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An Analysis upon Present Strategies Promoting Management of Diarrhea in Children: A Review

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Abstract – Diarrhea has been considered as a major cause of mortality in children aged less than five years old. Most of these deaths are due to dehydration and mis management or delayed management of the disease. Most of the diarrhea episodes are treated in the home by mothers. Therefore the mothers' knowledge in management of diarrhea is likely related to its mortality and morbidity. Diarrhea is the second leading cause of deaths in children under five—after pneumonia—with 1.5 million deaths per year. Several studies and meta-analysis, show that low osmolality oral rehydration salts and zinc, significantly reduce morbidity and mortality in children with diarrhea.

Scaling up of evidence-based management and prevention of childhood diarrhea is a public health priority in India, and necessitates robust literature review, for advocacy and action. A set of questions pertaining to the management (prevention, treatment, and control) of childhood diarrhea was identified through a consultative process. A modified systematic review process developed a priori was used to identify, synthesize and summarize, research evidence and operational information, pertaining to the problem in India. Areas with limited or no evidence were identified as knowledge gaps. Childhood diarrhea is a significant public health problem in India; the point (two-weeks) prevalence is 9-20%. Diarrhea accounts for 14% of the total deaths in under-five children in India. Infants aged 6-24 months are at the highest risk of diarrhea. There is a lack of robust nation-wide data on etiology; rotavirus and diarrheogenic E.coli are the most common organisms identified. The current National Guidelines are sufficient for case-management of childhood diarrhea. Exclusive breastfeeding, handwashing and point-of-use water treatment are effective strategies for prevention of all-cause diarrhea; rotavirus vaccines are efficacious to prevent rotavirus specific diarrhea. ORS and zinc are the mainstay of management during an episode of childhood diarrhea but have low coverage in India due to policy and programmatic barriers, whereas indiscriminate use of antibiotics and other drugs is common. Zinc therapy given during diarrhea can be upscaled through existing infrastructure is introducing the training component and information, education and communication activities.

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INTRODUCTION

Diarrhea remains an important contributor to childhood deaths in India, being one of the top 10 causes of deaths among infants and children of 0-4 year of age. About 10% of infants and 14% of 0-4 year children die due to diarrhea in India (1). Important interventions for reducing mortality due to childhood diarrhea include (*i*) appropriate diarrhea management; and (*ii*) promotion of personal and household hygiene practices. Two effective interventions have been introduced as part of the diarrhea management in the last two decades, namely low osmolality ORS and zinc.

According to the World Health Organization (WHO), an estimated 2.5 billion cases of diarrhea occur among children under 5 years of age each year, and estimates suggest that the overall incidence has become stable over the past two decades. More than half of the cases occur in Africa and South-East Asia, where bouts of diarrhea are likely to result in death or other severe outcomes. The incidence varies with the season and the child's age: incidence varies in the first two years and declines thereafter.

Diarrhea is the second leading cause of death among children under five. Nearly one in five child deaths (about 1.5 billion each year) is due to diarrhea. Mortality from diarrhea has declined over the past two decades from an estimated 5 million deaths among children under 5 to 1.5 million deaths in 2004, which parallels downward trends in overall under-five mortality during this period. Despite these declines, diarrhea remains the second most common cause of death among children under 5 globally, following

closely behind pneumonia, the leading killer of young children, and before malaria.

Why should diarrhea, an easily preventable and treatable disease still be causing an estimated 2.5 billion under five deaths every year? Reducing these deaths depends not only on preventive measures and the rotavirus vaccine, but largely on delivering life saving treatment of low osmolarity oral rehydration salts (ORS) and zinc tablets to all children with diarrhea. Today, only 39% of children with diarrhea in developing countries receive the recommended treatment, and limited trend data suggest that there has been little progress since 2000.

