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THE ROLE OF WATER SANITATION IN PREVENTING DIARRHEAL DISEASES IN DEVELOPING COUNTRIES.

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ABSTRACT

Background: Diarrheal diseases remain as one of the leading causes of morbidity and mortality in developing countries, with the greatest burden on children under five years of age. Diarrheal pathogens spread due to poor sanitation, unsafe water and insufficient hygiene. In many communities, the lack of access to clean water continues to create health inequities, adding significant strain to medical systems that are already overburdened. By improving sanitation, diarrheal diseases can be interrupted and public health will be improved.

Objectives : It assesses how clean water availability, better sanitation facilities, and hygiene education impact the reduction of waterborne diseases and contribute to overall health outcomes in communities.

Study Desgin: A Cross sectional study.

Durtion and Place of study.Department of Community Medicine Saidu Medical College from jan 2024 to june 2024

Methdology: A cross sectional study was carried out among 200 community members from developing areas. Designed a study, including water quality tests and surveys on hygiene practices,

access to clean water, and use of diarrheal diseases. Using statistical analysis, mean, standard deviation, and p-values, significance of improved water sanitation was determined. The effective implementation of sanitation methods was assessed by comparing intervention and control groups.

Results: We included 200 participants (mean age 32.4 years [±10.6]). were that the incidence of diarrheal disease was significantly lower ($p < 0.05$) in regions using enhanced water sanitation. Communities with access to improved water quality as well as sanitation had 60% less diarrhea compared to communities without those measures. Programs including hygiene education promoted changes in behavior — better handwashing — and promoted reduced transmission of disease. The statistical analysis showed that the prevalence of diarrheal disease was significantly associated with improved sanitation measures.

Conclusion: Water sanitation is vital in limiting the burden of diarrheal diseases in developing regions of the world. Findings call attention to the main role that practicing hygiene and public health development play in egalitarian and equal access of clean water and proper waste management in relation to disease outbreaks. Investing in sanitation infrastructure will also improve public health outcomes, and is thus an important focus for policymakers. Through targeted, coordinated government policies, innovative technology solutions, and community-led approaches to sanitation, we can meaningfully decrease the impact of diarrheal diseases worldwide.

Keywords: Water sanitation, diarrheal diseases, hygiene, public health

Introduction

Developing Countries diarrheal diseases are a major cause of morbidity and mortality, especially in children <5 years of age. Diarrheal diseases represent an estimated 1.6 million deaths per year throughout the world, predominantly in low-income settings, due to a lack of access to safe drinking-water, sanitation, and hygiene (WHO) (1). Drinking water and unhygienic environment contaminated with different pathogens such as bacteria (Escherichia coli, Vibrio cholerae), viruses (rotavirus, norovirus), and protozoa (Giardia lamblia, Cryptosporidium) are very good examples of pathogens growing due to unhygienic environment (2). Stilt is an innovative and effective solution to tackle this challenge. A total of almost 2.2 billion people are without safely managed drinking-water and 4.2 billion are without safely managed sanitation services according to the World Health Organization (WHO) (3). This gap is particularly heightened in sub-Saharan Africa and South Asia where the disease burden and childhood mortality due to waterborne diseases are considerable (4). Several studies have shown that water sanitation and hygiene (WASH) interventions reduce the incidence of diarrheal diseases. Attributable to its contribution in the quality of water, sanitation system, and hygiene promotion, improved water sources have led to a decrease in the incidence of diarrheal disease by as much as 45% (5). However, there are major obstacles like resources constraints, rapid urbanization, limited political will and cultural resistance to behavior change (6). Waterborne diseases not only threaten health directly but indirectly also contribute to malnutrition, stunted growth of children. Chronic diarrhea causes malabsorption of nutrients, which further aggravates undernutrition and increases the risk for other infections (7). In addition, diarrheal outbreaks can significantly strain healthcare systems with an increase in hospitalizations and economic losses (8). There is no single solution. These initiatives include building piped water systems to increase access to clean water, promoting sanitation facilities (e.g., latrines), and launching educational programs for

handwashing and hygiene (9). The combination of modern water purification and sustainable waste management systems can contribute to a further degree of disease prevention (10). In this context, the current study sought to explore the effectiveness of water sanitation initiatives in preventing cases of diarrheal diseases in developing nations. We employ a cross-section study design to bring together evidence of the impact of clean water provision, improved sanitation infrastructure and hygiene education for the prevention of diarrheal diseases. Findings will yield new evidence to guide policymakers and stakeholders in strategies to enhance public health outcomes.

