BMJ Open

Gender disparity in care-seeking behaviours and treatment outcomes for dehydrating diarrhoea among under-5 children admitted to a diarrhoeal disease hospital in Bangladesh: an analysis of hospital-based surveillance data

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To cite: Mahmud I, Das S, Khan SH, *et al*. Gender disparity in care-seeking behaviours and treatment outcomes for dehydrating diarrhoea among under-5 children admitted to a diarrhoeal disease hospital in Bangladesh: an analysis of hospital-based surveillance data. *BMJ Open* 2020;**10**:e038730. doi:10.1136/bmjopen-2020-038730

► Prepublication history and additional material for this paper is available online. To view these files, please visit the journal online (http://dx.doi.org/10.1136/bmjopen-2020-038730).

Received 24 March 2020
Revised 04 August 2020
Accepted 06 August 2020

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ABSTRACT

Introduction Despite economic development and augmented literacy rates, Bangladeshi households are still discriminating against girls when it comes to seeking medical care. We examined gender disparities in diarrhoeal disease severity and the treatment outcomes of under-5 children.

Setting A tertiary level diarrhoeal disease hospital in Dhaka, Bangladesh.

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

Outcome variables and methods The primary outcome of interest was severity of diarrhoea, defined as 'dehydrating diarrhoea' or 'non-dehydrating diarrhoea'. Multivariable logistic regression analyses were performed to assess the association between 'gender' and admission to hospital for dehydrating diarrhoea.

Results Data on 13 321 children under 5 years of age were analysed, of whom 61.5% were male and 38.5% were female. The mean (±SD) age of children with diarrhoea was 5.63 (±3.49) months. The median distance travelled to come to the hospital for admission was 10 miles (IQR: 6–25) and was significantly higher for boys (10 miles, IQR: 6–25) than girls (9.5 miles, IQR: 6–23) (p<0.001). Girls had 1.11 times higher odds (adjusted OR: 1.11, 95% CI 1.03 to 1.20, p=0.007) of presenting with dehydrating diarrhoea than boys at the time of hospital admission. Almost 20% of children received two or more medications during the period of hospital admission and this did not differ by gender. The median duration of hospital stay was 11 hours and was similar in both sexes. No gender-based disparity was observed in the management of diarrhoea and in the hospital outcome of children.

Conclusion We found that girls were more likely to have dehydrating diarrhoea when they were presented to the Dhaka hospital of International Centre for Diarrhoeal Disease Research, Bangladesh. No gender-based disparity was observed in the hospital outcome of children.

Strengths and limitations of this study

- Data were collected from an ongoing diarrhoeal 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 5 years old who visited the Dhaka hospital of International Centre for Diarrhoeal Disease Research, Bangladesh for over a decade (between January 2008 and December 2017).
- We do not know whether these gender-based differences in hospital attendance reflect the true gender disparity that might persist within the community as data for this analysis were collected from a specialised care hospital.
- If female children of similar severity were taken to lower-level institutions rather than a 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 differences 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] This means that, in an ideal and

equitable resource-allocated condition, girls have better chances of survival to age 5 than boys.[5 6] However, an exception is in 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 deprives female children of the advantage of a higher survival.[8] However, there is a knowledge gap with regard to the mechanisms that could play an important role in excess mortality. The most likely explanation can be sex differences in child-rearing and/or care-seeking behaviour.[9]

Although Bangladesh has achieved the child mortality target of Millennium Development Goal 4 (under-5 mortality rate is currently 46 per 1000 live births),[10] it is still unacceptably high. Despite different public health interventions in the country, around 129 433 under-5 children die every year.[11] Moreover, the Bangladesh Demographic and Health Survey (BDHS) in 2014 reported that the proportion of under-5 mortality is 9% higher for girls (48 compared with 44 per 1000 live births in boys),[12] which indicates that sex of the child may be a factor contributing to the 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 in 1977–1978 reported that visits to a diarrhoeal treatment facility, which were free of cost, were 66% higher for boys than for girls aged 0–4 months, even though the rates of diarrhoeal attack were similar.[9] Such treatment-seeking behaviour has been shown to be influenced by the distance of the healthcare centre from the residence. A study conducted in rural Teknaf, Bangladesh found that within the first 1.5 kilometre radius, 90% of diarrhoeal cases, irrespective of gender, came to clinics for treatment, but at two miles the attendance declined to 70% for boys and 40% for girls.[16]

