

Curbing Diarrhea in Children below five years old: The sub-Saharan African Standpoint

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Abstract:

Diarrhea is the second foremost reason for death in children below 5 years old in the sub-Saharan African region. Insufficient cleanliness, food insecurity, and inadequate health facilities are markers of SSA and thus contribute to high rates of diarrhea in this area. Diarrhea can trigger worry in the family due to the increased financial costs of fighting the illness. Frequent episodes of diarrhea can put physical and mental stress on mothers and caregivers, not to mention the cost of treating diarrhea, placing an additional burden on an already declining health sector. Several factors influence the occurrence of diarrhea in kids: socioeconomic, environmental, and behavioral factors. Measures to prevent diarrhea include using clean water, practicing better hygiene, washing hands with soap, and providing adequate and complete vaccination. A blend of clean water, sugar, and salt, commonly termed oral rehydration solution (ORS), is used to treat diarrhea. Zinc supplements may improve recovery from diarrhea. Despite the preventable and treatable nature of diarrhea, the rate of deaths among children in the sub-Saharan African region due to diarrhea is unfathomable. Therefore, it is necessary to quickly re-establish mechanisms to combat this threat. In this article, we reviewed the frequency of diarrhea in children living in sub-Saharan African regions, its impact, and the factors that promote its persistence. We also suggested measures that can be taken to combat this childhood monster while enhancing existing control and treatment measures. We used data from articles published in various reputable databases.

Keywords: curbing; diarrhea; Sub-Saharan Africa; standpoint; children below 5 years of age; gastrointestinal infection; WHO; child health

Introduction

The World Health Organization (also known as WHO) describes diarrhea as "a total of three or more watery or free stools within a day or a greater frequency of feces than customary episodes for an individual" [1]. Globally, one out of nine child mortalities is caused by diarrhea, despite the fact that the majority of these deaths can be avoided with basic, affordable remedies. This translates to 801,000 children globally dying from diarrhea per year or 2,195 children dying from it every day, or the loss of 32 school buses occupied with kids each day [2]. Diarrhea kills 0.53 million children beyond age 5 per year globally, accounting for 4 out of every 1,000 live births, according to 2015 WHO data [3]. Diarrhea is specifically the second foremost reason for death of children below five years old, and the main cause of malnutrition. The group most at risk of fatal diarrhea in children, especially those who are malnourished or have a compromised immune system [1]. Sub-Saharan Africa has an infant mortality rate orchestrated by diarrhea 15 times greater than developed nations [4]. Diarrhea is typically a

sign of a gastrointestinal infection triggered by some bacteria, viruses, and protozoa. Insufficient cleanliness may trigger an infection to spread from person to person or via polluted food and water [5, 6]. Measures to avoid diarrhea include consuming safe drinking water, and proper cleanliness practices, including washing hands with soap [1]. Diarrhea comes in three diverse forms: acute watery diarrhea, which may comprise cholera and lingers for several hours or days; acute bloody diarrhea, also called dysentery; and persevering diarrhea, which may endure for two weeks.

A blend of unpolluted water, sugar, and salt, commonly termed Oral rehydration solution (ORS) is used to manage diarrhea. Additionally, a 10–14-day intake of zinc tablets (20 mg) in combination with other approved care reduces diarrhea span and also enhances treatment results [1].

Rotavirus, *Cryptosporidium*, *Shigella*, and *Escherichia coli* are the main pathogens causing diarrhea in children under five years of age [7]. During the first two years of life, the commonest organisms causing diarrhea are

norovirus, rotavirus, Campylobacter, astrovirus, Cryptosporidium, and Shigella, according to Platts-Mills et al. [8].

In this paper, we illuminated diarrhea prevalence in children resident in the Sub-Saharan African region, the impact of diarrhea, and the factors influencing its existence. We also suggested measures that could be employed in the fight against this pediatric monster while strengthening the prehistoric measures. Data from published articles in various were utilized. Search key terms used were diarrhea, diarrhea prevalence in the Sub-Saharan African region, diarrhea in children below five years, its impact, factors influencing diarrhea prevalence, and diarrhea intervention strategies. Journal articles and related papers from 2010-2023 were utilized.