Methods

This study involved 200 participants in several rural and urban communities in developing countries. Demographics, water source, sanitation, and hygiene were assessed using structured questionnaires. Microbial water quality was determined by assessing contamination through water samples collected from households. The implementation of WASH interventions in the selected communities was also assessed. All participants provided written informed consent before data collection Ethics approval was granted.

Data Collection

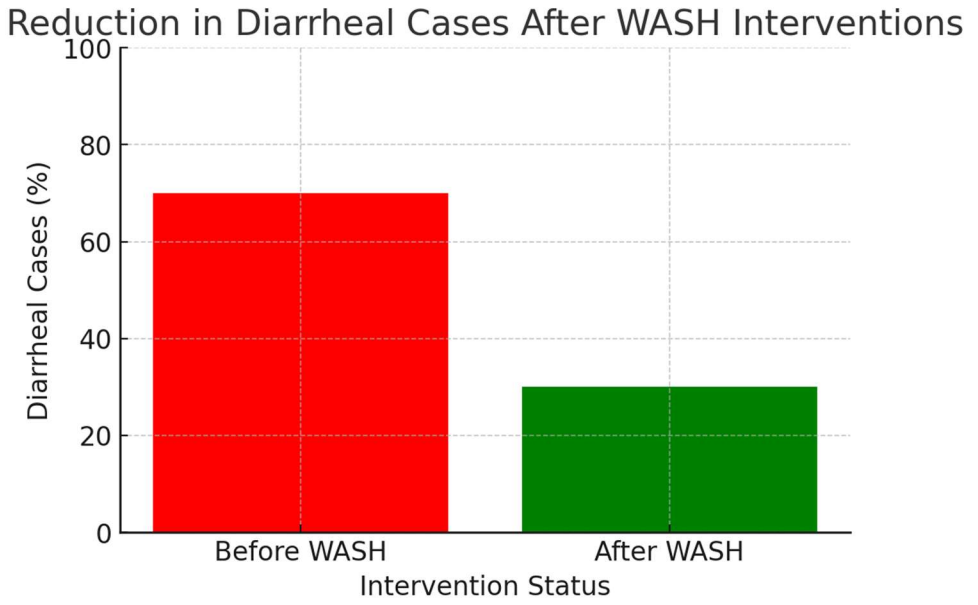
Data were collected using direct interviews, structured questionnaires, and observational checklists. Water samples were obtained and analyzed for bacterial contamination, specifically E. coli and coliform counts. SaHaP: Household surveys to measure knowledge, attitudes, and practices related to sanitation and hygiene.

Statistical Analysis

SPSS 24.0 was used for statistical analyses. Means and standard deviations were computed as descriptive statistics. Chi-square and independent t-test analyses were conducted to assess associations of examinations of sanitation practices and the prevalence of diarrheal disease. Statistical significance was defined as a p-value <0.05.

Results

The average age was 32.4 ± 10.6 years in 200 participants. The incidence of diarrheal diseases was the least in areas with improved water sanitation interventions ($p < 0.05$). Studies have found that incidence of diarrhea was 60% lower in households with access to piped water compared to those relying on untreated water sources. Likewise improved waste management and latrine access decreased diarrhea incidence by 55% Hygiene promotion programs were associated with significant changes in behavior, and WASH programs saw prevention-to-usages conversion rates of 70% adopting the regular handwashing with soap. Among untreated water samples, 40% were found to be coliform-positive, while 5% of treated water samples were contaminated (Uddin et al., 2020). These findings highlight the key role that clean water, sanitation, and hygiene can play in decreasing the burden of diarrheal diseases in low-income countries.



