Preventia: The Indonesian Journal of Public Health
ISSN: 2528-2999 (Print): 2528-3006 (Online)
DOI: 10.17977/um044v10i12025p50-57

Diarrhea Risk Factors of Toddlers in Jember District 2022

Annisa Fitrah Aini, Yunus Ariyanto*, Adistha Eka Noveyani
Universitas Jember, Jl. Kalimantan No. 37, Jember, East Java, 68121, Indonesia
*Authors correspondence, Email address: yunus.ariyanto@gmail.com

ARTICLE INFO

ORCHID ID
Author 1: -
Author 2: https://orcid.org/0000-0002-0529-041X
Author 3: https://orcid.org/0000-0002-1845-2705

Article History:
Paper received : 30-06-2024
revised: 24-06-2025
accepted: 24-06-2025

Keywords:
Diarrhea; toddlers; geographical.

ABSTRACT

Diarrhea is a disease characterized by passing feces three or more times a day. The occurrence of diarrhea is also influenced by sociodemographic factors (nutritional status) and environmental factors (access to clean water, access to sanitary latrines, and living in flood-prone areas). The purpose of this research focuses on finding risk factors for diarrhea and mapping the risk factors of diarrhea. This study used an ecological study design, in which the population is all sub-districts in Jember. Secondary data were used in this research. The data were analyzed using statistical correlation analysis using SPSS and mapping using GIS software. The statistical analysis results between each risk factor and the incidence of diarrhea indicated that all the risk factors were correlated with diarrhea. Maps showed that each sub-district has different potential risk factors. Our recommendation is determining specific programs to be implemented in each area, considering potential risk factors.

1. Introduction

Diarrhea is a condition marked by the passage of feces three or more times a day and can be triggered by various pathogens, including bacteria, viruses, and parasites (WGO, 2013). The consequences of diarrhea can lead to severe dehydration in children and impede the absorption of nutrients and food, potentially resulting in fatal outcomes, including death (Ibrahim & Sartika, 2021). In global, diarrhea was the third most common cause of death in children under the age of five years old, killing approximately 443.832 children each year (WHO, 2024). Cases of children under five years old 2020-2021 in Jember District showed a decrease of 3,1% with a total of 13 deaths reported. However, in 2022, the data of cases rose again by 7,9% compared to the previous year. Despite the cases increased, the data of deaths due to diarrhea among children under five decreased during that year, with only three deaths reported (Dinkes Kab. Jember, 2023). According to the East Java Provincial Health Office in 2022, Jember District ranked 9th for under-five diarrhea cases, with a total of 9.365 cases and a case fatality rate (CFR) of 0.03% (Dinas Kesehatan Provinsi Jawa Timur, 2022).

The etiology of diarrhea is multifactorial, influenced by various sociodemographic and environmental factors. Sociodemographic factors include age, gender, and nutritional status. Research indicates that diarrhea predominantly affects children aged 0-24 months, attributed to their underdeveloped immune systems, which make them more vulnerable to infections (Marita et al., 2022; Ponirah & Harini, 2022). Diarrhea's impact on nutritional status is particularly concerning when compounded by malnutrition. This interaction suggests that diarrhea can exacerbate undernutrition in toddlers by impairing nutrient absorption, while malnourished toddlers are at higher risk of infectious diseases like diarrhea, creating a cyclical

pattern that worsens their malnutrition (Alim et al., 2021). Research at Puskesmas Putri Ayu, Jambi showed a significant relationship between nutrition status with incidence of diarrhea in children under five. Children affected by malnutrition are more susceptible to diarrhoeal infections. The incidence of diarrhea causes malnutrition to become more severe resulting in increased mortality rate (Oktariana et al., 2023). Environmental factors, particularly inadequate sanitation, can degrade environmental quality significantly. For instance, water sources can become contaminated, a condition exacerbated by natural disasters like floods. Inadequate sanitation is further exacerbated by limited access to proper latrine facilities and the widespread practice of open defecation. These factors result in widespread fecal contamination of the environment (Ananda Br et al., 2023; Rau & Novita, 2021). Research conducted in Ujuhan Subdistrict, Palu showed that poor sanitation such as inadequate access to clean drinking water and latrines are risk factors for diarrhea in children under five. This is due to lack of public knowledge about the importance of clean water and ownership of proper latrine (Miswan et al., 2023).