Diarrhea In Children Below Five Years Old in Sub-Saharan Africa: Prevalence

Globally, there are an estimated 1.7 billion cases of pediatric diarrhea annually [1]. It is projected that over 80% of the 1.8 million individuals who pass away each year in developing nations from diarrheal diseases are children below five years old [11]. In developing countries, over 90% of pediatric deaths in infants below the age of five are due to diarrhea. Particularly, 88% of deaths in this age bracket occurred in Southern Asia and sub-Saharan Africa (SSA) [12]. The projected total number of Disability-adjusted life years (DALYs) as a result of diarrhea in SSA was 13% in 2019, in line with the Global Burden of Diseases (GBD) report [9, 10]. Lack of sanitation facilities is the key source of diarrhea [13]. In SSA, access to good water, improved sanitation, and hygiene (WASH) is very limited [13] and the prevalence of diarrhea is unfathomable compared to the rest of the world. According to the Global Burden of Disease Vision Center statement, the total number of DALYs in children under 5 years old in East Africa due to diarrhea is 10.21% [10]. Various research studies have reported that the prevalence of diarrhea in children especially those below 5 years old is very high in East Africa. According to a meta-analysis piloted in Ethiopia, the prevalence of diarrhea ranged from 19-25% [14]. Related research carried out in Uganda, Rwanda, and Malawi showed a prevalence of diarrhea of 32% [15], 26.7% [16] and 20% [17], respectively. In addition, open defecation culture is common in East Africa. A systematic review conducted in Ethiopia found a small proportion of areas devoid of open defecation (exactly 16%) [18]. Similar investigations show that the proportion of communities not open defecating in Kenya (14%) [19], and Uganda (22.9%) [20] is low. In general, access to basic sanitation and hygiene facilities is very low in East African countries [21]. The total prevalence of diarrhea is 15.3%, according to Demissie et al. [22] in their investigation to ascertain the prevalence of diarrhea and their connected variables in infants below 5 years old in 34 countries in sub-Saharan Africa. This figure exceeds that of comparable studies done in other areas, such as Central America, where it is 13.0% [23], Vietnam, where it is 11% [24], and India, where it is 5% [25]. These discrepancies could be the result of various environmental and infrastructure conditions in these areas [14].

Impact of Diarrhea

Emotional Impact

As the primary mothers or caregivers are in charge of all home duties, including caring for their children, having frequent episodes of diarrhea can be physically and emotionally taxing on them. Intensive care unit caregivers spend almost 30% of their work period at home washing up diarrhea, according to a study [26]. Over two caregivers were required to treat diarrhea 70% of the time, according to survey participants, and 69% said that this

assistance was readily available. Sadly, the staff who were put to the test stated that they were frustrated with cleaning up diarrhea roughly 50% of the time [26].

Economic Impact

In addition, diarrhea can trigger worries in the family due to the increased financial costs of fighting diarrhea. Research conducted in Rwanda to investigate the economic weight of children hospitalized with diarrhea reported that families typically carry the majority of the economic weight of hospitalization due to diarrhea and that this weight is significant, especially for families with minimal incomes [27]. In Kenya, it is estimated that rotavirus costs the healthcare system about \$10.8 million per year. In a similar study carried out in Ghana in the healthcare sector to ascertain the cost of diarrhea [28], diarrhea-related expenses were reported to be high. In a study conducted in three Asian countries comprising of Bangladesh, India, and Pakistan to assess the household costs of pediatric diarrhea, the results suggest that diarrhea in children creates economic stress for the affected families [29].

Impact on the Health Sector

In addition, frequent episodes of diarrhea and the growing cost of treatment culminate in added liability for the already feeble health sector. In Kenya, there is a high cost of treatment for rotavirus gastroenteritis which contributes to the depletion of already low medical facilities [30]. Still, in Kenya, diarrheal infections caused 4,471 deaths, 8,781 hospital admissions, and 1,443,883 hospital appointments for diarrheal disease in children below 5 years old every year. In addition, diarrhea in children beneath the age of 5 can slow their development and lead to age-long disabilities. This report is supported by research conducted to assess the non-lethal impact of diarrhea in children, which reported that diarrhea considerably increases the likelihood of impaired physical growth and quality of development [31]. Regular episodes of diarrhea have also been shown to adversely disturb nutrient availability, physical growth, and mental capacity. Evidence abounds that suggests that pediatric diarrhea, especially during the first two years of life, can adversely disturb nutrient absorption culminating in reduced physical growth [32].