India has made steady progress in reducing deaths in children younger than 5 years, with total deaths declining from 2.5 million in 2001 to 1.5 million in 2012. This remarkable reduction was possible due to the inception and success of many universal programs like expanded program on immunization, program for the control of diarrheal diseases and acute respiratory infection. Even though the deaths among children under-5 years have declined, the proportional mortality accounted by diarrheal diseases still remains high. Diarrhea is the third most common cause of death in under-fi ve children, responsible for 13% deaths in this age-group, killing an estimated 300,000 children in India each year. Information on diarrheal diseases, its determinants in India and preventive and control strategies in light of recent developments need to be reviewed for better planning and organization of health services within the community.

Diarrhea is defined as the passage of three or more loose or watery stools in a 24-hour duration (1). The point prevalence (last two weeks) of diarrhea among under-five children is about 9-20% (2). In developing countries the 4.9 children per 1000 per year die as a result of diarrheal illness in the first five years of life (1). Diarrhea causes an estimated 1.8 million deaths per year, and it is a major cause of mortality in children aged less than five years (3). In our country, diarrhea is the fourth cause of under five-year mortality. In a national survey in Iran, 10.1% of children reported to have diarrheal diseases two weeks prior to the interview (4). Young age, poor nutritional status, dehydration, and lack of breastfeeding are the major risk factors for death from diarrhea (5). Studies revealed that rotavirus is the most frequent etiological agent of diarrhea (2). Of the bacterial infectious agents, Escherichia coli are the major pathogens afflicting children aged less than five years (6). Most of diarrheal episodes are self-limited however the mortality is primarily due to dehydration (3). Oral rehydration therapy (ORT) with oral rehydration salt (ORS) solutions is the appropriate management of diarrheal dehydration and is the single most effective strategy in preventing diarrheal deaths in children (2). ORS has been considered as inexpensive and can be easily administered at home by the mothers as soon as a diarrhea episode begins. Its use has been widely advocated by World Health Organization (WHO) (7). It seems that death from diarrhea is easily preventable by simple programs. A systematic review by Shah revealed that only 26% of children used ORT during diarrhea. Only one in ten children was given increased fluids during diarrhea and twenty-seven percent of children were given less to drink; 10 percent were given much less to drink, and 4 percent were not given anything to drink, resulting in 4 in 10 children with diarrhea having their fluids decreased in diarrhea (2). In Iran, 51% of the children in urban and 65% in the rural areas had been treated with ORS (4). Research in Nigeria displayed that most of the mothers had a poor understanding of what caused the diarrhea and only 9.9% used ORS in treatment of diarrhea (8). These findings indicated poor management of diarrhea by mothers in particular areas. Mothers usually delay, seeking medical advice about diarrhea. Sometimes it is too late and the child is either already dehydrated or has started to lose weight. Therefore, it is imperative to notice and identify certain symptoms or signs in order to seek medical advice promptly (1). WHO recommended that mothers and caregivers should be able to identify the signs of dehydration including excessive thirst, sunken eye, reduced urine output, excessive drowsiness, poor skin turgor and restlessness and absence of tears. A study revealed that 73.1% of mothers identified only one of these signs correctly (7). Most of the diarrhea episodes are treated in homes, and mothers are the key caregivers in children under five years old. They are the ones who decide about the nutrition and management of diarrhea in children therefore their knowledge about this common disorder is critically important. The main question of our study was to identify the knowledge of mothers with children under five years old about diarrhea and its management.

Management and treatment of diarrhoea is relatively inexpensive. A review of case studies across nations credits the implementation of Oral Rehydration Therapy (ORT) with a “dramatic” reduction in global deaths from diarrhoea (Victora. Bryce. Fontaine. & Monasch 2000). ORT combats dehydration, a side-effect of diarrhoea linked directly to mortality, through the application of Oral Rehydration Salts (ORS). increased fluid intake, and continued feeding. There is clear evidence that ORS packets if used can lead to a dramatic decrease in childhood morbidity and mortality (Petri Jr.. Miller. Binder. Levine. Dillingham, and Guerrant, 2008).

