


Review Article

# The Role of Low Lactose Feeding for Preventing Childhood Malnutrition and Long-Term Gut Damage Caused by Recurrent Diarrhoeal Disease

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## Abstract

Even though it has decreased over the past three decades, diarrheal sickness continues to be a major global cause of death for children. There is a strong correlation between childhood rotavirus, diarrhea, climate factors, and malnutrition. On the other hand, a significant nutritional shift (lower levels of undernutrition) among children mal five has been documented in the last ten years, especially in developing nations like Bangladesh, where rotavirus infection has also been on the rise. Given the pathophysiology of rotavirus, there may be a link between the changing diet, the environment, and other artificial factors in urban areas such as Dhaka, Bangladesh, and the rise in rotavirus infections. Under-five malnutrition is still a major problem in Bangladesh, despite significant socioeconomic progress and ten years of initiatives to reduce it. Many research have been conducted in an attempt to identify the primary risk factors for malnutrition; however, none of these have looked into the importance of low birth weight (LBW) 36%. Bangladesh has seen a notable decline in the incidence of pediatric diarrhea deaths in recent decades. Over the past few decades, Bangladesh, a heavily populated country with limited resources, has managed to achieve a notable reduction in the death rate of pediatric diarrhea. Some of the obstacles that still need to be overcome in order to further lower the burden of disease and mortality brought on by diarrhea are enhancing hand hygiene practices, expanding zinc coverage for diarrhea treatment, and maintaining nutritional improvement. To increase intervention coverage and hasten the end of diarrheal mortality among children in Bangladesh, ongoing collaboration with non-governmental organizations and the private sector is necessary, as is the adoption of pluralistic health system platforms for the delivery of preventative and curative services.

## Keywords

Low Lactose, Diarrhea, Malnutrition, Policies and Programs, Management, Acute Diarrhea, Bangladesh

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**Received:** 29 February 2024; **Accepted:** 18 March 2024; **Published:** 11 April 2024



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## 1. Introduction

Despite a decrease over the past three decades, diarrheal illness continues to be a major worldwide cause of pediatric fatalities. [1] Global estimates of mortality related to diarrhea have been continuously declining since the 1980s. Even with all of the advances in medical technology, improved care, and increased use of oral rehydration therapy in recent years, diarrheal infections continue to be a leading cause of morbidity and mortality worldwide. Diarrhea-related morbidity has not declined, in contrast to reductions in mortality; global estimates indicate that each under-five child experiences two to three bouts of diarrhea annually [2, 3]. The poor declining trend in diarrheal infections is caused by several variables, especially in poorer countries, where environmental sanitation challenges are a major influence. According to a recent study, focus should be given to certain interventional techniques for environmental sanitation in India. [4] This is because exposure to urbanization and industry, two risk factors for water-borne illnesses, is changing at different rates. The aforementioned results, the morbidity pattern and variables related to diarrheal disease, as well as preventative and control methods and recent developments, must all be examined in order to establish appropriate control measures at different levels in the community. The bulk of the world's diarrheal mortality is borne by developing nations, with Sub-Saharan Africa and South Asia accounting for the majority of diarrheal fatalities. [5, 6]

Diarrhea among children is still a major problem in Bangladesh's impoverished neighborhoods. There is a significant correlation between certain environmental variables and diarrhea in children. For example, the number of non-cholera cases has been associated to rising temperatures and both high and low rainfall, while the number of diarrhea cases attributed to *Vibrio cholera* has been linked to both high and low rainfall [7]. These could have to do with increasing river levels, which have the potential to produce floods that disproportionately affect the most vulnerable citizens of low-income neighborhoods with insufficient water-satiation systems. In the megacity of Dhaka, flooding and fast land cover (land loss, habitat destruction, and loss of natural plant cover) are connected. In addition, Dhaka permits the spread of typhoid and dengue disease, which is further supported by elements like pollution, overpopulation, subpar sewage systems, waste management, stagnant water, and rising surface temperatures. [8, 9]

Epidemiological research has linked childhood malnutrition to an increased incidence of infectious diarrhea. [10] Rotavirus is one of the most common causes of diarrhea in infants, and cellular attachment to healthy cells in the intestinal brush border is a crucial part of the pathophysiology of rotavirus infection. Consequently, well-nourished children are more likely than undernourished children to contract rotavirus infection. Climate change affects ecosystems and can be used

to forecast the emergence and recurrence of certain illnesses. The Dhaka Hospital's long-running diarrheal disease surveillance system (DDSS) data has been compiled by the International Centre for Diarrheal Disease Research, Bangladesh (icddr,b) to show a correlation between rotavirus diarrhea and high temperatures, low humidity, high river levels, and seasonal variability. The institution has had a sustained increase in rotavirus infections over the last 20 years, despite notable advancements in water and sanitation regulations in the capital city and its surrounding catchment areas. Bangladesh's profile of childhood malnutrition has changed over time, similar to other nations. There has been a recent decline in undernutrition and a rise in overnutrition. [11, 12] The goal of the review research was to draw attention to the necessity of determining the essential elements needed to resurrect international initiatives to prevent and manage diarrhea in children. Bangladesh is suffering from the aftereffects of its success, such as a high degree of complacency regarding diarrhea and the perception that the problem has been resolved, which makes this study particularly interesting.