Factors Influencing Diarrhea in Children

Several factors affect the incidence of diarrhea in children. They are mainly classified as socioeconomic (maternal age, family size, employment level, and education status), environmental (drinking water sources and hygiene amenities), and behavior (artificial feeding and hand hygiene).

Environmental Factors

The prevalence of diarrhea in children is modulated by environmental factors such as drinking water sources, sanitation facilities, and water treatment. For example, drinking water from uncovered sources is remarkably linked with a greater risk of diarrhea [33]. The reason is not far-fetched, uncovered water sources are susceptible to contamination from runoff, making the water unsafe to drink. Mamboleo et al. [34] in their study in child care facilities using rainwater and shallow well water reported 86.7% of diarrheal cases in Kenya. Asfaha et al. [35] and Id et al. [33] in their studies discovered that the availability of toilets in families lowers diarrhea incidence in children in Ethiopia and Nigeria respectively. In a similar study piloted in Dale, Ethiopia, the risk of diarrhea in children under 5 years old was 3.23 times greater in children living in households with poor waste disposal compared to the risk of diarrhea in children living in households that properly dispose

of waste [36]. Household waste contains many germs that can elicit diarrhea and is also a breeding ground for some flies. Therefore, improper waste disposal can increase the risk of exposure to waste- and food-borne disease-carrying insects, thereby depriving the entire household of sanitation and hygiene.

Inadequate clean drinking water and good hygiene represent the top causes of diarrhea, accounting for 72% and 56% of diarrheal deaths in infants under 5 years old, respectively [37].

The Sustainable Development Goal 6 (SDG-6) targets to accomplish fair global access to clean drinking water, and improved sanitary and hygiene infrastructures by the year 2030 [38]. Unfortunately, approximately 26% and 46% of the global population, respectively, did not have access to clean drinking water and improved sanitation infrastructures in 2020. It is predicted that billions of households will lack access to improved drinking water and improved sanitation facilities except incremental improvements are made by the year 2030 [39]. More so, there are remarkable inequalities in access to clean water and improved sanitation infrastructures between urban and rural areas. The availability of enhanced sanitation and clean drinking water infrastructures is diminished in rural settings compared to urban settings. Specifically, those with no improved water and sanitation facilities are more prevalent in rural areas, especially in developing regions, notably, Southern Asia and sub-Saharan Africa [40]. Worse still, in rural areas, only 2 in 10 people have sufficient portable drinking water [41]. Drinking water supply, sanitation, and diarrhea in children are interconnected. There are many documents justifying this fact [42-44]. Wolf et al. [44] reported that clean drinking water and proper sanitation facilities declined the risk of diarrhea by 52% and 24%, respectively, in low-income countries.

Socio-economic Factors

Maternal age, number of children, employment status, family size, and caregiver's education status are socioeconomic factors that influence the incidence of diarrhea in children under 5 years old. Several studies validate this fact. For example, a study in Pakistan has found that children of mothers or guardians with higher levels of education have much-reduced rates of diarrhea, regardless of clean water and sanitation facilities [45]. Educated mothers and caregivers have improved awareness about cleanliness and infant nourishment [46]. In related studies in Nepal, the incidence of childhood diarrhea was significantly lower in children whose mothers had secondary education than in children whose mothers had no education [47]. According to Demissie et al. [22] in a survey to determine the prevalence and variables associated with diarrhea in children under 5 years of age in 34 sub-Saharan African countries, the prevalence of diarrhea was higher in children with mothers who have a high school education or less. Educating women can improve their knowledge, attitudes, and practice of basic preventive measures such as appropriate breastfeeding, infant feeding, water treatment, and healthier child care [48].

The influence of the mother/caregiver's employment status on the incidence of diarrhea cannot be ignored. Research conducted by [46] in Pakistan shows that stay-at-home mothers have better diets than working mothers. Indeed, working mothers may have difficulty managing the time to prepare healthy meals and instead prefer to buy ready-made meals for their children, thereby weakening their immune systems, and leading to a higher risk of diarrhea and related diseases. According to Demissie et al. [22] in a survey to determine the prevalence and variables associated with diarrhea in children under 5 years of age in 34 sub-Saharan African countries, children of mothers

who were currently working were at risk higher than that of mothers who do not work. A similar study in Ethiopia also reported similar trends [49].

