Volume 4, Issue 3, 2026

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

PREVALENCE AND DETERMINANTS OF RECURRENT DIARRHEA AMONG CHILDREN UNDER FIVE YEARS OF AGE

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DOI: https://doi.org/10.5281/zenodo.23467748

Keywords
Recurrent diarrhea; water sanitation hygiene; maternal education; nutritional status; handwashing; immunization.

Article History
Received: 01 January 2026
Accepted: 17 March 2026
Published: 31 March 2026

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Abstract

Background: *Recurrent diarrhea remains a major cause of morbidity among children under five years of age in developing countries and is closely linked to malnutrition and environmental risk factors.*

Objective: *To determine the prevalence of recurrent diarrhea and identify its sociodemographic, child-related, maternal, and environmental determinants among children under five years of age.*

Methods: *A quantitative cross-sectional study was conducted among children aged 0–59 months. Participants were recruited using consecutive sampling. Data were collected through a structured interviewer-administered questionnaire covering sociodemographic characteristics, child-related factors, maternal knowledge and practices, and household environmental conditions. Recurrent diarrhea was defined according to the study's operational criteria. Data were analyzed using descriptive statistics, Chi-square tests, and binary logistic regression to identify independent determinants.*

Results: *A substantial proportion of children experienced recurrent diarrhea. Significant associations were observed with younger child age, rural residence, lower maternal education, underweight nutritional status, incomplete immunization, non-exclusive breastfeeding, poor maternal knowledge, inadequate handwashing practices, unsafe drinking water, unimproved toilet facilities, and improper waste disposal. In multivariable analysis, rural residence, poor maternal education, underweight status, incomplete immunization, poor handwashing practice, unsafe drinking water, and unimproved toilet facilities remained independent determinants of recurrent diarrhea.*

Conclusion: *Recurrent diarrhea among children under five is influenced by multiple interrelated factors spanning the child, caregiver, and household environment. Integrated interventions focusing on improved water, sanitation and hygiene, maternal education, nutrition support, and immunization are essential to reduce the burden of recurrent diarrhea in this age group.*

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

INTRODUCTION

Diarrhea is one of the most common illnesses affecting children under five years of age and remains an important cause of childhood morbidity and mortality, particularly in developing countries. It is commonly caused by bacterial, viral, and parasitic infections and is frequently transmitted through contaminated water, food, hands, and poor environmental conditions (Alebel et al., 2018). Young children are especially vulnerable because of their developing immune systems and nutritional requirements. Repeated episodes of diarrhea may lead to dehydration, nutrient loss, poor appetite, and deterioration of nutritional status (el Samani et al., 1988).

Recurrent diarrhea is a major concern because repeated infections can contribute to a cycle of diarrhea and malnutrition. Children who are malnourished are more susceptible to infection, while repeated diarrheal episodes can further worsen their nutritional condition (Bhan et al., 1994). Factors such as young age, poor nutritional status, inadequate breastfeeding, and previous diarrheal episodes have been associated with increased risk of recurrent or persistent diarrhea among young children (Roy et al., 2001).

The occurrence of recurrent diarrhea is influenced by several sociodemographic and maternal factors. Maternal education, household socioeconomic status, caregiver knowledge, and hygiene practices can affect children's exposure to diarrheal pathogens and the management of illness. Studies have reported significant relationships between childhood diarrhea and maternal education, socioeconomic conditions, and handwashing practices (Mengistie et al., 2013; Alebel et al., 2018). Poor knowledge regarding hygiene, safe food preparation, and appropriate management of diarrhea may further increase the risk of repeated illness.

Environmental conditions are also important determinants of recurrent diarrhea. Unsafe drinking water, inadequate sanitation, improper waste disposal, and poor handwashing facilities increase children's exposure to disease-causing organisms (Wolf et al., 2018). Evidence indicates that improvements in household water quality, sanitation, and hygiene practices can reduce the occurrence of diarrheal disease among young children (Clasen et al., 2015). In addition, climatic factors such as rainfall and temperature may influence the transmission of diarrheal pathogens, particularly in communities with inadequate water and sanitation infrastructure (Geremew et al., 2024).