## 2. Sources and Causes of Diarrheal Disease

Diarrhea is the second most common cause of mortality for children under five. Every year, diarrhea claims the lives of around 500,000 children under the age of five. Each year, almost 1.7 billion individuals worldwide suffer from diarrhea. Every day, diarrhea claims the lives of more children than AIDS, malaria, and measles combined. Diarrheal illnesses claimed the lives of around 1.3 million people in 2013 and affected 45,000 babies. Approximately 40% of pediatric diarrhea hospitalizations are caused by the rotavirus. Every year, the rotavirus kills over 215,000 children under the age of five. *Shigella*, *E. Coli*, *Salmonella* that is not typhoidal, and *Campylobacter* are some of the most frequent causes of diarrhea. Common parasites that induce diarrheal disease include *Giardia lamblia*, *Entamoeba histolytica*, and *Cryptosporidium*. Malnutrition is one of the main causes of disease and death in children under the age of five. [1] It has negative short- and long-term effects on children's growth and development. [13, 14] For instance, compared to healthy children, malnourished children are less productive physically, emotionally, and cognitively. They also have a higher risk of developing chronic illnesses and other disabilities. [15-17] In low-income nations, diarrheal disease accounted for 1.5 million annual deaths among children under five in 2004, making it the second most common cause of death after pneumonia. In developing countries, children under the age of three experienced three episodes of diarrhea annually.



**Figure 1.** Causes of Childhood Diarrhoeal Diseases [44].

A review of 33 research conducted in rich nations found that the frequency and prevalence of acute gastrointestinal illnesses varied from 0.1 to 3.5 episodes per person-year. According to research done in Bangladesh, *Vibrio cholerae* O1 (23%) and ETEC (14%) were the two most often discovered pathogens (11%). Infants accounted for about 8% of cholera cases, with the youngest children being one month old, whereas ETEC infections accounted for 11%. The enterotoxin type was almost evenly distributed among the isolated ETEC strains: 31% were ST, 38% were LT/ST, and 31% were LT. Studies carried out in South Asia, Southeast Asia, and the Far East revealed that the prevalence of *G. lamblia* varied significantly; it was more common in impoverished communities, slightly higher in males than females with children between the ages of 2 and 5, and among university students, the elderly, patients with gastric carcinoma, and HIV-positive patients. Additionally, it was more common in cities than in rural regions. In rural southern India, the percentage of individuals with diarrhea who have *Giardia* infections ranges from 0.4% to 70%. In up to 50% of these instances, the cyst remains asymptomatic. Between 1980 and 2015, Bangladesh's under-five mortality rate decreased significantly, from 198.9 per 1000 live births to 37.6 per 1000 live births. The number of under-five diarrhea deaths decreased from 15.1 to 6.0 per 1000 live births during the same period. [18] Likewise, there was a reduction in the incidence of diarrheal diseases. According to the BDHS, the incidence of diarrhea with blood decreased from 2.8% to 1% (a 64% reduction) and the reported prevalence of diarrhea in children under five declined from 12.6 percent to 5.7 percent (a 56 percent reduction) between 1993 and 2014 [19]. According to studies conducted in hospitals, the frequency of persistent diarrhea dropped from 8% in 1991 to 1% in 2010 [20]. The absence of nationally

representative surveillance data makes it difficult to provide a fair assessment of the incidence of diarrhea in Bangladesh, even though we have estimates from smaller, more focused research groups at various times.

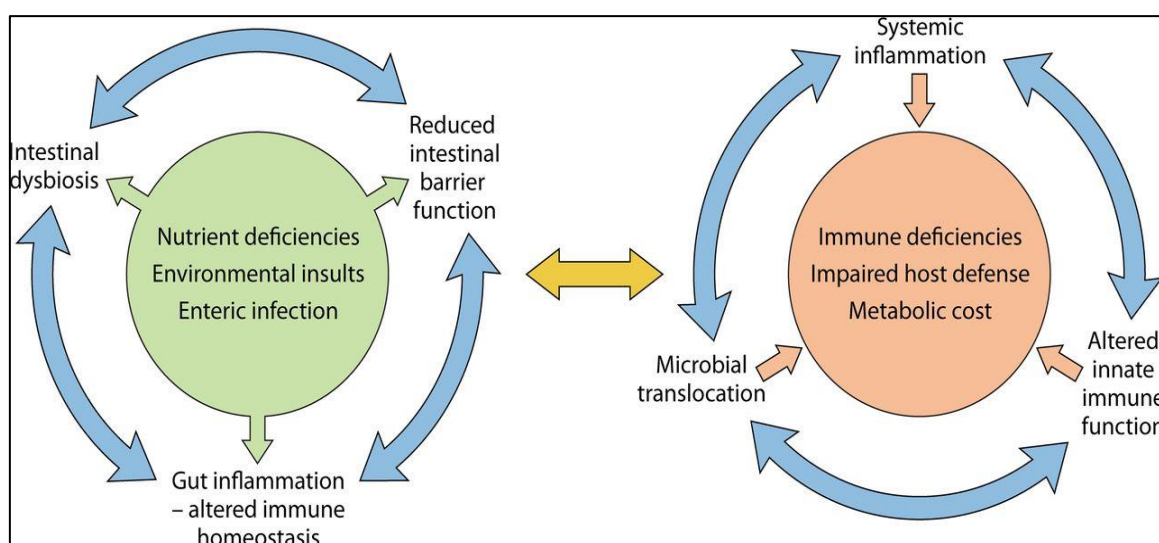
### 3. Childhood Malnutrition and the Fact

