh [35]. Moreover, national data evidences that death rate of female children is higher at the community level of Bangladesh[36], and diarrhea is the second leading

cause of under-five mortality worldwide.[7] Out of millions of diarrheal episodes among under-five children in a year only 2 – 3% develop life threatening dehydrating diarrhea.[37] These deaths are preventable by proper access to affordable healthcare, but unfortunately, In the low and middle-income countries like Bangladesh, female children are being punished in terms of survival because of gender inequality in the society.[38] A study conducted across 96 countries to see the association between Gender Inequality Index (GII) of women and prevalence of malnutrition and mortality among under-five children demonstrates significant positive association, suggesting gender equality as a predictor of the survival of children in the society.[39]

This analysis provides new insights into the severity and outcomes of diarrhea in children within icddr,b Dhaka hospital and evidenced gender-based disparity in the care-seeking behavior of the parents. Our findings are generalizable as icddr,b Dhaka hospital is known as the largest diarrheal disease hospital in the world, where children from all over the Bangladesh receive treatment and for this analysis we used previous 10-years of surveillance data which made this study robust. Further characterizations of incidence, severity of diarrhea, and qualitative research in terms of parental decision making, care seeking practices at the community level along with the real barriers to receive health care from the hospitals would be required to find out the real impact of the sex of the children on the results observed and to exclude parental preference of male child to seek care from the hospital. As far as a policy option to reduce the gender disparity in Bangladesh is concerned, our results suggest that more establishment of diarrheal disease hospitals especially in hard to reach areas of the country, raising awareness about the danger signs of dehydration and how to prevent them, women's education and empowerment to demonstrate their dynamic role at society level to equip them to take decision for her child can make the real change.

Conclusion

312 The study shows that female children were more likely to have dehydrating diarrhea when they were presented to the icddr,b Dhaka hospital, a specialized care hospital of Bangladesh. Community-based surveys need to be conducted to better understand the gender differentials in the incidence, severity of diarrhea and care seeking practices. Further research into behavioral and household-level factors which might lead to parental preferences for the care of children with diarrhea stratified by age and similar studies in different settings are required to get a profound insight into the role of gender in diarrheal management and outcomes of children attending to the hospitals of Bangladesh.

Acknowledgement: The authors would like to thank all the patients and their parents for sharing their time and providing consent and information necessary for the successful completion of the study. We also acknowledge the contribution of icddr,b's core donors including Government of the People's Republic of Bangladesh, Canada, Sweden and UK for their continuous support and commitment to the icddr,b's research efforts.

Contributorship statement: IM and TA conceived the study. SHK managed the data set and provided technical support. IM analyzed the data, developed the tables/graphs and wrote the initial draft of the manuscript. SD, AF and TA critically reviewed the manuscript and gave intellectual inputs. All authors contributed to the final version of the paper.

Funding: No funding was available for this work.

Competing interests: The authors do not have any competing interests to declare.

Patient consent: Informed written consent was obtained from the mother or primary caregiver.

Data sharing statement: Data are available upon reasonable request.

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Tables:

Table 1: Characteristics of children with diarrhea at the time of hospital admission

Characteristics	Total (N=13363)	Female (N=5,144)	Male (N=8,219)	P value
Child age (in years; Mean ± SD)	1.10 ± 0.79	1.10 ± 0.79	1.11 ± 0.79	0.170*
Child age category				
Infant (0 – 11 months)	7,593 (56.83)	2,977 (57.87)	4,616 (56.16)	0.052
Older (12 – 59 months)	5,770 (43.17)	2,167 (42.13)	3,603 (43.84)	Reference
Mother's education, n (%)				
No formal education	1,845 (13.81)	700 (13.6)	1,145 (13.9)	Reference
Up to primary (≤ 5 years of schooling)	2,807 (21.01)	1,087 (21.1)	1,720 (20.9)	0.591
More than primary (>5 years of schooling)	8,711 (65.19)	3,357 (65.3)	5,354 (65.1)	0.632
Father's education, n (%)				
No formal education	2,405 (18.00)	921 (17.90)	1,484 (18.06)	Reference
Up to primary	2,835 (21.22)	1,094 (21.27)	1,741 (21.18)	0.828
More than primary	8,123 (60.79)	3,129 (60.83)	4,994 (60.76)	0.842
Birth order of the child, n (%)				
1st	7,007	2,689 (52.3)	4,318 (52.5)	Reference
2nd	4,163	1,602 (31.1)	2,561 (31.2)	0.91
3rd or more	2,193	853 (16.6)	1,340 (16.3)	0.66
Total number of family members, n (%)				
Up to 4	6,597 (49.37)	2,629 (51.1)	3,968 (48.3)	0.001
5 or more	6,766 (50.63)	2,515 (48.9)	4,251 (51.7)	Reference
Income of the mother, n (%)				
Yes	1,372 (10.27)	570 (11.1)	802 (9.8)	0.014
No	11,991 (89.73)	4,574 (88.9)	7,417 (90.2)	Reference
Wealth Quintile, n (%)**				
Richest	529 (3.96)	226 (42.72)	303 (57.28)	0.003
Rich	4,721 (35.33)	1,882 (39.86)	2,839 (60.14)	0.001