The issue of diarrhea in Jember Regency requires significant attention. Each region has different characteristics of diarrhea from an epidemiological perspective, which include aspects of time, place, and people, leading to variations in the characteristics of diarrhea occurrence across geographical areas. Therefore, this research focuses on health issues that consider the combination of statistical-spatial aspect or region, employing mapping techniques to discern and analyze the distribution patterns and transmission risks of diarrhea attributed to environmental factors in each area. The Geographic Information System (GIS)-based mapping method aims to illustrate the spatial distribution of diseases, thereby providing information regarding high-risk locations to determine priority areas. Statistical techniques prove that risk factors and diarrhea datas are sociated or not (Siswanto, 2022). Based on the description above, Geographic Information System (GIS) based mapping is necessary to provide more comprehensive information about the distribution of diarrhea incidents and risk factors, which can be depicted spatially.

2. Method

This study used an ecological study design with a statistical and spatial approach. The data used in this study are secondary data from the Jember Regency Health Office and the Jember Regency Regional Disaster Management Agency. The research is conducted in Jember District, which includes 31 sub-districts. The sample included all records cases of diarrhea among children under five in Jember from January to December 2022. The data were selected based on availability, as they had already been compiled, verified, and processed by Jember Regency Health Office. The population consists of all cases of diarrhea in toddlers in Jember District. Risk factor variables consist of access to clean water, access to sanitary latrines, nutritional status, and living in flood-prone areas. Data collection used a checklist form. The analysis methods used are Spearman’s rank correlation test and mapping. Statistical analysis used Spearman's rank correlation test to determine the relationship between diarrhea incidence and its risk factors. Mapping employs the choropleth method. This research has passed the health research ethics committee (KEPK) of the Faculty of Dentistry, University of Jember, involving human subjects with registration number 2462/UN25.8/KEPK/DL/2024.

3. Result and Discussion

3.1 Statistic Analysis

The results of Spearman's Rho correlation test indicate a very strong relationship between all risk factors of diarrhea and the incidence of diarrhea in Jember Regency. Table 1 show about results of analysis of the relationship between diarrhea cases and risk factors or diarrhea.

Table 1. Results of Analysis of the Relationship between Diarrhea Cases and Risk Factors of Diarrhea

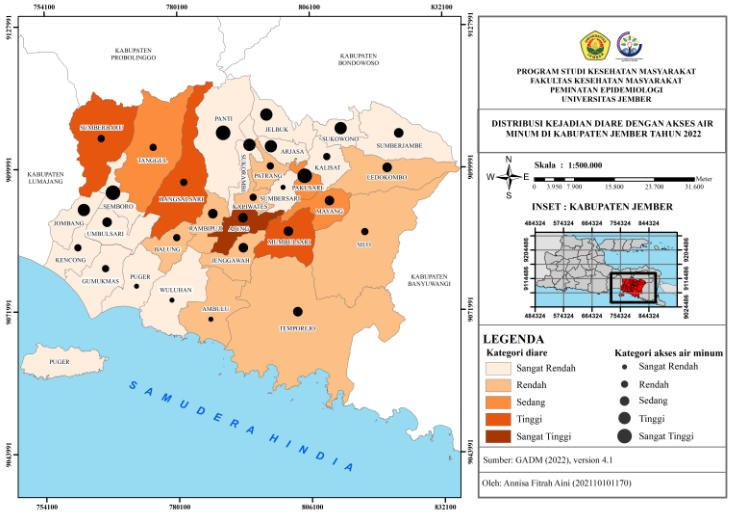
Risk Factors	Spearman's Rho	
	p-value	*r-value*
Access to Clean Water	0,000	-0,892
Access to sanitary latrine	0,000	0,889
Nutritional status	0,000	0,905
Living in flood-prone areas	0,000	0,900

Source: Secondary data, 2022

3.2 Distribution of Diarrhea Incidents with Risk Factors in Jember Regency in 2022

3.2.1 Incidents of Diarrhea with Access to Clean Water

Based on the distribution of access to adequate water, it showed that the Pakusari sub-district is an area with moderate incidents of diarrhea, which has access to water inadequate of the very high category. It means that the reported cases of diarrhea among toddlers in the Pakusari sub-district are attributed to the insufficient use of adequate water by some households. In the Semboro and Panti sub-districts, despite the access to inadequate water of the very high category, the incidents of diarrhea are classified as very low. Figure 1 show about map of diarrhea with access to clean water.