Child malnutrition is a major global health concern that continues to seriously jeopardize long-term development and efforts to reduce poverty. Almost 3.1 million children die from malnutrition each year, making up 45% of all deaths in children under five. [1, 2] Malnutrition adversely affects the cognitive development of infants in the early stages. [3, 4] In addition, it hinders adult productivity and earnings and raises school absenteeism. [13-16] Babies born to malnourished mothers have difficulties growing and thriving, and the effects of starvation may be inherited by subsequent generations. Regional estimates from 2014 indicate that the countries of South Asia—particularly India, Pakistan, and Bangladesh—have the highest rates of malnutrition. [1] While Bangladesh has made significant strides in achieving the most of the MDGs over the past ten years. [21] Nutrition for children has gradually improved. [22] When compared to the industrialized world, Bangladesh's malnutrition rate is still far too high, even after more than ten years of efforts to reduce it. [23] Based on the findings of the most current national health survey. In 2011, the percentage of people who were stunted (low height for age) fell from 51% in 2004 to 41%, and the percentage of people who were underweight (low weight for age) dropped from 43% in 2004 to 36% in. The prevalence of wasting, or low weight for height, stayed relatively constant during that time period at about 16 percent, much above the WHO emergency criterion of 15%. These results suggest that more actions are required to improve Bangladeshi children's under-five nutritional status. among Bangladesh, malnutrition among children under five is currently a significant priority for the government and several international organizations. Therefore, it is essential to pinpoint the factors that contribute to malnutrition in children under the age of five so that interested parties may create indication-based nutrition promotion strategies. Finding these variables and providing doable recommendations for better nutrition has been one of the main challenges facing public health professionals. [3] In research carried out globally over the last 20 years, factors such as colostrum deprivation, low household economic status, food instability, failure of exclusive breastfeeding, and the administration of pre-lacteals have all been associated to child malnutrition. [24-28] Research conducted in impoverished nations like Bangladesh has identified short prior birth intervals, low mother education, and poor socioeconomic status as significant risk factors. [24-27] Bangladesh has achieved notable advancements in all three areas over the last ten years [15], but the rate of child malnutrition has only decreased somewhat. [20]

#### 4. Childhood Malnutrition with a Negative Impact on Socio-Economic Condition

Bangladesh's child malnutrition rate, socioeconomic differences, and whether or not they differ by subnational region. Bangladeshi children born to moms with less education and those from lower-income families were found to be more likely to be stunted and underweight. A recent study found that there are significant differences in child malnutrition between the northeastern regions (like Sylhet) and the south and east (like Barisal and Chittagong) based on factors such as education and income. Furthermore, there were regional differences in the protective effects of a mother's education and family wealth in Bangladesh. According to a study, southern and eastern regions like Barisal, Chittagong, and Sylhet have higher rates of stunting and underweight people. Prior studies conducted in Bangladesh also found similar spatial tendencies in the prevalence of stunting and underweight. Previous studies have demonstrated that the highest rates of severe child stunting and wasting, with wasting levels exceeding the WHO critical threshold level, were found in Bangladesh's eastern and south-eastern regions. Parental education and

family wealth appeared to be the most significant predictors of the outcomes associated with malnutrition in children. The study found that children born to parents with higher incomes and educational attainment had the best nutritional results. The influence of these protective factors varies significantly between Bangladesh's regions [19], even if parental SES measurements are protective variables for child health in Bangladesh and other developing nations. For instance, the prediction probabilities of the adjusted models indicated a negative relationship between outcomes across the areas and a mother's educational attainment and family wealth. Both poverty and socioeconomic status are important indicators of underweight children. Compared to children from high-income families, underweight children are more likely to originate from low-income homes. [4] Over the past 20 years, Bangladesh has had significant economic growth and significant improvements in educational attainment; nonetheless, a sizeable portion of the population—roughly 43.3%—remains below the \$1.25 per day poverty threshold. [20] Reducing the prevalence of underweight children in the nation is especially difficult because a sizable portion of the populace is impoverished and unable to afford wholesome food or adequate medical treatment.