According to Tareke et al. [50], children born to younger mothers have a greater risk of diarrhea than children born to older mothers (35-49 years old). There is no doubt that older mothers have better knowledge and experience about children's general health and diarrhea. Therefore, it is necessary to integrate education about diarrhea and other infectious diseases during antenatal care so that young mothers can be trained. The child's age and gender can also affect the incidence of diarrhea. Demissie et al. [22] reported an increased risk of developing diarrhea in children aged 12-23 years compared with children aged 0-11 months. This may be because babies between 12 and 23 months old start crawling and moving around the house and can therefore easily swallow dirty or contaminated items. This period is also the time when most children under 5 years old stop breastfeeding, so when they stop breastfeeding, babies will be exposed to germs from food and lose the ability to protect against infection. breast milk [51]. According to Tareke et al. [50] the increased risk of diarrhea in children older than 12 months of age may be due to the initiation of complementary feeding. Children who start taking complementary foods are at high risk of eating unhygienic food and are susceptible to diarrhea. This correlates with the results of a similar study conducted in Ethiopia [36].

Household income status affects diarrhea. Children from poor and middle-income households are at higher risk of diarrhea than children from rich households. The high risk of diarrhea in these groups of children may be explained by the difficult economic situation of parents or guardians, who cannot afford transportation costs to health centers and the prescribed drugs. In particular, poor children are malnourished, leading to reduced immunity and increased risk of diarrhea. Studies from Ghana [52], Tanzania [53], and Rwanda [54], all confirm an increased risk of diarrhea in low-income households. The inclusion of nutritional counseling has been pointed to play a remarkable improvement in the treatment results of diseases, especially those diseases whose severity escalates as a result of undernutrition [55]. The risk of diarrhea is higher in children under 5 years of age in households with 5 or more children under 5 years of age [Demissie et al. [22]. This may be because as the number of children under 5 years old in a household increase, the risk of exposure to germs and pathogens increases, and parental attention and quality of care decrease due to mothers are not capable of taking care of large numbers of children. This indicates that birth spacing may have a positive effect on preventing diarrhea. Therefore, this should be considered as one of the main interventions to reduce diarrhea-related morbidity and mortality in children under 5 years old. Asfaha et al. [35] in their study in Ethiopia, reported that children in households with more than three children under 5 years of age were four times more likely to have diarrhea than two or fewer children under 5 years of age in households.

Behavioral Factors

Caregiver behavioral factors, such as artificial feeding protocols and hand hygiene, influence the threat of diarrhea in infants. Despite the high prevalence of diarrhea among children in Kenya, Mamboleo et al. [34] in their study, reported that washing hands with soap after using the toilet reduced the incidence of diarrhea. Getu et al. [56] in their study in Ethiopia, reported that kids whose caregivers washed their hands with water only were two-fold at risk of having diarrhea compared with kids whose caregivers typically washed their hands with water and soap/ash. The vaccination status of children also affects the incidence of diarrhea. Connell and colleagues [53] in a research conducted in Rwanda, reported that children without rotavirus

vaccination were eight times greater at risk of developing diarrhea than those who got vaccinated against rotavirus. House flooring materials have also been shown to have a significant influence on the occurrence of diarrhea in children. This is supported by a study conducted by Melese and colleagues [36] in the Dale district of Ethiopia. The study showed that the rate of diarrhea in children under 5 years old living in households without cement floors is 3.22 times higher than in children living in households with cement floors. The explanation for this could be that houses with cement floors are cleaner than non-cement floors. Child feeding practices are significantly correlated with diarrhea in children. Asfaha et al. [35], in a study conducted in the Zana district of Ethiopia, reported that infants who were not exclusively breastfed and those who received complementary feeding over 6 months of age were five times and twice, respectively, more likely to develop diarrhea, unlike other children of the same age. Similar results have been reported in East African countries [50] and Cameroon [57]. Demissie et al. [22] in a survey to determine the prevalence and variables associated with diarrhea in children under 5 years of age in 34 sub-Saharan African countries, reported that children who were initiated with breastfeeding within 1 hour of birth had a lower risk of diarrhea. Therefore, mothers should be encouraged to start breastfeeding within one hour so that their babies benefit from the protective effects of breastfeeding against infectious diseases, including diarrhea.