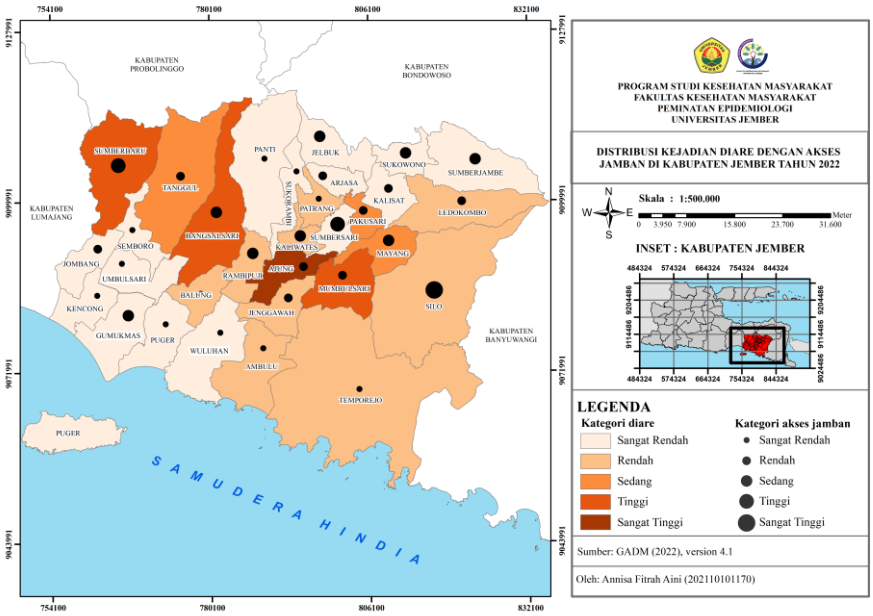
Source: Primary Data, 2024

Figure 1. Map of Diarrhea Incidents with Access to Clean Water

Water plays a crucial role as a conduit for disease transmission via microorganisms, leading to waterborne illnesses. Diarrhea can be transmitted through contaminated drinking water. This risk is further compounded by human behaviours if the management of drinking water, including storage and processing, does not meet the standards. One example of drinking water management is boiling, which aims to kill microorganisms to reduce the spread of diarrheal diseases (Adria *et al.*, 2023). In addition to water management, inadequate access to clean water represents another significant factor contributing to diarrhea. Previous research has explained that households facing limited availability of clean water are at a heightened risk of inducing diarrhea in toddlers due to consuming water from contaminated sources, unlike households with ample access to adequate water (Labado & Wulandari, 2022).

3.2.2 Incidents of Diarrhea with Access to sanitary latrine

Based on the distribution of access to sanitary latrines, the map showed that Sumberbaru sub-district is an area with high incidents of diarrhea, which has access to inadequate latrines of the high category. This means that the reported cases of diarrhea among toddlers in the Sumberbaru sub-district are caused by the numerous households using inadequate latrines. In the Sumbersari and Silo sub-districts, despite the numerous households using inadequate latrines, the reported cases of diarrhea are low. Figure 2 show about map of diarrhea incidentes with access to sanitary latrine.



Source: Primary Data, 2024

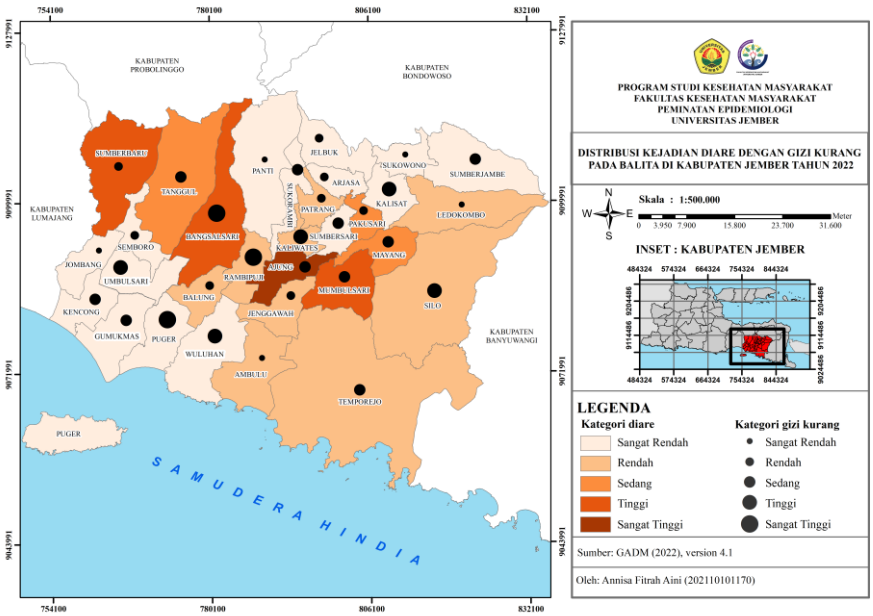
Figure 2. Map of Diarrhea Incidents with Access to Sanitary Latrine