**Figure 2.** Impact of childhood malnutrition (Cycle of infection and malnutrition) [42].

Indeed, a number of studies conducted in Bangladesh discovered that children's underweight was mostly determined by the socioeconomic status of the household, with children from higher socioeconomic backgrounds less likely to be underweight. [20] According to research done in Bangladesh by Alom et al., children from the wealthiest wealth index had 44% lower odds of being underweight than children from the poorest wealth index. [20] The majority of studies conducted in Bangladesh showed a correlation between poor family income, the choice of latrine, and mothers' literacy levels as

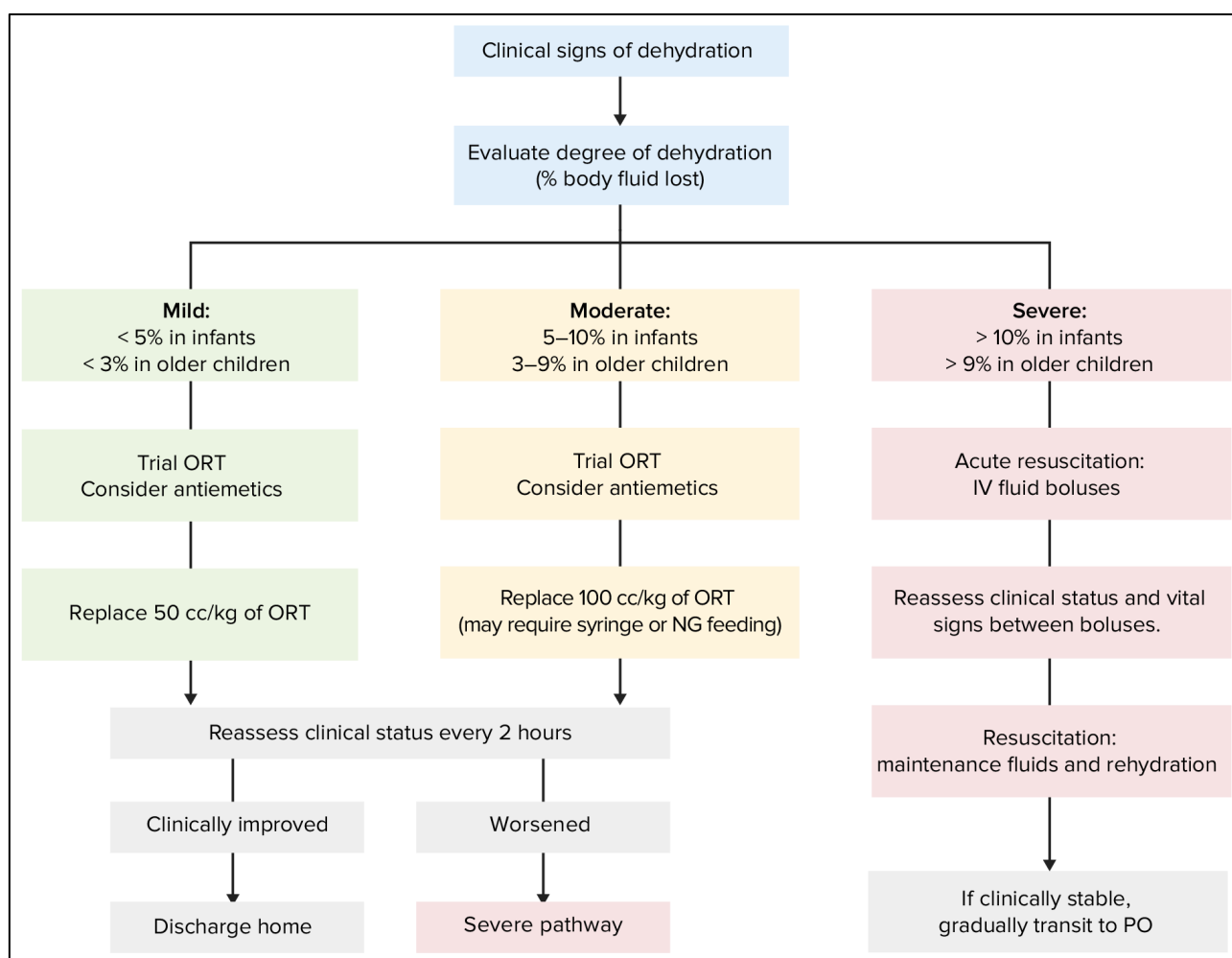
risk factors for underweight in children under five. [22-24] inappropriate feeding techniques, prenatal and postnatal treatment for mothers, and diarrhea in kids who have had it within the last two weeks. [25] residing in a remote region. Other risk variables assessed to be strongly linked with the incidence of child underweight include living in the Sylhet division [15], having fewer media exposure [24], having children whose mothers work outside the home [26], and having inadequate bathroom facilities. According to several research conducted in Bangladesh, children under the age of



five are more likely to be underweight as they get older. Because the causes of underweight are multifaceted, interrelated, and specific to a given area, it is imperative that local research studies be conducted. There is ample evidence that childhood illness rates are correlated with a child's age, particularly in the majority of developing nations. [8] One study found that children in houses with a higher wealth index were less likely to be underweight, while children in homes with a lower wealth index were more likely to be underweight. [27] It's

likely that kids from houses with higher wealth indices were raised in more affluent households, had parents with greater education levels, and resided in better areas with better access to healthcare. It is commonly recognized that a mother's awareness of her child's health has a significant influence on the child's nutrition, and a study conducted in Bangladesh identified women who have healthier child health knowledge had mostly come from the richest household.