Despite marked improvements in diarrhoea treatment in other parts of the world, management of childhood diarrhoea is poor in Indian households. Furthermore. India exhibits a negative trend in the prescription of oral rehydration therapy (Forsberg et al. 2007). According to the latest National Family Health Survey (NFHS III)[1]. 55%-66% of mothers bring their children with diarrhoea into health facilities, but only 33% of families administer ORS as pan of the treatment. Further, despite a widespread awareness of ORS its usage remains low: 60.7% of uneducated mothers. 75% of mothers with primary education, and 88.4%

with minimum high school attainment have knowledge of ORS. However, only 18.1%, 24.3%, and 36%, of each respective group uses ORS to treat children. This pattern has persisted over time: the knowledge of ORS has increased actual usage still remains low indicating a gap between awareness of proper care and acmal treatment practices (Rao et al. (1998).

REVISED GUIDELINES FOR MANAGEMENT OF DIARRHEA

The revised guidelines for management of diarrhea (*personal communication*) issued by the Government of India and the Indian Academy of Pediatrics recommend low osmolarity ORS, zinc (10 mg elemental zinc for infants 2 to 6 months and 20 mg/day for children >6 months for 14 days) and continued feeding of energy dense feeds in addition to breastfeeding(11). The guidelines emphasize the importance of home available fluids, hand washing and other hygiene practices. Antimicrobials are recommended only for gross blood in stools or *Shigella* positive culture, cholera, associated systemic infection, or severe malnutrition.

There is presently not enough evidence on either safety or efficacy of antisecretory drugs like racecadotril for its routine use in the treatment of diarrhea. There is no data from our settings. Methodology of most of the published studies on anti-secretory drugs is questionable.

There is presently insufficient evidence to recommend probiotics in the treatment of acute diarrhea in our settings as almost all the studies till date are from developed countries. It is not possible to extrapolate the findings of these studies to our setting where the breastfeeding rates are higher and the microbial colonization of the gut is different.

The effect of probiotics is strain related and there is paucity of data to establish the efficacy of the probiotics available in the Indian market. To recommend a particular species, it will have to be first evaluated in randomized controlled trials in Indian children. More clarity is required on strain standardization, their colonization, dose and duration of therapy, and interaction with other therapy (zinc) before probiotics can be considered for use during diarrhea in India.

PROGRAM DESCRIPTION

The Diarrhea Alleviation Through Zinc and Oral Rehydration Salts Therapy (DAZT) project aimed to enhance the uptake of zinc and ORS among children 2–59 months of age over the course of 4 years in 12 districts of Uttar Pradesh and 6 districts of Gujarat in India. The main strategy of the project was to train public and private sector providers on the appropriate use of zinc and ORS for diarrhea treatment.

Public-Sector Activities - Micronutrient Initiative (MI), an international NGO, led the public-sector aspect of the project in all intervention districts. Public-sector activities focused on increasing the supply of zinc and ORS for diarrhea management and enhancing the diarrhea treatment capacity of all cadres of public-sector health care workers. To ensure the political and policy environment was primed for a public-sector campaign, MI collaborated with state and district governments to develop and promote appropriate diarrhea management policies and to establish a plan to routinely procure long-term zinc supplements. Initially, MI secured zinc and ORS products using its own tender scheme, to ensure the products were available in the intervention areas once training had started, until the state government was able to selfprocure the products.

MI worked with the Ministry of Health in Gujarat and Uttar Pradesh to lead the training of all clinic and community health workers, including auxiliary nurse-midwives (ANMs), medical officers (MOs), ASHAs, and AWWs, on appropriate diarrhea management and the introduction of zinc treatment. MI first conducted a training of trainers, and the trainers subsequently trained groups of providers in each health worker cadre.

The training continued until all providers in each project district had an opportunity to attend training. The training target was set at 100% of providers.

The 1-day training sessions were conducted in the local languages (Gujarati in Gujarat and Hindi in Uttar Pradesh) and covered:

- Signs and symptoms of diarrhea and dehydration
- Treatment of diarrhea, including how and why to prescribe zinc and ORS and the appropriate dose and duration of zinc and ORS
- Why to avoid unnecessary antibiotics
- When to refer diarrhea cases to higher-level health facilities

MOs and ANMs were trained together while community-based workers (ASHAs and AWWs) were trained in a separate group. The timing of the training sessions coincided with supply availability in each district so health care providers could start using their knowledge immediately.