Inadequate latrines can heighten the risk of diarrheal transmission. For example, improper disposal of septic tank effluents into rivers can be a major problem. Human faeces can act as a reservoir of diarrheal pathogens, particularly when it's left exposed in open areas. Flies landing on human faeces can carry diarrheal bacteria and transfer them to human bodies when they land on consumed food. Moreover, diarrheal pathogens can also spread through direct contact with the faeces of infected individuals. Additionally, diarrhea can be caused when fecal containment sites are located too close to clean water sources (within less than 10

meters), leading to water contamination (Adria *et al.*, 2023; Fauziyah & Siwiendrayanti, 2023). Previous research has explained that households with inadequate latrines have a 1,263 times increased risk of causing diarrhea in toddlers compared to households with adequate sanitary latrines (Leni, 2019).

3.2.3 Incidents of Diarrhea with Nutritional status

Based on the distribution of nutritional status, the map showed that Bangsalsari sub-district is an area with high incidents of diarrhea, which has an undernutrition status of the very high category. It means that the reported cases of diarrhea among toddlers in the Bangsalsari sub-district are caused by undernutrition. In the Rambipuji and Puger sub-district, despite the high incidents of undernutrition, the reported cases of diarrhea are low. Figure 3 show about map of diarrhea incidents with nutritional status.



Source: Primary Data, 2024

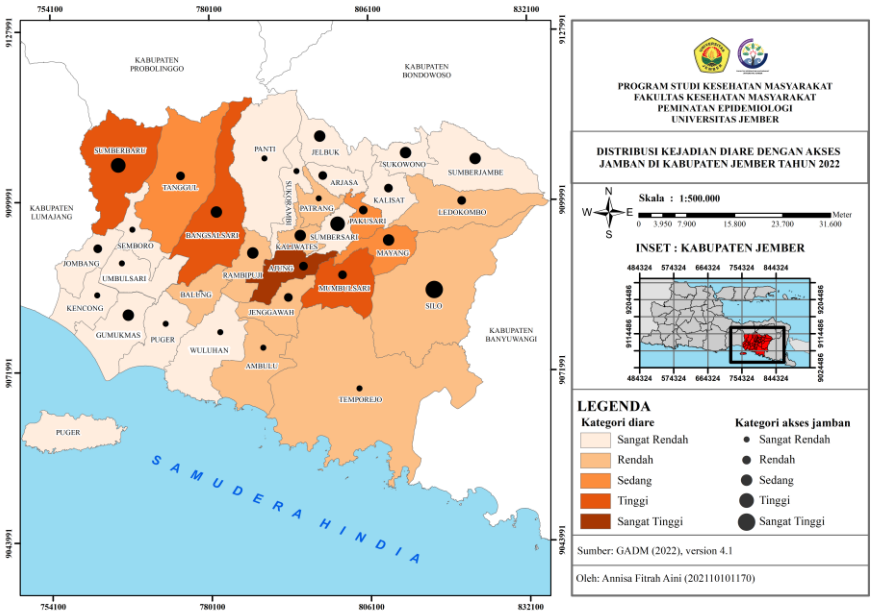
Figure 3. Map of Diarrhea Incidents with Nutritional Status

Diarrhea and malnutrition share a reciprocal relationship, wherein each can exacerbate the other. Diarrhea can induce malnutrition by disrupting nutrient absorption and causing fluid loss. Conversely, malnutrition weakens the immune system increasing susceptibility to infections like diarrhea. Toddlers experiencing diarrhea with malnutrition often endure more frequent and prolonged episodes due to delayed intestinal mucosal cell repair. Malnourished toddlers experience can decrease in food or nutrient absorption function in the intestine, further weakening the immune response and heightening vulnerability to infectious diseases such as diarrhea (Ma'arif, M. Z., 2021; Puhi *et al.*, 2023).