## 5. Public Health Campaigns to Compete Diarrhea



**Figure 3.** Key changes in policies and programs for reduction of diarrhoeal diseases in Bangladesh [43].

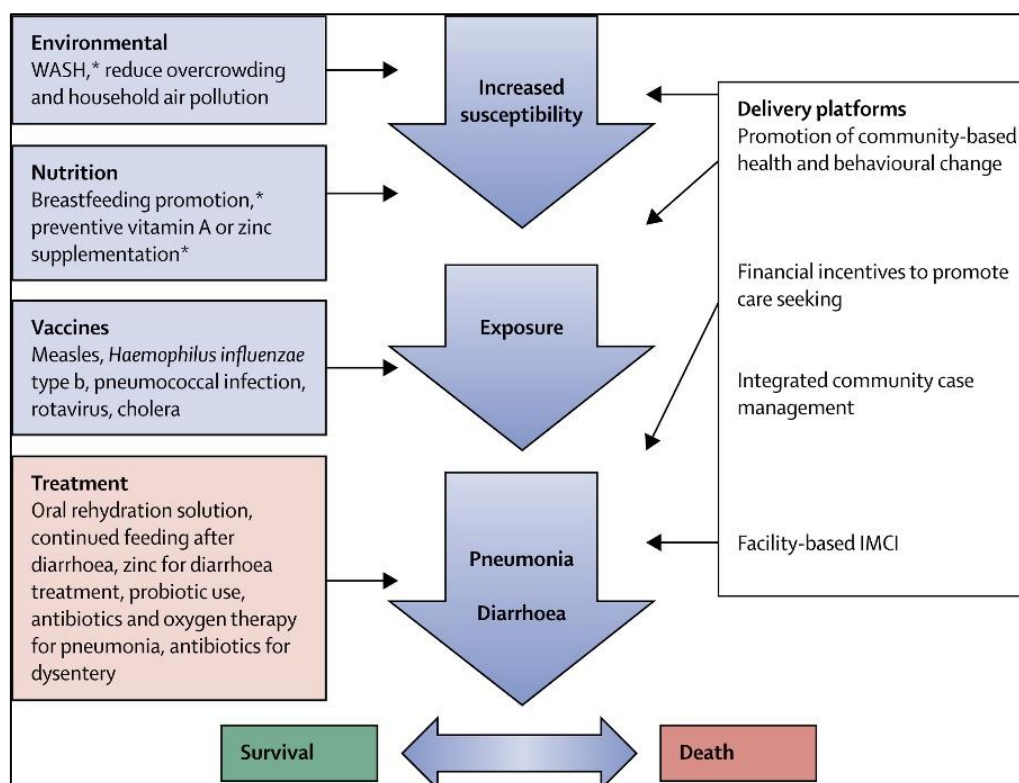
One of the first nations to undertake initiatives aimed at lowering child mortality from diarrhea was Bangladesh. It all began in 1970, when the country of Bangladesh was still a part of Pakistan, and a program called Communicable Disease Control was implemented to monitor outbreaks of diarrhea across the country. With the 1978 Alma-Ata declaration, the prevention and treatment of diarrheal diseases became a major priority for the health sector. In response to the global burden of diarrheal illnesses, [25] WHO launched the Control of Diar-

rhoeal Disease (CDD) Programme [7], which was later adopted by Bangladesh in 1989 [28]. In the late 1990s, WHO and UNICEF developed the Integrated Management of Childhood Illness (IMCI) method, which combines the treatment of common children ailments such as pneumonia, malaria, measles, diarrhea, and malnourishment. When the government of Bangladesh embraced IMCI as an integrated strategy under the "Health and Population Sector Programme (1997-2002) (HPSP)"—the first Sector Wide strategy (SWA)—it took a

major step in reducing the death rate among children under five. Each vertical program that addressed common pediatric illnesses was consolidated into a single management guideline. Significant public and corporate sector investments in com-

munity health workers, especially after the Alma Ata Declaration of 1978, facilitated the rapid uptake of community-based interventions like ORS (oral rehydration Saline) for immunization, family planning, and diarrhea. [29]