Private-Sector Activities - FHI 360, an international NGO, led the privatesector aspect of the DAZT project. The primary goals in the private sector were to increase the supply of zinc and ORS for diarrhea management, as in the public sector, and to provide necessary information to change the prescription practices among private providers in rural areas, including those in the formal sector (trained physicians), those in the informal sector (without formal medical degrees), and drug sellers/chemists.

The private-sector strategy was based on a cascade of knowledge from the formal to informal sector, and finally to the community to ensure demand creation and long-term sustainability. The project focused first on physicians with formal training because they have long-standing influence in their communities. Reaching informal providers, who are mostly not recognized by the government, was also important because they typically treat the majority of diarrhea patients in rural India. Additional details describing the implementation of the program and other aspects of the evaluation have been published elsewhere.

NEW TECHNICAL ADVANCES: LOW OSMOLARITY ORS AND ZINC

The WHO Meeting of Experts concluded in 2001 that there are programmatic advantages of using a single rehydrating solution globally for all causes of diarrhea in all ages. Evidence from large, well conducted, randomized controlled trials including those in India, showed that low osmolarity ORS with 75 mEq/L of sodium and 75 mmol/L of glucose, osmolarity of 245 osmol/L is effective in children with non cholera diarrhea and in adults and children with cholera(2). This new improved ORS was recommended by the WHO/UNICEF as the universal solution for all ages and all types of diarrhea (3). It was also included in the national policy by the Government of India in 2004.

Subsequently, two Phase IV studies on more than 100,000 adults and children hospitalized with diarrhea (approximately 20% with cholera), reported no increased risk of symptomatic hyponatremia with low osmolarity ORS (4). A number of trials in India and other low middle income countries have documented faster recovery and reduced severity from zinc supplementation during acute diarrhea (5,6). Zinc deficiency is common in children living in such settings due to low intake of animal foods, high dietary phytate content, and overall inadequate diets(7). This led to the WHO recommendation of supplemental zinc syrup or tablets (10 mg elemental zinc for infants <6 months and 20 mg/day for children >6 months for 10 to 14 days) during acute diarrhea (8). Addition of zinc to current case management strategy was evaluated in a cluster randomized study in six primary health centers in North India (9). Prevalence and hospitalization for diarrhea decreased significantly in the villages that received low osmolarity ORS and zinc as compared to the control villages. It is important to note that the prescriptions for antibiotics by care providers and use of unwarranted injections were significantly less, and the ORS use rates significantly higher in the intervention villages. Additionally, zinc given during an episode of diarrhea reduced subsequent diarrheal morbidity. Similar benefits on reduction of antibiotic use during diarrhea were seen in a large multicentre study done across India, Brazil, Ethiopia, Egypt, and the Philippines(10). Prompted by these results, Government of India included zinc in the National program for treatment of diarrhea in 2007.

METHODOLOGY

The methodology for this systematic review has been presented earlier. A set of key questions for review were finalized through consensus building, and categorized as 'Technical Issues' and 'Operational Issues' . Literature searches were initially carried out during April 2010, and updated on 10 January 2012.

RESULTS-

1. Diarrheal Morbidity and Mortality in India

According to 'SRS Report (2009) on Causes of Death (2001-2003)', diarrhea is the third most common cause of death in under-five children in India, responsible for 14% deaths in this age group . Diarrheal illnesses are the leading causes of childhood deaths beyond infancy; it is responsible for 24% of the deaths in children aged 1-4 years, and 17% of all deaths in children 5-14 years.

World Health Organization (WHO) estimates of mortality from 34 studies published between 1992 and 2000 suggest that 4.9 children per 1000 per year in developing countries died as a result of diarrheal illness in the first 5 years of life. This has declined over the years from 13.6 (1982) and 5.6 (1992) per 1000 per year. The decrease was most pronounced in children aged less than 1 year. Diarrhea accounted for a median of 21% of all deaths of children aged less than 5 years in these areas and countries, being responsible for 2.5 million deaths per year. *Lancet* child survival series, using a prediction model, estimated that 22% (14-30%) of all under-five deaths are attributable to diarrhea in 42 countries, where 90% of all under-five deaths occur.