3.2.4 Incidents of Diarrhea Living in flood-prone areas

Based on the distribution of flood-prone areas, the map showed that Ajung and Mumbulsari sub-district is an area with high incidents of diarrhea and a high level of flood vulnerability. It means that diarrhea often occurs in areas prone to flooding. Some areas have

few reported diarrhea incidents but have a high risk of flooding. Figure 4 show about map of diarrhea incidents living in flood-prone areas.



Source: Primary Data, 2024

Figure 4. Map of Diarrhea Incidents Living in flood-prone areas

Previous research conducted in Bangladesh revealed a significant positive correlation between flood-prone areas classified as moderate and high and the incidence of diarrhea among toddlers. The persistence of diarrhea in flood-prone areas without a decrease could be attributed to the ineffectiveness of sanitation infrastructure development in preventing diarrhea, resulting in unequal access to essential sanitation facilities such as safe drinking water and proper latrines (Kikuchi, 2023).

In this research, it is observed that flood-prone areas typically exhibit moderate access to adequate water. This suggests that there are still households lacking sufficient access to adequate water contributing to numerous cases of diarrhea among toddlers. Consequently, some households resort to consuming unprotected water sources for their daily needs. In addition to sanitation facility factors, communities in flood-prone areas also experience health issues due to poor personal hygiene, particularly in handwashing behaviour with soap. Toddlers with mothers who do not consistently wash their hands with soap have a 5.12 times higher risk of developing diarrhea compared to those with mothers who practice regular handwashing with soap (Kikuchi, 2023; Marselina *et al.*, 2024).

4. Conclusion

Based on the conducted research, it can be concluded that there is a significant relationship between all risk factors of diarrhea with the incidence of diarrhea. Pakusari sub-district is an area that has a moderate category of diarrhea incidents with the highest number of inadequate accesses to safe drinking water. Sumberbaru sub-district is identified as an area that has a high category of diarrhea incidents with the highest number of inadequate latrines facilities. Bangsalsari sub-district is characterized as an area that has a high category of diarrhea incidents with the highest number of cases of malnutrition. Ajung and Mumbulsari

sub-districts are identified as flood-prone areas with a high-risk level, experiencing a significant number of diarrhea incidents. Jember District Health Office is urged to complete the determination of priority programs to be implemented with spatial mapping aspects. to ensure effective and efficient outcomes. This is aimed at considering the topographic conditions of each region with programs intended to achieve effective and efficient outcomes. Each region has different characteristics, so the designated programs must take into account geographical aspects.

This study could not to investigate diarrhea-related issues in depth in each area due to the lack of access to rural-level diarrhea case data and information on child care practices (including feeding habits and bottle hygiene), which would require primary data collection through interviews. The mapping of diarrhea and its risk factors was based on secondary data reported by puskesmas. This data may not accurately the actual incidence of diarrhea in public due to variations in reporting and distribution patterns.

References

Adria, B. P., Wulandari, R. A., & Kurniasari, F. (2023). Spatial analysis of diarrhea incidences, environmental influences, and behavioral factors in an ecological study. *Media Kesehatan Masyarakat Indonesia*, *19*(4), 185–192. https://doi.org/10.30597/mkmi.v19i4.28644

Alim, M. C., Hasan, M., & En Mariska, N. U. (2021). Hubungan diare dengan status gizi pada balita di Rumah Sakit Umum Daerah Dr. H. Chasan Boesoirie. *Kieraha Medical Journal*, *3*(1), 1–6. https://doi.org/10.33387/kmj.v3i1.3262

Ananda Br, D., Siregar, N. A., Syahadah, R. F., Mahendra, A. F. R., Laoli, A. N., & Siregar, P. A. (2023). Gambaran sanitasi dasar dengan kejadian diare di Kawasan Risiko Banjir. *Journal of Educational Innovation and Public Health*, *1*(3), 24–31. https://doi.org/10.55606/innovation.v1i3.1466

Dinas Kesehatan Provinsi Jawa Timur. (2022). *Profil Kesehatan Dinas Kesehatan Jawa Timur 2021*. https://doi.org/10.21831/dinamika.v3i1.19144

Dinkes Kab. Jember. (2023). *Profil Kesehatan Kabupaten Jember Tahun 2022*.