Middle	2,531(18.94)	992 (39.19)	1,539 (60.81)	0.014
Poor	2,951 (22.08)	1,100 (37.28)	1,851 (62.72)	0.280
Poorest	2,631 (19.69)	944 (35.88)	1,687 (64.12)	Reference
Distance of travel, in miles, median (IQR)	10 (6, 25)	9.5 (6, 23)	10 (6, 25)	< 0.001
Duration of diarrhea before arrival, in hours, median (IQR) hours	41 (20,75)	40 (21,74)	41 (20,75)	0.628
Reporting of vomiting in the last 24 hours, n (%)				
No	3,630 (27.16)	1,333 (25.91)	2,297 (27.95)	0.01
Yes	9,733 (72.84)	3,811 (74.09)	5,922 (72.05)	Reference
***Vibrio cholerae*, n (%)**				
Positive	545 (4.08)	209 (4.06)	336 (4.09)	0.943
Negative	12,818 (95.92)	4,935 (95.94)	7,883 (95.91)	Reference
***Shigella*, n (%)**				
Positive	356 (2.66)	146 (2.84)	210 (2.56)	0.323
Negative	13,007 (97.34)	4,998 (97.16)	8,009 (97.44)	Reference
Undernutrition indicators, n (%)				
Normal WAZ	9,745 (73.77)	3,806 (74.72)	5,939 (73.18)	Reference
Moderate underweight	2,266 (17.15)	857 (16.82)	1,409 (17.36)	0.277
Severe underweight (	1,199 (9.08)	431 (8.46)	768 (9.46)	0.037
Normal WHZ	10,643 (80.57)	4,104 (80.57)	6,539 (80.57)	Reference
Moderate wasting	1,720 (13.02)	693 (13.60)	1,027 (12.65)	0.172
Severe wasting	847 (6.41)	297 (5.83)	550 (6.78)	0.044
Normal HAZ	10,209 (77.28)	4,070 (79.90)	6,139 (75.64)	Reference
Moderate stunting	1,941 (14.69)	694 (13.62)	1,247 (15.36)	0.001
Severe stunting	1,060 (8.02)	330 (6.48)	730 (8.99)	< 0.001

426 *Student's' t-Test

427 ** Wealth quintile (composite measure of household's cumulative living standards) was categorized in
428 to 'richest', 'rich', 'middle' 'poor' and 'poorest' based on certain criteria's such as household

construction materials, presence of certain assets (radio, television, fan, almirah, cot), presence of electricity and gas, access to the sanitary latrine and the source of drinking water.

Table 2: Risk factors for dehydrating diarrhea in children at the time of hospital admission