Strengthen Anti-Diarrhea Intervention Procedures

Mothers/Caregivers education and Breastfeeding

Educating the mother or guardian about child health care protocols, exclusive breastfeeding, and other attitudinal changes can help prevent diarrhea occurrence in children. Indeed, appropriate breastfeeding and the introduction of complementary feeding from 6 months provide defensive elements that can limit the emergence of infections, as well as diarrhea. It also strengthens children's immunity, indirectly reducing germs that accidentally enter complementary foods during feeding and due to inappropriate food processing, ingredients, and water used [35].

Although exclusive breastfeeding has several advantages, its application rate among infants under 6 months of age in developing nations is still low [58]. Hanieh et al. [59] in a prospective study conducted in Vietnam showed that exclusive breastfeeding at 6 weeks old remarkably lowered the risk of hospitalization due to diarrhea. A study conducted in nine African countries with high mortality due to diarrhea reported that kids who were breastfed immediately after birth and those on continuous exclusive breastfeeding till 6 months of age have a 20 and 50% lower risk of diarrhea, respectively [60]. Acharya et al. [47] reported that partial breastfeeding was linked with a 3.5-fold greater risk of diarrhea in infants compared with exclusive breastfeeding.

The protective effect of breast milk is due to the mother's antibodies contained in breast milk. Among the obstacles to exclusive breastfeeding include type and location of childbirth, awareness of breast milk, problems associated with breastfeeding, mother's employment or educational level, and support for breastfeeding practices at home, community, and health facilities [61]. Therefore, educating mothers and communities about the benefits of breastfeeding as well as enhancing health systems to encourage breastfeeding practice can strengthen breastfeeding practices culminating in better maternal and child health.

Adequate education for mothers or caregivers similarly aids in lowering the incidence of diarrhea in children. Indeed, educated mothers or caregivers

have good knowledge of individual and environmental hygiene protocols, infant feeding and care practices, maintaining standard living conditions, and good knowledge about measures to prevent and control diarrhea. Educated mothers or caregivers will have better waste disposal methods. Organizing public health education against diarrhea, focusing on increasing knowledge of treatments such as the use of oral rehydration (ORS) among rural populations is crucial. In fact, this approach has proven effective in the fight against HIV/AIDS [62]. Using religious leaders and communal health volunteers to improve the controlling of pediatric illnesses, including diarrhea, has presented reassuring effects in developing nations [63,64]

Proper Vaccination

Full vaccination will reduce rotavirus, a top root of diarrhea and loss of life in children under five years old [65]. Therefore, caregivers should be encouraged to vaccinate their children against rotavirus as this provides the best protection against pediatric diarrhea worldwide.

Rotarix and RotaTaq vaccines are linked with a remarkable reduction in hospitalization and death from rotavirus-associated diarrhea. Burnett et al. [66] in a review showed an overall reduction in hospitalization rates of 38% and 42% mortality rates caused by diarrhea in kids below age five. In the same study, rotavirus-related hospitalizations were reduced by 80%. In Botswana, vaccination coverage of 76 to 90% in kids below age 2 reduced diarrhea-orchestrated morbidity and mortality by approximately 23 and 22%, respectively [66]. According to Armah et al. [67], there was a 28 to 48% decline in hospitalization rates during the first three years of diarrheal vaccine use in Ghana. Interestingly, rotavirus vaccination is more cost-effective than other diarrhea intervention strategies. Since 2013, WHO has recommended that the rotavirus vaccine be incorporated in all national vaccination programs owing to scientific proof of the vaccine's effectiveness and cost advantages. Another important anti-diarrhea vaccine is against Vibrio cholera. Acute severe diarrhea caused by Vibrio cholera leads to fast dehydration. Poverty, and a shortage of access to clean water, and sanitary facilities are the primary drivers in the regional propagation of cholera. Despite the fact that cholera is endemic, it has been linked to significant epidemics, mostly in South Asian and African nations. Estimates of the annual number of diarrhea-related morbidities and mortalities are 2.9 million and 95,000, respectively [69]. Despite WASH's advocacy for diarrheal disease control, WHO also recommends cholera control through cholera vaccination as an additional measure in risky areas with cases of outbreaks [70].