Fauziyah, Z., & Siwiendrayanti, A. (2023). Kondisi sanitasi dasar dengan kejadian diare. *Higeia Journal of Public Health Research and Development*, *7*(3), 430–441.

Ibrahim, I., & Sartika, R. A. D. (2021). Faktor-faktor yang berhubungan dengan kejadian diare pada siswa Sekolah Dasar di Kabupaten Lebak, Provinsi Banten, Indonesia. *Indonesian Journal of Public Health Nutrition*, *2*(1), 34–43. https://doi.org/10.7454/ijphn.v2i1.5338

Kikuchi, M. (2023). Influence of sanitation facilities on diarrhea prevalence among children aged below 5 years in flood-prone areas of Bangladesh: A multilevel analysis. *Environmental Science and Pollution Research*, *30*(43), 97925–97935. https://doi.org/10.1007/s11356-023-29373-0

Labado, N., & Wulandari, R. A. (2022). Hubungan sumber air minum dengan kejadian diare di Provinsi Gorontalo. *Jurnal Medika Hutama*, *03*(04), 2837–2847.

Leni, P. (2019). Household risk factors on the event of diarrhea disease. *Jurnal Ilmu Kesehatan Masyarakat*, *10*(1), 50–58. https://doi.org/10.26553/jikm.2019.10.1.50-58

Ma'arif, M. Z., E. al. (2021). Hubungan kejadian diare dengan status gizi balita di Kelurahan Sidorejo Kecamatan Kabupaten Tuban. *Jurnal Gizi Aisyah*, *4*(2), 35–41.

Marita, Y., Harokan, A., & Wahyudi, A. (2022). Aanlisis kejadian diare pada balita di Wilayah Kerja UPTD Puskesmas Tanjung Agung. *Health Care : Jurnal Kesehatan*, *11*(2), 381–390.

Marselina, Larasati, R. D., Vidyanto, Sari, N. F., Nuriyah, N. A., & Nurhalisah, S. (2024). Hubungan perilaku masyarakat dengan kejadian diare di Wilayah Rawan Banjir Desa Lembasada Kabupaten Donggala. *Jurnal Ners*, *8*(1), 262–271.

Miswan, Firyanti, & Hamidah. (2023). Factors associated with diarrhea in toddlers. *Jurnal Kolaboratif Sains*, *6*(6), 536–543.

Oktariana, M., Hariyanti, R., Riya, R., & Sulastri, S. (2023). Hubungan status gizi dan status imunisasi dengan kejadian diare pada balita di Puskesmas Putri Ayu Kota Jambi. *Jurnal Ilmiah Ners Indonesia*, *4*(2), 198–206. https://doi.org/10.22437/jini.v4i2.27518

Ponirah, & Harini, R. (2022). Faktor-faktor yang berhubungan dengan kejadian daire pada balita usia 0 – 60 bulan. *MANUJU: Malahayati Nursing Journal*, *4*(12), 3460–4567.

Puhi, C. N., Sudirman, A. N., & Febriyona, R. (2023). Studi literatur: Hubungan status gizi dengan kejadian diare pada balita 0-5 tahun. *Jurnal Nurse*, *6*(1), 39–50.

Rau, M. J., & Novita, S. (2021). Pengaruh sarana air bersih dan kondisi jamban terhadap kejadian diare pada balita di Wilayah Kerja Puskesmas Tipo. *Preventif : Jurnal Kesehatan Masyarakat*, *12*(1), 110–126. https://doi.org/10.22487/preventif.v12i1.298

Siswanto. (2022). *Metode analisis pemetaan epidemiologi* (D. Fadhila (ed.)). Mitra Cendekia Media.

WGO. (2013). Acute diarrhea in adults and children: A global perspective. *Journal of Clinical Gastroenterology*, 24. https://doi.org/10.1097/MCG.0b013e31826df662

WHO. (2024). *Diarrhoeal disease*. https://www.who.int/news-room/fact-sheets/detail/diarrhoeal-disease#:~:text=It is both preventable and,and adequate sanitation and hygiene.