Characteristics	**Dehydrating Diarrhea**		**Unadjusted OR (95% CI)**	**P value**	**Adjusted OR (95% CI)**	**P value**
	Dehydration	No Dehydration				
Sex						
Female	1,807 (39.89)	3,337 (37.78)	1.09 (1.01 – 1.17)	0.018	1.11 (1.03 – 1.20)	0.007
Male	2,723 (60.11)	5,496 (62.22)	1.0		1.0	
Child age (months)						
0 - 11	2,320 (51.21)	5,273(59.70)	1.0		1.0	
12 - 59	2,210 (48.79)	3,560 (40.30)	1.41 (1.31 – 1.51)	0.0001	1.20 (1.11 – 1.30)	<0.001
Mother education						
No formal education	893 (19.71)	952 (10.78)	2.27 (2.05 – 2.51)		1.27 (1.11 – 1.46)	<0.001
Up to primary	1,091 (24.08)	1,716 (19.43)	1.53 (1.40 – 1.68)	0.0001	1.11 (1.00 – 1.23)	0.048
More than primary	2,546 (56.20)	6,165 (69.80)	1.0	0.0001	1.0	
Father education						
No formal education	1,107 (24.44)	1,298 (14.69)	2.10 (1.91 – 2.31)	0.0001	1.31 (1.16 – 1.49)	<0.001
Up to primary	1,082 (23.89)	1,753 (19.85)	1.52 (1.39 – 1.66)	0.0001	1.17 (1.06 - 1.31)	0.002
More than primary	2,341 (51.68)	5,782 (65.46)	1.0		1.0	
Shigella infection						
Yes	142 (3.13)	214 (2.42)	1.30 (1.05 – 1.61)	0.016	1.32 (1.04 – 1.67)	0.018
No	4,388 (96.87)	8,619 (97.58)	1.0		1.0	
***Vibrio Cholerae* infection**						
Yes	392 (8.65)	153 (1.73)	5.37 (4.44 – 6.50)	0.0001	3.86 (3.15 – 4.72)	<0.001
No	4,138 (91.35)	8,680 (98.27)	1.0		1.0	

Vomiting						
Yes	3,728 (82.30)	6,005 (67.98)	2.18 (2.00 – 2.39)	0.0001	2.07 (1.89 – 2.28)	<0.001
No	802 (17.70)	2,828 (32.02)	1.0			
Wealth Quintile						
Richest	129 (2.85)	400 (4.53)	1.0			
Rich	1,406 (31.04)	3,315 (37.53)	1.31 (1.06 – 1.61)	0.01	1.22 (0.98 – 1.5)	0.069
Middle	859 (18.96)	1,672 (18.93)	1.59 (1.28 – 1.97)	0.0001	1.31 (1.04 – 1.64)	0.019
Poor	1,071 (23.64)	1,880 (21.28)	1.76 (1.42 – 2.18)	0.0001	1.41 (1.12 – 1.77)	0.003
Poorest	1,065 (23.51)	1,566 (17.73)	2.10 (1.70 – 2.60)	0.0001	1.41 (1.12 – 1.78)	0.003
Birth order						
1st	2,190 (48.34)	4,817 (54.53)	1.0			
2nd	1,446 (31.92)	2,717 (30.76)	1.17 (1.07 – 1.26)	0.0001	1.14 (1.04 – 1.24)	0.003
3rd or more	894 (19.74)	1,299 (14.71)	1.51 (1.37 – 1.67)	0.0001	1.19 (1.07 – 1.33)	0.001
Undernutrition indicators						
Normal WAZ	2,762 (62.00)	6,983 (79.76)	1.0		1.0	
Moderate underweight	1,014 (22.76)	1,252 (14.30)	2.04 (1.86 – 2.24)	0.0001	1.59 (1.41 – 1.80)	<0.001
Severe underweight	679 (15.24)	520 (5.94)	3.30 (2.92 – 3.73)	0.0001	2.11 (1.72 – 2.58)	<0.001
Wasting						
Normal WHZ	3,164 (71.02)	7,479 (85.43)	1.0			
Moderate Wasting	808 (18.14)	912 (10.42)	2.09 (1.88 – 2.32)	0.0001	1.37 (1.21 – 1.56)	<0.001
Severe wasting	483 (10.84)	364 (4.16)	3.13 (2.72 – 3.61)	0.0001	1.71 (1.42 – 2.07)	<0.001
Stunting						
Normal HAZ (≥	3,232 (72.55)	6,977 (79.69)	1.0			
Moderate stunting	741 (16.63)	1,200 (13.71)	1.33 (1.20 – 1.47)	0.0001	0.91 (0.81 – 1.03)	0.533
Severe stunting	482 (10.82)	578 (6.60)	1.80 (1.58 – 2.04)	0.0001	0.94 (0.79 – 1.12)	0.145