We hypothesise that despite economic development and augmented literacy rates, particularly for women in Bangladesh, households are still discriminating against girls when it comes to seeking medical care. Considering the above-mentioned context, we examined gender disparities in diarrhoeal disease severity and treatment outcomes for children under the age of 5 attending the Dhaka hospital of International Centre for Diarrhoeal Disease Research, Bangladesh (icddr,b).

MATERIALS AND METHODS

Study design

This is a cross-sectional analysis of hospital-based surveillance system data collected between January 2008 and December 2017.

Setting

icddr,b is located in the city of Dhaka, the capital of Bangladesh. It primarily conducts research on aetiology, pathogenesis, prevention and treatment of diarrhoeal disease. It also deals with childhood pneumonia, malnutrition, tuberculosis, vaccine, laboratory diagnosis and science, and maternal, child, adolescent and mental health. Other than research it operates two hospitals in Bangladesh to treat patients with diarrhoea, 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 the icddr,b Dhaka hospital during the time period from January 2008 to December 2017.

Variables

The primary outcome of interest was severity of diarrhoea, defined as 'dehydrating diarrhoea' or 'non-dehydrating diarrhoea'. According to the icddr,b 'Dhaka method',[17] diarrhoeal 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 that goes back after 2–3 s—the child would be considered 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—the child would be considered a case of 'severe dehydration'. If a child has none of these signs, the child would be considered a case of 'no dehydration'. In our analysis both 'some' and 'severe' dehydrated patients were defined as cases of 'dehydrating diarrhoea', and patients with 'no dehydration' were defined as cases of 'non-dehydrating diarrhoea'. 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 household expenditure were associated with seeking care from a trained healthcare provider for neonates.[17 18]

Data source and data collection

Data used for this analysis were from the Diarrheal Disease Surveillance System (DDSS) of icddr,b Dhaka hospital. The DDSS was established in 1979 to collect information on demographics, aetiology and clinical characteristics of patients. Among all patients attending the hospital, a systematic 2% of patients of all ages are enrolled in the surveillance system. Informed voluntary consent was taken from all participants, and for the minors informed verbal approval from parents, guardians, caregivers or any nearby family members was obtained and documented in the DDSS database. Delinked medical reports were used in all data analyses. Data on sociodemographic status, morbidity, disease symptoms and nutritional status were collected and recorded on a web-based data collection tool using pretested standard questionnaires (online supplemental file) and validated tools. Anthropometric indices such as stunting, wasting and underweight were measured using the WHO Anthro 2006 software.[19]

Underweight was categorised into 'normal ' (Weight-for-Age Z-score ≥−2 SD), 'moderate underweight' (WAZ ≥−3 SD and <−2 SD) and 'severe underweight' (WAZ <−3 SD). Wasting was categorised into 'normal ' (Weight-for-Height Z-score, WHZ ≥−2 SD), 'moderate wasting' (WHZ ≥−3 SD and <−2 SD) and 'severe wasting' (WHZ <−3 SD). Stunting was defined as Length-for-Age Z-score (LAZ)/ Height-for-Age Z- score (HAZ) less than −2, severe stunting as LAZ/HAZ score less than −3, and LAZ/HAZ ≥−2 SD was considered normal.[20]

Bias

All 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 children under 5 years of age included in the DDSS database between January 2008 and December 2017 were analysed. A total of 13 361 participants fulfilled the criteria for analysable data set.

Statistical methods

Data were analysed using STATA/SE V.13.0. Descriptive statistics were carried out to explore the distribution of different variables across the sex of the children. Mean and SD were used to report normally distributed continuous variables, and for non-normal continuous data median and IQR were used. Pearson's χ^2 test was used for categorical variables, and Student's t-test and Wilcoxon rank-sum test were used for continuous variables.