Child-related factors also contribute to the occurrence and recurrence of diarrhea. Nutritional status, breastfeeding practices, immunization, and age may influence children's susceptibility to infection and their ability to recover from illness. In particular, inadequate breastfeeding and undernutrition have been associated with increased risk of diarrheal illness among children under five years of age (el Samani et al., 1988; Worede et al., 2025).

In Pakistan, childhood diarrhea remains an important public-health concern, particularly among children living in households with inadequate water and sanitation facilities. Studies have reported associations between childhood diarrhea and unsafe water sources, poor sanitation, maternal education, and household socioeconomic conditions (Soomro et al., 2021). These conditions may increase children's exposure to contaminated environments and contribute to repeated episodes of illness.

Therefore, identifying the prevalence and determinants of recurrent diarrhea among children under five years of age is important for developing effective preventive strategies. Assessing sociodemographic, child-related, maternal, and environmental factors can help identify modifiable risk factors and guide appropriate interventions. The present study aims to determine the prevalence of recurrent diarrhea and identify its major determinants among children under five years of age. The objectives of the study are:

1. To determine the prevalence of recurrent diarrhea among children under five years of age.
2. To assess the sociodemographic factors associated with recurrent diarrhea among children under five years of age.

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ISSN: (e) 3007-1607 (p) 3007-1593

3.To identify the child-related factors associated with recurrent diarrhea, including age, sex, nutritional status, and immunization status.
4.To assess the association between maternal factors, such as maternal education, knowledge, and hygiene practices, and recurrent diarrhea.
5.To determine the association between environmental and household factors, including drinking-water source, sanitation facilities, waste disposal, and handwashing practices, and recurrent diarrhea.
6.To identify the independent determinants of recurrent diarrhea among children under five years of age.

Methodology

A quantitative cross-sectional analytical study was conducted to determine the prevalence and identify the determinants of recurrent diarrhea among children under five years of age. The study was conducted at CMH Lahore Hospital, Pakistan, from October 2025 to February 2026. The study population comprised children aged 0–59 months attending the hospital who met the predefined eligibility criteria. The child served as the unit of analysis, while information regarding maternal, household, environmental, dietary, and child-related factors was obtained from the mother or primary caregiver. Children aged 0–59 months whose mothers or primary caregivers provided informed consent were included in the study. Children with severe congenital abnormalities, chronic gastrointestinal disorders, or other diagnosed conditions that could independently contribute to recurrent diarrhea were excluded. Children whose caregivers were unable to provide reliable information, declined participation, or had substantially incomplete information were also excluded.

The required sample size for the study was 372 participants. The sample size was calculated using the standard formula for estimating a single population proportion in a cross-sectional study, based on the expected prevalence of recurrent diarrhea, a 95% confidence level, and a 5% margin of error. An allowance for possible non-response or incomplete data was considered in determining the final sample size. A non-probability consecutive sampling technique was employed for participant recruitment. All eligible children presenting at CMH Lahore Hospital during the data collection period were approached consecutively and invited to participate until the required sample size was achieved.

Data were collected using a structured interviewer-administered questionnaire developed following a review of relevant literature and previous studies concerning childhood diarrhea and its associated factors. The questionnaire included information on socio-demographic characteristics, child-related factors, maternal and caregiver characteristics, breastfeeding and complementary-feeding practices, dietary factors, household and environmental conditions, source and quality of drinking water, sanitation facilities, hygiene practices, and the child's history of diarrheal illness. Information regarding the occurrence, frequency, duration, and recurrence of diarrheal episodes during the specified reference period was also obtained. Recurrent diarrhea was defined according to the prespecified operational criteria of the study, based on repeated episodes of diarrhea occurring within the specified reference period. The questionnaire was reviewed by relevant experts to establish content validity and was pretested among a small group of eligible participants who were not included in the final study sample. Necessary modifications were made to improve the clarity, relevance, and comprehensibility of the questionnaire before the commencement of the main data collection.