432

433 **Table 3: Pattern of management of diarrhea and outcome in hospital by sex**

Variables	Total (N=13,363)	Female (N=5,144)	Male (N=8,219)	P value
ORS given, n (%)	12,867 (96.30)	4,948 (96.21)	7,919 (96.36)	0.648*
Antibiotic was given, n (%)				0.94***
• No antibiotic	1,606 (12.02)	627 (12.19)	979 (11.91)	
• 1 antibiotic	9,054 (67.75)	3,446 (66.99)	5,608 (68.23)	
• 2 antibiotics	2,257 (16.89)	894 (17.38)	1,363 (16.58)	
• 3 or more antibiotics	446 (3.34)	177 (3.44)	269 (3.27)	
Length of stay in the hospital (hours), Median (IQR)	11(2,26)	11(2,26)	11(2,26)	0.839**
Outcome of the patient, n (%)				0.561***
• Children discharged by doctors after cure	12,447(93.15)	4,814(93.58)	7,633(92.87)	
• Illness continued	879 (6.58)	317(6.16)	562(6.84)	
• Children died in hospital after admission	3(0.02)	1(0.02)	2(0.02)	
• Children left hospital against medical advice	34 (0.26)	12(0.24)	22(0.27)	

434 * t-test; ** Wilcoxon rank-sum test; *** Pearson's chi-square test

ICDDR,B SURVEILLANCE ACTIVITY, CRSC, DHAKA, BANGLADESH

Patient's Name : ____________________ Father/Husband's name :_____________________

Variables	**Code**
1. Case Number	☐☐☐☐☐☐☐
2. Interviewer	☐
3. Date	☐☐ ☐☐ ☐☐ (Day Month Year)
4. Age	☐☐ ☐☐ ☐☐ (Year Month Day)
5. Sex 1=Male, 2 = Female	☐
6. Religion 1= Muslim, 2=Hindu, 3=Christan, 4=Buddist, 5= Others.	☐
7. Use of replacement Fluid before arrival 0=None, 1=ORS Packet, 2=Home made ORS, 3=Barley, 4=Rice/Gruel soup, 5=I.V. fluid, 6=1/2+4, 7=1/2+5, 8=3/4+5	☐
8. Chemotherapy before arrival: 0=None, 01=Penicillin, 02=Tetra, 03=Ampi 04=Chlo 05=Furox, 06=Genta, 07=Sept, 08=Kana 09=Nali, 10=Metro, 11=Amp+Furox, 12=Sept+Metro, 13=Furox+Nali, 14=Selexid, 98=Other.	☐☐
9. How many persons eat from the same cooking pot	☐☐
10. How many hours before onset of diarrhoea meal was taken	☐☐
11. How many children < 5 years of age in your family	☐

12. How many members of your family had diarrhoea in past 7 days

13. Number o deaths in last 5 years from diarrhoea

14. Feeding (upto 3 years of age) practice
1=BM, 2=BM+CM/PM, 3=BM+Rice/Ata Powder, 4=CM/PM,
5=Rice/Ata gruel/powder, 6=3+4, 7=4+5, 8=Family food.

15. Education of Patient's Father
0=None, 1=Maktab, 2=1-3 yrs. 3=4-5 yrs.
4=6-10 yrs. 5=10-12 yrs. 6= >12 yrs.

16. Education of Patient's Mother
(code as 15.)

17. Self education for patients (>15 years of age)
(code as 15.)

18. Monthly Income of Household (from all sources)
1=Upto Tk. 500, 2=501-999, 3=1000-1499, 4=1500-1999
5=2000-2999, 6=3000-4999, 7= >5000

19. Source of Drinking water
1=Tap, 2=TW, 3=Pond/River/Ditch, 4=1+2,
5=1+3, 6=2+3, 7=1+2+3

20. Source of water for washing/bathing
(Code as 19)

21. Place of defecation
1=Sanitary, 2=Semi-sanitary, 3=Service, 4=Dughole (with ring),
5=Open pit, 6=Hanging, 7=No fixed place