## 6. Current Developments in the Fight Against Diarrhea



**Figure 4.** Integrated Global Action Plan for the Prevention and Control of Pneumonia and Diarrhoea (GAPD) [44].

The rotavirus vaccine is authorized for use in 62 countries, and 11 of those have included it in their national immunization schedules. All national immunization programs should include the infant rotavirus vaccine, advises the Strategic Advisory Group of Experts (SAGE). As soon as the vaccine is reconstituted as an oral dosage of 1 milliliter, it should be administered. It is advised to have the immunization in two doses total. The initial dosage should be administered at 6 weeks of age, and no later than 12 weeks. Doses one and two should be separated by at least four weeks. [24] Although rotavirus vaccination is currently too expensive for developing nations, all of the research concluded that it is still cost-effective. Developing countries will surely require financial aid from international organizations to implement rotavirus immunization. Constant antibiotic monitoring is necessary since bacteria were very resistant to some antimicrobial medications, such as co-trimoxazole and erythromycin, which are now recommended for empirical treatment of diarrhea. [9] Global efforts to reduce diarrhea mortality have been reinvigorated by new approaches to prevention, man-

agement, and treatment of the disease, such as zinc supplements, rotavirus vaccinations, and improved oral rehydration formulations. [28] The duration of children's diarrhea is shortened when zinc and prebiotics are added to ORS. There was a 13% decrease in the frequency of diarrhea with prophylactic zinc supplementation. Preventive vitamin A supplementation reduces the mortality rate in children aged 6 to 59 months from all causes and diarrhea specifically in community settings in developing countries. It was discovered that among Finnish visitors to Morocco, the oral killed WC/rBS cholera vaccine (DukoralTM) prevented 23% of all diarrhea episodes and 52% of ETEC cases. However, it was mentioned that this resistance held good for a limited period of time. The preventive efficacy of the rCTB-CF ETEC vaccination against ETEC infection was examined in two larger, placebo-controlled Phase III studies including American visitors to Mexico and Guatemala. 350 infants between the ages of 6 and 18 months took part in the only pediatric study conducted in rural Egypt to evaluate the efficacy of the rCTB-CF ETEC immunization. Certain ETEC immunizations

are being generated using a transcutaneous immunization patch, a unique delivery method. [30]

## 7. Defensive Actions Provide the Basis for Guarding Child Healthy and Disease-Free

### 7.1. Exclusive Breastfeeding (No Extra Meals or Drinks, Including Water)

Keeps babies healthy and makes sure they have access to a clean, safe, and well-balanced food supply throughout the first six months of their lives. Increasing breastfeeding might reduce one-third of respiratory diseases and almost half of diarrhea episodes in low- and middle-income nations.

### 7.2. Continuous Breastfeeding and Sufficient Supplemental Feeding

Proper supplement feeding, which involves providing infants safe, wholesome meals in adequate portions while they continue to be breastfed, may help reduce infant mortality between the ages of six months and two years, particularly in cases of pneumonia and diarrhea.

### 7.3. Vitamin A Supplementation

15% less diarrhea can occur while using a high-dose vitamin A supplement, helping to maintain a healthy immune system. Children between the ages of 6 and 59 months should get two high-dose vitamin A supplements annually in countries with high under-five mortality rates or where vitamin A deficiency poses a risk to the public's health.

In order to manage children's diarrhea, UNICEF and the World Health Organization (WHO) have recommended replacing lost fluids with oral rehydration therapy since 2004. Sustaining meals, zinc supplements, and oral rehydration salts (ORS) are recommended treatments for diarrhea.

## 8. Recent Measures Taken for the Prevention of Diarrhea

### 8.1. Advancements in the Combat of Diarrhea

Throughout the 1960s, a number of studies were conducted at the Dhaka-based Cholera Research Laboratory (now the International Centre for Diarrhoeal Disease Research, Bangladesh; icddr,b), where the revolutionary ORS was created. It has been demonstrated that this drug lowers the chance of pediatric diarrheal disease fatality. [31] In 1981, the National Oral Rehydration Project [30] started distributing ORS widely through medical facilities and during pandemics. However,

because ORS packets were not commercially manufactured, there was a limited supply in rural areas, which hindered attempts to expand up. [32] Around the same time, BRAC started a nationwide campaign that was authorized by the government to raise awareness of diarrheal illness and teach caregivers how to make Lobon-Gur Solution, a basic homemade ORS substitute. [31, 33] The Lobon-Gur Solution has been very successful in increasing awareness of rehydration, however concerns regarding its reliability and safety have been raised. [32] The focus shifted to ORS packets, which are distributed under the OR Saline brand by SMC (Social Marketing Firm), the largest non-profit private social marketing organization in Bangladesh [34]. ORS was also distributed by personnel in the community and government health facilities. A low osmolality ORS (OR Saline-N) was authorized by the WHO in 2003 for use as a treatment for diarrhea in children due to its higher efficacy. [35] SMC established a manufacturing facility in OR Saline-N to facilitate large-scale production and nationwide distribution. Nowadays, all businesses, whether public and private, create low osmolality. The use of ORS for diarrhea is highest in Bangladesh [36]. The business sector, NGOs, public sector governance, and the corporate sector all contributed to the spread of ORS. The community's standard procedure before the Lobon-Gur Solution project was to restrict the amount of food and liquids a child experiencing diarrhea may consume [37, 38]. As part of the Lobon-Gur Solution program, BRAC community health workers performed door-to-door services to raise awareness of the need of seeking medical attention from a certified practitioner as well as the prevention and treatment of diarrhea. The widespread adoption of homemade dehydration treatments and a shift in community norms away from restricted meals were both greatly impacted by this enormous public awareness effort. An evaluation conducted in 1993 found that 70% of mothers were able to make Lobon-Gur Solution and that over half of children under five who experienced diarrhea responded well to oral rehydration treatment (ORT) using either premix ORS or Lobon-Gur Solution. 38 SMC advertised packaged ORS with a national media campaign and made them widely accessible through neighborhood stores and outlets. However, in 1996, the CDD program launched a comprehensive ORT communication campaign through several channels to promote community knowledge and awareness of critical homecare recommendations like drinking more fluids, eating for longer periods of time, and appropriately seeking medical attention when experiencing diarrhea. [28] Rehydrating orally Saline became a common household ingredient and the "go-to" remedy for dehydration. From 50% in 1993 to 77% in 2014, the percentage of children under five who received ORS for a diarrhea episode increased. It has been demonstrated that taking zinc supplements during a bout of diarrhea reduces the need for antibiotics but has no impact on the use of ORS. [18] These findings have led to a major focus of national and international development efforts on increasing the use of zinc in conjunction with ORS for the treatment of diarrhea. Scaling Up Zinc for Young Children (SUZY) was started in 2003 by