Multivariable logistic regression analyses were performed to assess the influence of 'sex' on admission for dehydrating diarrhea, adjustingfor confounding variables. All covariates were chosen based on relevant literature and biological plausibility. Variables that were adjusted 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 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-5 children between January 2008 and December 2017, of whom 61.5% were male and 38.5% were female. Of the children, 51.28% met the case definition of dehydrating diarrhoea.

The mean (±SD) age of children with diarrhoea was 5.63 (±3.49) months (table 1). Both boys and girls were of similar age (p>0.05). The median time duration 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 this was significantly higher for boys (10 miles, IQR: 6–25) than for girls (9.5 miles, IQR: 6–23) (p<0.001) (table 1). At the time of hospital admission, one-third of the children had dehydrating diarrhoea, and among them 35% were girls and 33% were boys (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 diarrhoea. About 8.02% of the children were severely stunted, 9.08% were severely underweight and 6.41% were severely wasted. In all categories, boys were significantly more undernourished than girls.

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

Table 1 Characteristics of children with diarrhoea at the time of hospital admission

Characteristics	Total (N=13 363)	Female (n=5144)	Male (n=8219)	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, n (%)				
Infant (0–11 months)	7593 (56.83)	2977 (57.87)	4616 (56.16)	0.052
Older (12–59 months)	5770 (43.17)	2167 (42.13)	3603 (43.84)	Reference
Mother's education, n (%)				
No formal education	1845 (13.81)	700 (13.6)	1145 (13.9)	Reference
Up to primary (≤5 years of schooling)	2807 (21.01)	1087 (21.1)	1720 (20.9)	0.591
More than primary (>5 years of schooling)	8711 (65.19)	3357 (65.3)	5354 (65.1)	0.632
Father's education, n (%)				
No formal education	2405 (18.00)	921 (17.90)	1484 (18.06)	Reference
Up to primary	2835 (21.22)	1094 (21.27)	1741 (21.18)	0.828
More than primary	8123 (60.79)	3129 (60.83)	4994 (60.76)	0.842
Birth order of the child, n (%)				
First	7007	2689 (52.3)	4318 (52.5)	Reference
Second	4163	1602 (31.1)	2561 (31.2)	0.91
Third or higher	2193	853 (16.6)	1340 (16.3)	0.66
Total number of family members, n (%)				
Up to 4	6597 (49.37)	2629 (51.1)	3968 (48.3)	0.001
5 or more	6766 (50.63)	2515 (48.9)	4251 (51.7)	Reference
Income of the mother, n (%)				
Yes	1372 (10.27)	570 (11.1)	802 (9.8)	0.014
No	11 991 (89.73)	4574 (88.9)	7417 (90.2)	Reference
Wealth quintile†, n (%)				
Richest	529 (3.96)	226 (42.72)	303 (57.28)	0.003
Rich	4721 (35.33)	1882 (39.86)	2839 (60.14)	0.001
Middle	2531 (18.94)	992 (39.19)	1539 (60.81)	0.014
Poor	2951 (22.08)	1100 (37.28)	1851 (62.72)	0.280
Poorest	2631 (19.69)	944 (35.88)	1687 (64.12)	Reference
Distance of travel, in miles, median (IQR)	10 (6–25)	9.5 (6–23)	10 (6–25)	<0.001
Duration of diarrhoea 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	3630 (27.16)	1333 (25.91)	2297 (27.95)	0.01
Yes	9733 (72.84)	3811 (74.09)	5922 (72.05)	Reference
Vibrio cholerae, n (%)				
Positive	545 (4.08)	209 (4.06)	336 (4.09)	0.943
Negative	12 818 (95.92)	4935 (95.94)	7883 (95.91)	Reference
Shigella, n (%)				
Positive	356 (2.66)	146 (2.84)	210 (2.56)	0.323
Negative	13 007 (97.34)	4998 (97.16)	8009 (97.44)	Reference
Undernutrition indicators, n (%)				
Normal Weight-for-Age Z-score	9745 (73.77)	3806 (74.72)	5939 (73.18)	Reference
Moderately underweight	2266 (17.15)	857 (16.82)	1409 (17.36)	0.277
Severely underweight	1199 (9.08)	431 (8.46)	768 (9.46)	0.037