22. Used Vitamin –A capsule
0=None, 1=Within 3 months, 2=4-5 Months,
3=6-12 months, 4= >12 months

23. Temperature
0=Upto 36.6 °C, 1=36.7-37.7 °C, 2=37.8-38.8 °C, 3=38.9 °C+

24. Duration of diarrhoea before arrival
    1= <1 day, 2=1-3 days 3=4-6 days 4=7-9 days, 5=10-12 days, 6=12-14 days, 7=15+ days

25. Character of stool (1=Watery, 2= Non-watery)

26. Stool contents (0=Usual, 1=Mucus, 2=Blood, 3=MU+BL)

27. Number of stools in 24 hours
    1=3-5, 2=6-10, 3=11-15, 4=15-20, 5= >20

28. Abdominal Pain (0=No, 1=Yes)

29. Vomiting in last 24 hours
    0=No, 1= <10 times, 2=10+ times

30. History of cough with diarrhoea (in days)
    0=None, 1=1-7, 2=8-14, 3=15-20, 4= >20 days

31. History of Measles
    0=None, 1=Measles in past 3 months, 2=Measles in >3-6 months
    3= Present history of night blindness, 4=Past history of night blindness
    5=Measles + Night blindness

32. History of convulsion
    0=None, 1=Convulsion within 12 hours,
    2=Convulsion within 13-24 hours,
    3=Convulsion > 24 hours

33. Other diseases (specify)

34. Since how long do you live in Dhaka city
    0=Never, 1=<1 Yr., 2=1-2 Yrs, 3=3-5 Yrs., 4= > 5 Yrs., 5=Seasonal

35. Present Location (Thana/Area)
    1=Basti, 02=Cmmon housing area, 03=Residential area, 04=Village area, 05=Others

PHYSICAL EXAMINATION

36. Thirst
    0=Normal, 1=Mild, 2=Moderate, 3=Severe (for adult)

37. General condition
    0=Normal, 1=Restless, 2=Lethergic but irritable when touched, 3=Drowsy/cold and sweating extremities, 4=Coma

38. Radial pulse
    0=Normal rate & good volume, 1=Rapid & weak, 2= Rapid & feeble/sometimes impalpable, 3=Not palpable

39. Respiration
    0=Normal, 1=Faster than normal, 2=Deep & Rapid

40. Clinical assessment of dehydration
    0=No dehydration, 5=Some, 3=Severe

41. Convulsion (0=No, 1=Yes)

OTHER PHYSICAL FINDINGS

41. Vitamin A deficiency
    0=Normal, 1=Conj. Xerosis, 2=Bitot spot, 3=Corneal ulcer, 4=Keratomalacia, 5=1+2, 6=3+4, 7=Corneal scar.

43. Ear –Otitis media
    0=Absent, 1=Otitis media present

44. Sore mouth
    0=None, 1=Angular stomatitis, 2=Glossitis, 3=Pharyngitis, 4=Tonsilities

45. Lungs
    0=Clear, 1=Rhonce, 2=Crepitation, 3=Both

46 Abdomen
    0=Normal, sounds present
    1=Distended, sounds present
    2=Distended, sounds present sluggish
    3=Distended , sound absent
    4=Distension with tenderness

47. Liver and spleen
0=Not palpable, 1=Liver enlarged, 2=Spleen enlarged
3=Liver and spleen enlarged.

48. Rectum prolapse (0=None, 1=Yes)

49. Extremities
0=Odema absent, 1=Odema present

50. Diagnosis
1=Uncomlicated diarrhoea, 2=Comlicated Diarrhoea
(Note: Complicated diarrhoea admitted in medical ward

51. Disposition
1=Discharge from examination desk, 2=ORP,
3=TC, 4=TC to Ward, 5=Ward 6=Study ward,
7=Reffered to another hospital, 8=Death on arrival

52 Duration of stay (Days/hour)

53. Outcome
1=Cured, 2=Illness continuing, 3=Died,
4=Absconded, 5=Others.

54. Rehydration Method used
0=None, 1=ORS, 2=IV only, 3=ORS to IV,
4=IV to ORS, 5=Others

TREATMENT

55. 0=No medicine, 1=One medicine, 2=Two medicine, so on

56. Tetracycline (0=No, 1=Yes)

57. Ampicillin (0=No, 1=Yes)

58. Septrin (0=No, 1=Yes)

59. Furoxone (0=No, 1=Yes)

60. Penicillin/Crystapen V (0=No, 1=Yes)

61. Metronidazole (0=No, 1=Yes)

62. Gentamycine (0=No, 1=Yes)

63. *Nalidixic acid* (0=No, 1=Yes)