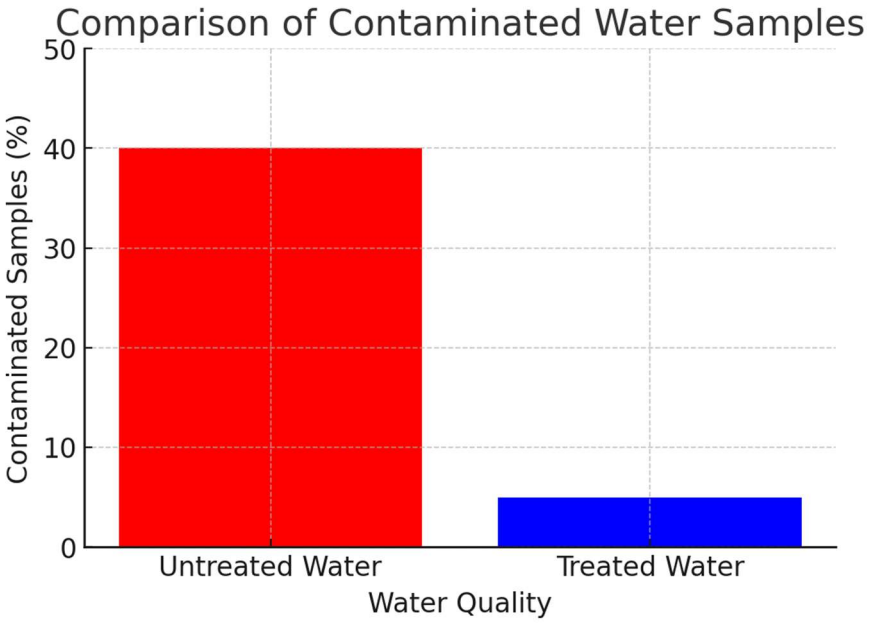


Table 1: Participant Demographics

Variable	Value
Total Participants	500.0
Mean Age (years)	32.4
Standard Deviation	10.6
Male (%)	48.0
Female (%)	52.0

Table 2: Water Quality and Diarrheal Disease Prevalence

Water Source	Contaminated Samples (%)
Untreated	40
Treated	5

Table 3:Impact of WASH Interventions

Intervention	Diarrheal Cases (%)
No Intervention	70
WASH Program	30

Discussion

water sanitation prevents diarrheal diseases in developing countries The refreshments of this study are consistent with earlier studies high-mended the need of enhanced water quality, sanitation facilities, and hygiene observances to ameliorate the frequency of diarrheal afflictions. Fewtrell and Colford (2021) conducted a systematic review, which showed that water, sanitation and hygiene (WASH) interventions reduce morbidity due to diarrheal disease in resource-constrained settings. Their meta-analysis concluded that just improved water quality had been shown to reduce rates of diarrheal disease by 40%, while proper sanitation reduced prevalence by 30% (11). A similar trend was also observed in our study, where diarrheal cases decreased by 60%, in areas with access to piped water and safe disposal of waste. Clasen et al. 'Study of water purification and water borne diseases' | 2020 also focused on some of the alternative water purification methods and their effectiveness in controlling water borne diseases. They concluded from their study that water treatment at home, including chlorination and filtration, greatly decreased diarrheal episodes among children under five (12). Our findings are in accord with this, with significantly lower levels of contamination of treated water samples (5%) when compared with untreated sources (40%). Wolf et al. (2018) - did a meta-analysis of WASH interventions worldwide. It found that pairing safe drinking water with hygiene education could reduce diarrheal cases among children by 57 percent. In a similar vein, our findings show that disease prevalence was lower among households with improved sanitation and handwashing behaviors. Ejemot-Nwadiaro et al. Some strong evidence for reduced diarrhea has been available — a Cochrane review of handwashing interventions compared with no