Continued

Table 1 Continued

Characteristics	Total (N=13363)	Female (n=5144)	Male (n=8219)	P value
Normal Weight-for-Height Z-score	10643 (80.57)	4104 (80.57)	6539 (80.57)	Reference
Moderate wasting	1720 (13.02)	693 (13.60)	1027 (12.65)	0.172
Severe wasting	847 (6.41)	297 (5.83)	550 (6.78)	0.044
Normal Height-for-Age Z-score	10209 (77.28)	4070 (79.90)	6139 (75.64)	Reference
Moderate stunting	1941 (14.69)	694 (13.62)	1247 (15.36)	0.001
Severe stunting	1060 (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 categorised into 'richest', 'rich', 'middle', 'poor' and 'poorest' based on certain criteria, such as household construction materials, presence of certain assets (radio, television, fan, almirah, cot), presence of electricity and gas, access to sanitary latrine, and source of drinking water.

stunted, it was found that girls had significantly higher odds of coming to the hospital with dehydrating diarrhoea compared with boys (OR: 1.11, 95% CI 1.03 to 1.20, p=0.007).

Majority of children were treated with an antibiotic (11757, 87.98%) after being admitted to the hospital (table 3). Almost 20% of children received two or more medications at the hospital and this ratio did not differ by gender. The median duration of hospital stay was 11 hours and was similar in both sexes. Illness resolved prior to discharge in 12447 (93.15%) children, whereas 879 (6.58%) had persisting illness, 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 children.

DISCUSSION

Conforming to other studies from the South Asian regions and Bangladesh, our study has revealed a discriminating disadvantage among female children when it comes to care-seeking in the hospital for diarrhoea.[21 22]

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

We also observed that older children (12–59 months) had higher odds of developing dehydrating diarrhoea, which is similar to other studies in Bangladesh.[24] A possible explanation could be that parents might seek healthcare 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 when they have diarrhoea.[25] BDHS 2014 reported that in Bangladesh only 36% of patients with diarrhoea visit a hospital or a healthcare provider within their locality and that girls are discriminated against when it comes to receiving ORS and zinc for episodes of diarrhoea.[10] Possibly more female children with dehydrating diarrhoea might already have died at home without their parents seeking hospital care, or parents came to the hospital only when their female children have developed more serious forms of the 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 with dehydrating diarrhoea, which is aligned with earlier findings that poor socioeconomic status was significantly associated with poor utilisation of health facilities.[26–28] Interestingly, across all family income groups, girls were less hospitalised compared with boys. This finding is contradictory to the available literature that suggests a declining trend in gender bias with increase in family income.[28] Our study demonstrated distance as a significant factor which influenced the hospital attendance rate of female children, which was in line with previous studies conducted in Bangladesh.[16] In Bangladesh, when a child suffers from diarrhoea 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 to the healthcare facility is too far. On the other hand, as majority of Bangladeshis are conservative Muslims, for mothers with female children, travelling presents not only a physical barrier but also a social barrier. As female children are undervalued, this mindset, along with social