64. Chloramphenicol (0=No, 1=Yes)

65. Others (0=No, 1=Yes)

66. Weight on Admission in Kg (1 decimal)

67. Weight on Discharge in Kg (1 decimal)

68. Height in cm (1 decimal)

69. Arm Circumference (1 decimal)

70. Azithromycin (0=No, 1=Yes)

71. Amikacin (0=No, 1=Yes)

72. Carbenicillin (0=No, 1=Yes)

73. Ciprofloxacin (0=No, 1=Yes)

74. Ceftriaxone (0=No, 1=Yes)

75. Ceftazidime (0=No, 1=Yes)

76. Erythromycin (0=No, 1=Yes)

77. Flucloxacillin (0=No, 1=Yes)

78. Imipenam (0=No, 1=Yes)

79. Nitrofurantoin (0=No, 1=Yes)

80. Tobramycin (0=No, 1=Yes)

81. Selexid (0=No, 1=Yes)

82. Doxycycline (0=No, 1=Yes)

83. $MagSO_4$ (0=No, 1=Yes)

ICDDR,B SURVEILLANCE ACTIVITY (ADDITIONAL QUESTIONNAIRE)

1. Case Number
2. Date of interview
3. Total distance covered (miles)
4. Total time taken to reach (Hour/minutes)
5. Birth order of the child (< 5 years)
   Ist=01, 2nd =02, Adopted =88
6. Any diarrohea of this child in last 7 days, other than this episode (1=Yes, 2=No)
7. Any diarrohea of this child in last 14 days, other than above episode (1=Yes, 2=No)
8. Any diarrohea of this child in last 1 month, other than above episode (1=Yes, 2=No)
9. any cough/fever/sneezing/running nose/rapid resp./breathing difficulty/ear discharge/husky voice in last 14 days (1=Yes, 2=No)
10. Any other disease of this child in last 7 days (1=Yes, 2=No)
11. Any other disease of this child in last 14 days (1=Yes, 2=No)
12. Any other disease of this child in last 1 month (1=Yes, 2=No)
13. Father's Age (If respondent <= 15 years of Age)
    Not applicable = 99
14. Mother's Age (If respondent <= 15 years of Age)
    Not applicable = 99
15. Floor structure
    1=Cemented, 2=Non-cemented

16. Wall structure
1=Brick, 2=Bamboo fence, 3=Ordinary tin, 4=Corrogated tin, 5=Straw, 6=Jute stick, 7=Mixed, 8=Mud, 9=Other

17. Roof structure
1=Concrete/Pucca, 2=Bamboo fence, 3=Ordinary tin, 4=Corrogated tin, 5=Straw, 6=Polythene, 7=Mixed, 8=Mud, 9=Other

IMMUNIZATION HISTORY : (Children < 5 years)

18. BCG given
1=Yes, 2=No, 3=Don't know, 9=NA

19. DPT given
1=IST dose, 2=Ist+ 2nd dose, 3=Ist+2nd+3rd dose
4=Not given, 5=Don't know

20. Polio given (Code as 19.)

21. Measles given
1=Yes, 2=No, 3=Don't know, 9=NA

22. Is the child breastfed now (< 5 years)
1=Yes, 2=No, 9=NA

23. If yes, frequency of breastfeeding from 6 A.M. to 6 P.M.
(Adopted child=88, NA=99)

24. How long did you predominantly breastfeed the child (months)
(<3 years of child) 00=<1 month, 01=1 month,… ,
adopted child=88, NA=99

25. At what age, did you stop breastfeeding (totally) your child (months)
(< 5 years) (< 1 month=00, 1 month=01, adopted child=88, NA=99)

26. Primari occupation of father (<=15 years of child) or self employment of the patient (>15 years)
1=Farmer, 2=Day labor 3=share cropper, 4=Rickshow /Push cart puller
5=Taxi/Bus/truck/Tempo driver, 6=Mill/Industry worker, 7=Skill worker,
8=Office non-executive, 9=Office executive, 10=Petty business,
11=Big business, 12=Overseas employment, 13=Boatman, 14=Fisherman,
15=Unemployed, 16=Abscent, 17=Dead, 18=Begger, 19=Street vendor,
20=Other