icddr,b (International Centre for Diarrhoeal Disease Research, Bangladesh) in collaboration with the Bangladeshi government. [25, 28]

## 8.2. Policy and Programs to Prevent Diarrhea

To increase access to safe drinking water, the Bangladeshi government erected some 10 million deep tube-well (hand pump) wells at no cost in the 1970s with assistance from UNICEF. [10] Improving sanitation became a priority in the middle of the 1990s. Between 1990 and 2014, the public and non-governmental sectors carried out a number of donor-supported large-scale sanitation programs using a range of intervention strategies. These included offering free or partially subsidized building materials for better sanitation facilities, encouraging hygiene practices through behavior change communication (BCC), and fostering an environment that was conducive to good sanitation by doing away with bad sanitation practices. [32] In order to coordinate the Water, Sanitation, and Hygiene (WASH) programs, the first National Policy for Safe Water Supply and Sanitation (NPSWSS) was established in 1998. The National Sanitation Strategy was created in 2005. [39] The development of affordable con-

sumer-oriented latrines and tube wells by the private sector has expedited the shift to clean drinking water and community-led full sanitation. Almost ten districts experienced 100% latrine coverage during the National Sanitation Campaign 2003–06, which was accomplished quickly by combining top-down and bottom-up strategies. [40] In 2014, access to private, sanitary latrines had increased by 45% and clean drinking water was available in nearly every residence in the country. Bangladesh started giving vitamin A supplements to infants in 1973 as part of the Nutritional Blindness Programme to treat vitamin A deficiency. [7] Frontline staff gave vitamin A pills to children during home visits and other service delivery encounters between 1973 and 1993, achieving a coverage rate of 49% among children under three. [11] But in 1995, significant amounts of vitamin A capsules were given out, independently during vitamin A weeks and in conjunction with national immunization days. [41] The National Vitamin a Plus Campaign was originally scheduled to take place once a year by the GoB in 2003, but as of 2004, it has been held twice a year. The percentage of children under five that take vitamin A supplements peaked in 2004 at 82% and has subsequently fallen to 62% in 2014.

SIGNS	CLASSIFY AS	IDENTIFY TREATMENT (Urgent pre-referral treatments are in bold print.)
Two of the following signs: ● Lethargic or unconscious ● Sunken eyes ● Not able to drink or drinking poorly ● Skin pinch goes back very slowly	SEVERE DEHYDRATION	<ul style="list-style-type: none"> <li>➤ If child has no other severe classification: — Give fluid for severe dehydration (Plan C). OR</li> <li>If child also has another severe classification: — Refer <b>URGENTLY</b> to hospital with mother giving frequent sips of ORS on the way. Advise the mother to continue breastfeeding</li> <li>➤ If child is 2 years or older and there is cholera in your area, give antibiotic for cholera.</li> </ul>
Two of the following signs: ● Restless, irritable ● Sunken eyes ● Drinks eagerly, thirsty ● Skin pinch goes back slowly	SOME DEHYDRATION	<ul style="list-style-type: none"> <li>➤ Give fluid and food for some dehydration (Plan B).</li> <li>➤ If child also has a severe classification: — Refer <b>URGENTLY</b> to hospital with mother giving frequent sips of ORS on the way. Advise the mother to continue breastfeeding</li> <li>➤ Advise mother when to return immediately.</li> <li>➤ Follow-up in 5 days if not improving.</li> </ul>
Not enough signs to classify as some or severe dehydration.	NO DEHYDRATION	<ul style="list-style-type: none"> <li>➤ Give fluid and food to treat diarrhoea at home (Plan A).</li> <li>➤ Advise mother when to return immediately.</li> <li>➤ Follow-up in 5 days if not improving.</li> </ul>

Figure 5. Management plan in every sector to combat Diarrhoea disease in Bangladesh [44].