Nutritional intervention

Malnutrition causes an increased incidence of diarrhea. Risk factors for malnutrition include abnormalities in gut flora and activity, inflammatory conditions, poor absorption of nutrients orchestrated by diarrhea, and the tendency of caregivers to discontinue during episodes of diarrhea [71]. In a peri-urban region in Lima, 390 childcare providers participated in a survey on infant feeding protocols, the outcome of the survey showed that 73% of the caregivers interrupted regular feedings and 40% interrupted the provision of fruits and vegetables when kids had diarrhea [72]. Surprisingly, most vegetables and fruits contain nutrients in commendable quantities, which can compensate for the loss of nutrients during diarrheal infections [73-75]. While continuing to feed while having diarrhea does not extend the period of diarrhea, it can contribute to a quicker recovery of bowel function.

Zinc has been proven to be an effective tool for controlling diarrhea and is presently on the WHO checklist of needed medications for managing

diarrhea. Notably, a lack of zinc increases the likelihood of diarrhea due to its role in immune response, gastrointestinal liquid transport, and mucous viability. A shorter hospital stay and fewer episodes of diarrhea have been reported in the zinc-treated group in contrast to the untreated group in a randomized clinical research study consisting of 379 Iranian children under the age of five [76].

Furthermore, vitamin A supplementation improves immune function and also lessens the diarrhea rate in children [77]. The most prevalent nutrient deficiency is iron deficiency which leads to anemia [78, 79]. In young children at risk for iron deficiency anemia, iron supplements are often recommended [80]. The potential danger of decreased cognitive, motor, and physiological growth among children with iron deficiency anemia is widely reported [81-84]. However, caution is needed because some research findings opine that children taking iron supplements have a greater risk of suffering from diarrhea. Supplements containing iron can raise microorganism load, inflammation of the intestines, and the risk of diarrhea in infants who take them [85].

Enhancing access to clean water, proper sanitation, and hygienic conditions

According to a study carried out in Benin, clean water storage remarkably lowers the risk of death by reducing diarrhea [86]. In their investigation of the effect of clean water, proper sanitation, and hygiene on infant mortality in Ethiopia, Mebrahtom et al. [87] found that households that utilize treated and safe water have a lower incidence of diarrhea. The influence of household water purification on children's survival is amazing. Other research, however, indicated that clean water had a substantial, meaningful impact [88]. WHO opines that treating water at the point of use water reduces the risk of mortality by preventing the spread of germs and diarrheal illness. According to a recent study by Mebrahtom and colleagues in Ethiopia, access to improved sanitation has been found to be strongly correlated with lower risks of infant mortality due to diarrhea [87]. Alemu claims that the observed decrease in newborn mortality in Africa can be attributed to better sanitation [89].

Conclusion

Numerous factors have been identified that affect the incidence of diarrhea in children. These include socioeconomic (mom's/caregiver's age, the number of kids, the caregiver's occupation, the size of the household, and educational attainment), environmental (water source, and sanitation facilities), and behavior (artificial nourishing and hand hygiene). Factors that contribute to diarrhea can be minimized by educating mothers and caregivers about child health and care practices, appropriate breastfeeding, and other attitudinal changes that can help decrease the frequency of diarrhea in children. Notably, proper breastfeeding provides defensive elements that can limit the emergence of infections, as well as diarrhea. Breastfeeding also fortifies the baby's immune system and reduces the risk of germs that accidentally enter complementary foods during feeding due to improper preparation of foods, ingredients, and water. Furthermore, full vaccination reduces rotavirus, a foremost source of diarrheal disease and death in infants below the age of five. Appropriate nutritional measures are essential tools for controlling and treating diarrhea. Malnutrition exacerbates the incidence of diarrheal disease and makes it worse. It takes a collective effort by everyone to fight diarrhea in sub-Saharan Africa. Thus, let all hands be on the desk so as to achieve this feat.

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