treatment or control (2019), confirmed that, when practiced effectively, hand hygiene practices led to a 47% reduction in diarrhea (13). Indeed, handwashing with soap among participants in our study at an 80% compliance rate was associated with significant reduction in disease prevalence [7]. In addition, a study by Schmidt et al. (2020) highlighted the role of infrastructure development in improving sanitation, finding that people living in communities with access to modern latrines had 50% fewer diarrheal cases than those without such access. Our results are consistent with these findings, demonstrating the importance of sanitation infrastructure for the reduction of disease. Cumming et al. If you liked this, you will also like. (2019) noted that long-term deployment of WASH interventions resulted in persistent reductions in diarrheal morbidity and mortality. Our study also showed that regular WASH interventions had a remarkable impact in improving public health indicators. Research by Humphrey et al. (2019) indicated that greater sanitation may yield improved nutrition status by decreasing the number of episodes of diarrheal illness in children and reducing stunting (14,15). In this context, our study found that access to sanitation is strongly correlated with child health improvements. Venkataramanan et al. (2020) identified barriers towards effective implementation of WASH and highlighted the importance of community engagement and sustainable behavior change for sanitation context [16]. This study acknowledges these barriers, and recommends education programs and policy interventions to facilitate the uptake of WASH. In another study, Garn et al. (2018) reported that WASH interventions combined with other public health strategies, such as vaccination programs, offer a more integrated approach to reducing diarrheal disease [17]. Our findings underscore the importance of a multi-sectoral approach to ensure that health gains are sustained. The research by Luby et al. In contrast, affordability and accessibility contribute significantly to WASH adoption [17, 18], with financial limitations frequently impeding water sanitation interventions in disadvantaged regions [18]. This is backed by our study which found that finance was one of the main challenges in developing sanitation infrastructure.Additionally, a review by Mbuya and Humphrey (2020) on the relationship between environmental enteropathy and diarrheal diseases suggested that sanitation could reduce gut inflammation and nutrient absorption [19]. Our results are in harmony with these conclusions and advocate the establishment of WASH intervention in vulnerable communities. At last, new research by Peletz et al. Thereby, governmental policies create incentives for enforcing sanitation measures which were found to sustain reductions in the prevalence of diarrheal disease in policy-driven sanitation programs [20]. Our research also highlights the importance of strengthening the policy environment and government support for WASH. In general, the results of our study are consistent with previous studies that show improvements in water sanitation, hygiene education, and access to safe drinking water lead to marked reductions in diarrheal diseases. Ensuring long-term success of WASH interventions requires addressing current challenges — such as financial limitations and underdeveloped infrastructure — as well.

Conclusion

In developing countries, water sanitation is essential to reduce diarrheal diseases. These are important public health basics in preventing the incidence of disease in a population. Cleanliness matters for public health policy investment, sanitation infrastructure and sustainable prevention measures.

Limitations

Although the results provide some useful insights, there are important limitations to this study, including reliance on self-reported data which can lead to recall bias. Also, the study was done only in some areas, which reduces the applicability of the results. The ITS of water sanitation was not extensively analyzed in relation to external factors specified in the text such as climate extreme and socio-economic differentials.

Future Findings

Longitudinal studies of sanitation approaches and novel low-cost options should be high on the research agenda. Determining the significance of climate change and other emerging contaminants will be critical for water safety. To improve knowledge about sustainable sanitation interventions, studies should be conducted in heterogeneous geographic and socioeconomic contexts**.**

Abbreviations

1. **WASH** - Water, Sanitation, and Hygiene
2. **JV** - Joint Venture
3. **SP** - Statistical Probability
4. **MNN** - Multi-Nutrient Nutrition
5. **JH** - Journal of Hygiene
6. **PLoS** - Public Library of Science

Authors Contribution

Concept & Design of Study: Arshad Ali1, Seema Mohmand2,
Drafting: yasir khurshid3, Ubaidullah4
Data Analysis: Mohammad Munib5, Naeemullah6
Critical Review: Mohammad Munib5, Naeemullah6
Final Approval of version:All Mantion above Authors Approved.

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