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

Characteristics	Dehydrating diarrhoea		Unadjusted OR (95% CI)	P value	Adjusted OR (95% CI)	P value
	Dehydration	No dehydration				
Sex						
Female	1807 (39.89)	3337 (37.78)	1.09 (1.01 to 1.17)	0.018	1.11 (1.03 to 1.20)	0.007
Male	2723 (60.11)	5496 (62.22)	1.0		1.0	
Child age (months)						
0–11	2320 (51.21)	5273 (59.70)	1.0		1.0	
12–59	2210 (48.79)	3560 (40.30)	1.41 (1.31 to 1.51)	0.0001	1.20 (1.11 to 1.30)	<0.001
Mother's education						
No formal education	893 (19.71)	952 (10.78)	2.27 (2.05 to 2.51)		1.27 (1.11 to 1.46)	<0.001
Up to primary	1091 (24.08)	1716 (19.43)	1.53 (1.40 to 1.68)	0.0001	1.11 (1.00 to 1.23)	0.048
More than primary	2546 (56.20)	6165 (69.80)	1.0	0.0001	1.0	
Father's education						
No formal education	1107 (24.44)	1298 (14.69)	2.10 (1.91 to 2.31)	0.0001	1.31 (1.16 to 1.49)	<0.001
Up to primary	1082 (23.89)	1753 (19.85)	1.52 (1.39 to 1.66)	0.0001	1.17 (1.06 to 1.31)	0.002
More than primary	2341 (51.68)	5782 (65.46)	1.0		1.0	
Shigella infection						
Yes	142 (3.13)	214 (2.42)	1.30 (1.05 to 1.61)	0.016	1.32 (1.04 to 1.67)	0.018
No	4388 (96.87)	8619 (97.58)	1.0		1.0	
Vibrio cholerae infection						
Yes	392 (8.65)	153 (1.73)	5.37 (4.44 to 6.50)	0.0001	3.86 (3.15 to 4.72)	<0.001
No	4138 (91.35)	8680 (98.27)	1.0		1.0	
Vomiting						
Yes	3728 (82.30)	6005 (67.98)	2.18 (2.00 to 2.39)	0.0001	2.07 (1.89 to 2.28)	<0.001
No	802 (17.70)	2828 (32.02)	1.0			
Wealth quintile						
Richest	129 (2.85)	400 (4.53)	1.0			
Rich	1406 (31.04)	3315 (37.53)	1.31 (1.06 to 1.61)	0.01	1.22 (0.98 to 1.5)	0.069
Middle	859 (18.96)	1672 (18.93)	1.59 (1.28 to 1.97)	0.0001	1.31 (1.04 to 1.64)	0.019
Poor	1071 (23.64)	1880 (21.28)	1.76 (1.42 to 2.18)	0.0001	1.41 (1.12 to 1.77)	0.003
Poorest	1065 (23.51)	1566 (17.73)	2.10 (1.70 to 2.60)	0.0001	1.41 (1.12 to 1.78)	0.003
Birth order						
First	2190 (48.34)	4817 (54.53)	1.0			
Second	1446 (31.92)	2717 (30.76)	1.17 (1.07 to 1.26)	0.0001	1.14 (1.04 to 1.24)	0.003
Third or higher	894 (19.74)	1299 (14.71)	1.51 (1.37 to 1.67)	0.0001	1.19 (1.07 to 1.33)	0.001
Undernutrition indicators						
Normal Weight-for-Age Z-score	2762 (62.00)	6983 (79.76)	1.0		1.0	
Moderately underweight	1014 (22.76)	1252 (14.30)	2.04 (1.86 to 2.24)	0.0001	1.59 (1.41 to 1.80)	<0.001
Severely underweight	679 (15.24)	520 (5.94)	3.30 (2.92 to 3.73)	0.0001	2.11 (1.72 to 2.58)	<0.001
Wasting						
Normal Weight-for-Height Z-score	3164 (71.02)	7479 (85.43)	1.0			

Continued

Table 2 Continued

Characteristics	Dehydrating diarrhoea		Unadjusted OR (95% CI)	P value	Adjusted OR (95% CI)	P value
	Dehydration	No dehydration				
Moderate wasting	808 (18.14)	912 (10.42)	2.09 (1.88 to 2.32)	0.0001	1.37 (1.21 to 1.56)	<0.001
Severe wasting	483 (10.84)	364 (4.16)	3.13 (2.72 to 3.61)	0.0001	1.71 (1.42 to 2.07)	<0.001
Stunting						
Normal Height-for-Age Z-score	3232 (72.55)	6977 (79.69)	1.0			
Moderate stunting	741 (16.63)	1200 (13.71)	1.33 (1.20 to 1.47)	0.0001	0.91 (0.81 to 1.03)	0.533
Severe stunting	482 (10.82)	578 (6.60)	1.80 (1.58 to 2.04)	0.0001	0.94 (0.79 to 1.12)	0.145

and physical barriers, dominates decision-making with regard to seeking medical care for female children as the distance to 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 healthcare, of which the third and fourth 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 healthcare and expenditure for their children.[29]