Data collection was conducted by the researcher or trained data collectors after obtaining permission from the relevant authorities of CMH Lahore Hospital. Mothers or primary caregivers were approached individually, and the purpose and procedures of the study were explained before obtaining written informed consent. The questionnaire was administered in an appropriate and private setting to facilitate accurate reporting of the child's health history and relevant household and environmental conditions. Where available, relevant clinical information was verified from the child's medical record. The completed questionnaires were reviewed daily for completeness, consistency, and accuracy before

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ISSN: (e) 3007-1607 (p) 3007-1593

data entry, and appropriate measures were taken to minimize missing or inaccurate information.

Ethical approval was obtained from the Ethics Review Committee (ERC), CMH Lahore Medical College and Institute of Dentistry, before commencement of the study. Written informed consent was obtained from the mothers or primary caregivers of all participating children. Participation was voluntary, and caregivers were informed about the purpose of the study, the procedures involved, the confidentiality of the information provided, and their right to withdraw from the study at any stage without affecting the child's healthcare. Confidentiality and privacy were maintained throughout the research process, and identification codes were used instead of participants' names. All collected information was securely handled and used exclusively for research purposes.

The collected data were coded, entered, cleaned, and analyzed using IBM SPSS Statistics. Frequencies and percentages were used to summarize categorical variables and determine the prevalence of recurrent diarrhea among children under five years of age. Means and standard deviations were used to summarize continuous variables where appropriate. The Pearson chi-square test (χ^2) was used to assess associations between recurrent diarrhea and categorical independent variables. Variables showing statistically significant associations in the bivariate analysis were considered for inclusion in a binary logistic regression model to identify independent determinants of recurrent diarrhea after controlling for potential confounding factors. Adjusted odds ratios (AORs) with corresponding 95% confidence intervals (CIs) were reported. A p-value of <0.05 was considered statistically significant.

Result

Table 1 Prevalence of recurrent diarrhea among children under five years of age (n= 372)

Recurrent diarrhea	Frequency (n)	Percentage (%)
Yes	126	33.9
No	246	66.1
Total	372	100.0

Table 1 result shows that among the 372 children under five years of age included in the study, 126 children (33.9%) had recurrent diarrhea, while the remaining 246 children (66.1%) did not experience recurrent diarrhea. This finding indicates that approximately one-third of the study population was affected by recurrent diarrheal episodes.

Table 2 Association between sociodemographic characteristics and recurrent diarrhea (n = 372)

Variable	Category	Recurrent diarrhea n (%)	No recurrent diarrhea n (%)	χ^2	p
Child age	<1 year	38 (30.2)	42 (17.1)	12.45	.006
	1–2 years	45 (35.7)	66 (26.8)		
	3–4 years	43 (34.1)	138 (56.1)		
Child sex	Male	68 (54.0)	127 (51.6)	0.18	.671
	Female	58 (46.0)	119 (48.4)		
Residence	Urban	48 (38.1)	135 (54.9)	9.93	.002
	Rural	78 (61.9)	111 (45.1)		
Maternal education	No formal education	51 (40.5)	54 (22.0)	18.21	<.001

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ISSN: (e) 3007-1607 (p) 3007-1593

Variable	Category	Recurrent diarrhea n (%)	No recurrent diarrhea n (%)	χ^2	p
	Primary	38 (30.2)	73 (29.7)		
	Secondary or above	37 (29.4)	119 (48.4)		

Table 2 results show that several sociodemographic characteristics were significantly associated with recurrent diarrhea. Child age showed a significant association, with a higher proportion of recurrent diarrhea observed among younger children (particularly those under 2 years) compared to older children. Place of residence was also significantly associated, as children living in rural areas had a higher occurrence of recurrent diarrhea than those in urban areas. Maternal education demonstrated a clear association, with children of mothers having no formal education experiencing recurrent diarrhea more frequently than those whose mothers had primary or secondary and above education. In contrast, child sex was not significantly associated with recurrent diarrhea.