27. Any gainful employment of mother (<15 years of child) or self Employment of female patient (>15 years) 1=Yes, 2=No, 9=NA

28. Income of Father (Last month) in Taka (<15 years of child) or self income (male patient) (>15 years), NA=999999

29. Income of Mother (Last month) in Taka

(<15 years of child) or self income (female patient) (>15 years), NA=999999

30. Mother reads newspaper (<15 years of child) or she reads (>15 years) 1=Yes, 2=No, 9=NA

31. If yes, how many days in a week (1= 7 days in a week 2=< 7 days in a week, 9=NA

32. Mother watches TV (<15 years of child) or she watches TV (>15 years) 1=Yes, 2=No, 9=NA

33. If watches, how many days in a week (1= 7 days in a week 2=< 7 days in a week, 9=NA

34. Mother listens Radio (<15 years of child) or she listens (>15 years) 1=Yes, 2=No, 9=NA

35. If listens, how many days in a week (1= 7 days in a week 2=< 7 days in a week, 9=NA

36. Father reads newspaper (<15 years of child) or he reads (>15 years) 1=Yes, 2=No, 9=NA

37. If yes, how many days in a week (1= 7 days in a week 2=< 7 days in a week, 9=NA

38. Father watches TV (<15 years of child) or he watches TV (>15 years) 1=Yes, 2=No, 9=NA

39. If watches, how many days in a week (1= 7 days in a week 2=< 7 days in a week, 9=NA

40. Father listens Radio (<15 years of child) or he listens (>15 years) 1=Yes, 2=No, 9=NA

41. If listens, how many days in a week (1= 7 days in a week 2=< 7 days in a week, 9=NA

42. Mother member of any cooperative (<= 15 years) society, NGO/Women organisation or she herself (>15 years)
1=Yes, 2=No, 9=NA

43. If yes, Name of that : ______________________________

44. Father member of any cooperative (<= 15 years) society, NGO/Women organisation or she herself (>15 years)
1=Yes, 2=No, 9=NA

45. If yes, Name of that : ______________________________

46. Main source of water :

	Distance from Kitchen (ft)	# of Family User	Frequency of collection
46. Drinking			
Cooking			
Washing			

47. Any treatment of drinking water
0=None, 1=boiling, 2=Alum/tablet,, 3=Sieving,
4= Use filter, 5=Other.

48. Years of schooling of father (read upto)

49. Years of schooling of mother (read upto)

50. Number of rooms in the family

51. Number of beds in the family

52. Family owns fan (1=Yes, 2=No)

53. Family owns radio (1=Yes, 2=No)

54. Family owns TV (1=Yes, 2=No)

55. Family owns Almirah (1=Yes, 2=No)

56. Family owns luxury cot (1=Yes, 2=No)

57. Family owns ordinary cod (1=Yes, 2=No)

58. Family uses gas for cooking (1=Yes, 2=No)

59. Cooks in the bedroom (1=Yes, 2=No)

60. Use of light at night (1=Electrical, 2=Ordinary kerosine lamp 3=Hurricane, 4=2+3, 5=None).

61. Keeps chicken/Duck in
Bedroom=1, Courtyard=2, Corridor=3, Other places=4
More than one places=5, NA=9

62. Chicken/ducks enter in kitchen (1=Yes, 2=No, 9=NA)

63. Chicken/ducks enter in bedroom (1=Yes, 2=No, 9=NA)

64. Keeps pigeon/birds in
Bedroom=1, Courtyard=2, Corridor=3, Other places=4
More than one places=5, NA=9

65. Pigeon/birds enter in kitchen (1=Yes, 2=No, 9=NA)

66. Pigeon/birds enter in bedroom (1=Yes, 2=No, 9=NA)

67. Keeps Cows/goats/dogs/cats in
Bedroom=1, Courtyard=2, Corridor=3, Other places=4
More than one places=5, NA=9

68. Cows/goats/dogs/cats enter in kitchen (1=Yes, 2=No, 9=NA)

69. Cows/goats/dogs/cats enter in bedroom (1=Yes, 2=No, 9=NA)

70. Disposal of garbage (1=Courtyard 2=Outside the house)

71. Number of cigarettes smoked by father per day (< 15 years)
None=00, Unknown=88, NA=99

72. Number of cigarettes smoked by mother per day (< 15 years)
None=00, Unknown=88, NA=99

73. Number of cigarettes smoked by patient per day (> 15 years)
None=00, Unknown=88, NA=99

74. Number of biri/hukka smoked by father per day (< 15 years)
None=00, Unknown=88, NA=99

75.Number of biri/hukka smoked by mother per day (< 15 years)
None=00, Unknown=88, NA=99