Most recent prediction modeling data also conclude that diarrheal diseases globally are responsible for most under-five child deaths beyond neonatal age. This model predicts that 14% of under-five child deaths totaling to about 0.24 million in India occur due to diarrhea. This figure is similar to the SRS verbal autopsy estimates.

Further, there was marked regional variation with mortality rate from diarrheal diseases in Central India was three times that in the West. Girls in Central India

had four times higher diarrheal disease mortality rate compared to boys in the West.

According to NFHS-3 report, 9% of all under-five children were reported to be suffering from diarrhea in last 2 weeks . The corresponding figures for NFHS-2 and NFHS-1 were 19.2% and 10%, respectively.

These figures are not truly comparable as these datasets were obtained from mothers of children with different age groups (< 4 yr in NFHS-1, < 3 yr in NFHS-2 and < 5 yr in NFHS-3). On comparing the different age groups, the prevalence was more or less similar in NFHS-1 and NFHS-3 whereas it was significantly higher in all age groups up to three years in NFHS-2 survey. The reasons for a worsening trend between NFHS-1 and NFHS-2 followed by a decline in NFHS-3 are not clear.

Surprisingly, states with some of the worst health indicators like UP, MP and Rajasthan reported a very low prevalence of diarrhea in NFHS-1; it increased by 2-3 times in NFHS-2. Another surprising finding from NFHS-1 was that almost 50% of the prevalence of diarrhea in previous two weeks was contributed by prevalence during last 24 hours. This may suggest a significant recall bias in using two week prevalence as an indicator. The second and third survey did not present any data on 24 hour prevalence. Overall, there appears to be decrease in prevalence from NFHS-2 to NFHS-3. However, all this data have to be interpreted with caution as these reported prevalence levels reflect mother's perception of the illness and not the medically certified illness.

More recent data from UNICEF 10-district survey report that 19.8% children (2-59 months) suffered from diarrhea in the two weeks preceding the survey . However, this UNICEF data was from some districts in states with higher child mortality rates, and therefore not representative for the whole country. Countrywide UNICEF coverage evaluation survey reported 14.3% of children (< 2 yrs) to be suffering from diarrhea in the two weeks preceding the survey .

2. Etiology of Childhood Diarrhea in India

There is no large-scale nationally representative community based study in last two decades regarding etiology or trends of diarrhea from India. Most studies have been either designed to specifically evaluate the contribution of a single etiological agent or are based on isolation of microbes from stool samples of hospitalized patients without their clinical details. Moreover, the frequent presence of enteric pathogens in healthy children from developing countries makes it more difficult to determine their true etiological role in causation of diarrhea. The seasonality of some agents also preclude valid analysis from studies reporting cases within a short duration.

CONCLUSION

Despite gains in controlling mortality relating to diarrheal disease, the burden of the disease remains unacceptably high. Reviewing current scenario presents an unprecedented opportunity to save many more children. Focus on comprehensive diarrheal disease control strategy through improved case management, addressing social determinants of health like environmental sanitation and clean drinking water, health promotion regarding preventive practices like breastfeeding and research in the fi eld of cost-effective interventions is crucial to reduce the burden of diarrhea among children in India.

With training about appropriate treatment of childhood diarrhea with both zinc and ORS and access to the products, some providers report prescribing zinc, but long-term sustained use and comfort with the new recommendations will require additional training and distribution of job aids, and possibly other behavior change approaches, to help providers overcome early skepticism and increase familiarization with the correct dose and duration.

Reduced osmolarity ORS and zinc supplementation have proven to be the cornerstone of management of diarrhea in children. As recommended by UNICEF/WHO and key expert partners, a comprehensive strategy encompassing interventions as breastfeeding and hygiene, reduced ORS, zinc supplementation and rotavirus vaccines can be a highly effective way to reduce childhood diarrheal diseases in developing countries.

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