The Third Health Population Nutrition Sector Development Programme 2011–2016 gave growth monitoring and promotion, early initiation, exclusive breastfeeding, and counseling for infant and young child feeding top priority. The National Infant and Young Child Feeding (IYCF)

strategy was created in 2007 [19]. [22] Apart from official endeavors, non-governmental organizations (NGOs) have significantly contributed to the advancement of community awareness on IYCF practices. In order to carry out direct nutrition interventions, such as IY promotion, Bangladesh's



Integrated Nutrition Programme, which lasted from 1995 to 2002, and its successor, the National Nutrition Programme, partnered with NGOs [21]. Even after the 3rd Sector Programme mainstreamed nutrition services delivery via the health system. [30] The frequency of exclusive breastfeeding in the first six months of life increased from 46% in 1993 to 64% in 2011, despite statistics showing a reduction in 55 multi-sectoral projects to improve baby feeding habits. BDHS, 2014.

## 9. Discussion

Bangladesh has assumed the lead in reducing the number of deaths in low- and middle-income nations that are due to diarrhea in children under five. In this piece, we list the major contributing variables that have decreased the number of deaths among children under five who have diarrhea. The most noteworthy benefits were gained from increasing nutritional status and establishing high coverage with ORS and zinc for the treatment of diarrheal episodes, while vitamin A and mild side effects from most other therapies also had an impact. The health system reforms that made this possible were facilitated by the prompt implementation of evidence-based policies and programs, successful partnerships with the private sector, non-governmental organizations, and social marketing initiatives, as well as general socioeconomic advancement. Enhancements in the water and sanitation contributed to a 10% decrease in death from diarrhea between 2000 and 2015. When comparing 1980 to 2000, its impact grew between 2000 and 2015. Bangladesh's adoption of a pro-poor water and sanitation policy in 2005 and the widespread use of tried-and-true solutions throughout the nation may help to explain this. However, Bangladesh still has to improve its hand hygiene standards. Only 4% (4/103) of cholera patients and their family in Bangladesh had taken all recommended measures, including washing their hands with soap, according to data from hospital-based study. [19] It has been suggested that the most effective approach to motivate individuals to wash their hands is through hand hygiene messaging that emphasize the nutritional advantages of good hand hygiene. [27] Severe or chronic diarrhea and fatal enteric illnesses have been linked to under-nutrition [29]. Bangladesh has significantly reduced childhood malnutrition over the past 20 years; in 1996, the percentage of children under five who were stunted was 55%; by 2014, that number had dropped to 36%. Between 1980 and 2015, the drop in diarrheal mortality among children under five was primarily due to a decrease in stunting. According to recent research, averting a child's development from coming to an abrupt stop could reduce the incidence of diarrhea and its associated adverse consequences, like death. [20] Bangladesh's progress in nutrition can be attributed to a number of factors, including pro-poor economic growth, increases in agricultural productivity and diversification, policy interventions that prioritize nutrition, the implementation of vertical programs that raise community

awareness of women's rights and empowerment issues, the response to nutritional emergencies, and support from the non-governmental organization (NGO) sector for the provision of nutrition services. [21]

## 10. Conclusion

A greater effort would be required to attain Millennium Development Goal 4 (MDG 4) since diarrheal illnesses cause a high rate of morbidity and mortality among children in developing nations. The goal of MDG 4 is to reduce the global under-five mortality rate by two-thirds by the year 2015. The provision of oral rehydration solution and zinc supplements, enhanced case management, research on cost-effective interventions, and improved water quality, hygiene, and sanitation should all be priorities for governments when it comes to controlling diarrheal diseases.. Current public health campaigns ought to come up with economical ways to encourage hand washing that can reach millions of people who are vulnerable. Monitoring, appropriate budgetary allocation, follow-up assessment, and strong political will are necessary for the management of pediatric diarrheal diseases in developing nations. Bangladesh's apparent success in lowering diarrheal illness has led to the widespread belief that diarrhea is no longer a priority and has thus become a forgotten worry. Intervention packages that maximize coverage of direct diarrheal interventions and support nutrition and WASH activities are crucial to maintaining the momentum of saving lives from preventable and treatable diseases like diarrhea. Increasing zinc coverage for the treatment of diarrhea, maintaining nutritional improvement, and enhancing hand hygiene habits are some of the challenges that need to be overcome in order to significantly reduce the burden of illness and mortality from diarrhea. Expanding the reach of interventions and hastening the reduction of pediatric diarrheal deaths in Bangladesh would need continued cooperation with non-governmental organizations and the private sector, in addition to utilizing pluralistic health system platforms to administer preventive and curative care.

## Abbreviations

WASH: Water-Sanitation-and-Hygiene-Wash  
ORS: Oral Rehydration Saline  
NGO: Non-Government Organization  
BDHS: Bangladesh Demographic Health Survey  
MDG: Millennium Development Goals  
IYCF: Infant and Young Child Feeding

## Conflicts of Interest

The authors declare no conflicts of interest.

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