76.Number of biri/hukka smoked by patient per day (< 15 years)
None=00, Unknown=88, NA=99

77.Since how long do you live in the same house (if rented)
< 1 year=00, One year=01, 2 year=02 … 10+ year=10, NA=99

78.Since how long do you live in the same house (if Own house)
< 1 year=00, One year=01, 2 year=02 … 10+ year=10, NA=99

79. Admission weight in Kg (2 decimal)

80. Discharge weight in Kg (2 decimal)

81. Admission height in cm (1 decimal)

82. Discharge height in cm (1 decimal)

83. MUAC in cm (1 decimal)

84. Tibial length (1 decimal)

85. Duration of diarrhoea prior to admission
(days/hour) persistent diarrhoea = 15+ days

86. Stool specimen collected
1=Yes, 2=No, 3=R/S

87. Number of school going children in the family

88. Currently pregnant or not
(1=Yes, 2= No, 9=NA)

89. Duration of pregnancy (weeks)
99=NA

STROBE (Strengthening The Reporting of OBservational Studies in Epidemiology) Checklist

A checklist of items that should be included in reports of observational studies. You must report the page number in your manuscript where you consider each of the items listed in this checklist. If you have not included this information, either revise your manuscript accordingly before submitting or note N/A.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

Section and Item	Item No.	Recommendation	Reported on Page No.
Title and Abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	
Introduction			
Background/Rationale	2	Explain the scientific background and rationale for the investigation being reported	
Objectives	3	State specific objectives, including any prespecified hypotheses	
Methods			
Study Design	4	Present key elements of study design early in the paper	
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	
Participants	6	(*a*) *Cohort study*—Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up *Case-control study*—Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls *Cross-sectional study*—Give the eligibility criteria, and the sources and methods of selection of participants	
		(*b*) *Cohort study*—For matched studies, give matching criteria and number of exposed and unexposed *Case-control study*—For matched studies, give matching criteria and the number of controls per case	
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	

Section and Item	Item No.	Recommendation	Reported on Page No.
Data Sources/ Measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	
Bias	9	Describe any efforts to address potential sources of bias	
Study Size	10	Explain how the study size was arrived at	
Quantitative Variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	
Statistical Methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	
		(*b*) Describe any methods used to examine subgroups and interactions	
		(*c*) Explain how missing data were addressed	
		(*d*) *Cohort study*—If applicable, explain how loss to follow-up was addressed *Case-control study*—If applicable, explain how matching of cases and controls was addressed *Cross-sectional study*—If applicable, describe analytical methods taking account of sampling strategy	
		(*e*) Describe any sensitivity analyses	
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	
		(b) Give reasons for non-participation at each stage	
		(c) Consider use of a flow diagram	
Descriptive Data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	
		(b) Indicate number of participants with missing data for each variable of interest	
		(c) *Cohort study*—Summarise follow-up time (eg, average and total amount)	
Outcome Data	15*	*Cohort study*—Report numbers of outcome events or summary measures over time	
		Case-control study—Report numbers in each exposure category, or summary measures of exposure	
		Cross-sectional study—Report numbers of outcome events or summary measures	

Section and Item	Item No.	Recommendation	Reported on Page No.
Main Results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	
		(*b*) Report category boundaries when continuous variables were categorized	
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	
Other Analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	
Discussion			
Key Results	18	Summarise key results with reference to study objectives	
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	
Generalisability	21	Discuss the generalisability (external validity) of the study results	
Other Information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Once you have completed this checklist, please save a copy and upload it as part of your submission. DO NOT include this checklist as part of the main manuscript document. It must be uploaded as a separate file.