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

Our results showed that among the hospitals attended children, with the rise of birth order, the chances of arriving at the hospital with dehydrating diarrhoea increased. It might be due to parental preferences for their younger children. But this is also plausible that, parents with several small children were less likely to manage a diarrhoeal episode at home or they might just ignore the incidences in case of the older children.[31]

Deaths from diarrhoea can be reduced by 93 per cent for children under 5 years of age when they are 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% received at least one antibiotic and that majority were cured following their treatment.

This study shows no gender-based disparity in the treatment of children with diarrhoea at the icddr,b Dhaka hospital. The stool culture reports did not reveal any difference in the detection of invasive diarrhoea in children by sex. Our study does not support the concept

Table 3 Pattern of management of diarrhoea and outcome in hospital by sex

Variables	Total (N=13 363)	Female (n=5144)	Male (n=8219)	P value
Oral Rehydration Salts (ORS) given, n (%)	12 867 (96.30)	4948 (96.21)	7919 (96.36)	0.648*
Antibiotic was given, n (%)				0.94†
No antibiotic	1606 (12.02)	627 (12.19)	979 (11.91)	
1 antibiotic	9054 (67.75)	3446 (66.99)	5608 (68.23)	
2 antibiotics	2257 (16.89)	894 (17.38)	1363 (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)	4814 (93.58)	7633 (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.
†Pearson's χ^2 test.
‡Wilcoxon rank-sum test.

that there is a difference in hospital care for children by sex, rather it suggests that it is the difference in the care-seeking behaviour of parents towards diarrhoea prior to hospitalisation.

Our study also identified older age, malnutrition, invasive diarrhoea, low literacy of parents, poor socioeconomic condition and reporting of vomiting as predictors of dehydrating diarrhoea at the time of hospitalisation. This study reports that around a quarter of under-5 children who came to the hospital with diarrhoea were undernourished, with boys suffering from a more severe form of undernutrition than girls. Despite girls' better nutritional status, we observed that a higher proportion of them were suffering from dehydrating diarrhoea at the time of hospitalisation, which is a matter of concern. This provides further evidence for gender-based discrimination in the care-seeking behaviour of parents at the household level.

Although there is limited evidence in Bangladesh supporting parental preferences for male children when deciding to seek care for diarrhoea, 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 showing that gender was central in illness reporting, choice of external care, public provider and amount to be spent, and in every situation male children were more privileged compared with 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 in South Asia parents prefer male over female children when seeking healthcare for their children.

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

Despite these limitations, we observed that in this study setting, female children are hospitalised less, which is similar to previous findings from Bangladesh.[35] Moreover, national data evidence that death rate among female children is higher at the community level in Bangladesh,[36] and diarrhoea is the second leading cause of under-5 mortality worldwide.[7] Out of millions of diarrhoeal episodes among under-5 children in a year, only 2%–3% develop life-threatening dehydrating diarrhoea.[37] These deaths are preventable through proper access to affordable healthcare. Unfortunately, in low-income and middle-income countries like Bangladesh, female children suffer in terms of survival due to gender inequality in the society.[38] A study conducted across 96 countries to see the association between Gender Inequality Index among women and the prevalence of malnutrition and mortality among under-5 children demonstrates significant positive association, suggesting gender equality as a predictor of survival of children in the society.[39]

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

CONCLUSION

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

Acknowledgements We 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 the 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.

Contributors IM and TA conceived the study. SHK managed the data set and provided technical support. IM analysed 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 input. All authors contributed to the final version of the paper.

Funding The authors have not declared a specific grant for this research from any funding agency in the public, commercial or not-for-profit sectors.

Competing interests None declared.

Patient and public involvement Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

Patient consent for publication Not required.

Ethics approval The Diarrheal Disease Surveillance System was approved by the Research Review Committee and Ethical Review Committee of icddr,b.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement Data are available upon reasonable request.

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