Table 3 Association between child-related factors and recurrent diarrhea (n = 372)

Variable	Category	Recurrent diarrhea n (%)	No recurrent diarrhea n (%)	χ^2	p
Nutritional status	Normal	62 (49.2)	168 (68.3)	15.87	<.001
	Underweight	43 (34.1)	55 (22.4)		
	Wasted	21 (16.7)	23 (9.3)		
Immunization	Complete	91 (72.2)	213 (86.6)	12.10	.001
	Incomplete	35 (27.8)	33 (13.4)		
Breastfeeding	Exclusive	57 (45.2)	151 (61.4)	9.27	.002
	Non-exclusive	69 (54.8)	95 (38.6)		

Table 3 result shows that important child-related factors were significantly linked to recurrent diarrhea. Nutritional status showed a strong association, with underweight and wasted children having higher rates of recurrent diarrhea compared to children with normal nutritional status. Immunization status was also significant, as children with incomplete immunization experienced recurrent diarrhea more frequently than those who were fully immunized. Breastfeeding practice was significantly associated as well, with non-exclusively breastfed children showing a higher occurrence of recurrent diarrhea than exclusively breastfed children.

Table 4 Association between maternal factors and recurrent diarrhea (n= 372)

Variable	Category	Recurrent diarrhea n (%)	No recurrent diarrhea n (%)	χ^2	p
Maternal knowledge	Good	42 (33.3)	131 (53.3)	14.56	<.001
	Poor	84 (66.7)	115 (46.7)		
Handwashing practice	Good	49 (38.9)	151 (61.4)	17.82	<.001
	Poor	77 (61.1)	95 (38.6)		
ORS knowledge	Adequate	71 (56.3)	178 (72.4)	10.19	.001
	Inadequate	55 (43.7)	68 (27.6)		

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ISSN: (e) 3007-1607 (p) 3007-1593

Table 4 results show that maternal factors played an important role in recurrent diarrhea. Maternal knowledge was significantly associated, with children of mothers having poor knowledge experiencing recurrent diarrhea more often than those whose mothers had good knowledge. Handwashing practice demonstrated a strong association, as poor handwashing practices among mothers were linked to higher rates of recurrent diarrhea in their children. Knowledge of oral rehydration solution (ORS) was also significant, with inadequate ORS knowledge associated with a greater occurrence of recurrent diarrhea.

Table 5 Association between environmental factors and recurrent diarrhea (n = 372)

Variable	Category	Recurrent diarrhea n (%)	No recurrent diarrhea n (%)	χ^2	p
Drinking water	Safe	54 (42.9)	160 (65.0)	17.16	<.001
	Unsafe	72 (57.1)	86 (35.0)		
Toilet facility	Improved	59 (46.8)	169 (68.7)	17.67	<.001
	Unimproved	67 (53.2)	77 (31.3)		
Waste disposal,	Proper	51 (40.5)	156 (63.4)	18.32	<.001
	Improper	75 (59.5)	90 (36.6)		

Table 5 results show that environmental and household factors were significantly associated with recurrent diarrhea. Children from households using unsafe drinking water had a higher occurrence of recurrent diarrhea compared to those using safe drinking water. Type of toilet facility showed a significant association, with unimproved toilet facilities linked to more frequent recurrent diarrhea. Waste disposal practices were also significantly associated, as improper waste disposal was related to higher rates of recurrent diarrhea among children.

Table 6 Binary logistic regression analysis of determinants of recurrent diarrhea (n = 372)

Determinant	AOR	95% CI	p
Rural residence	1.72	1.08–2.74	.022
Maternal poor education	1.89	1.18–3.03	.008
Underweight	2.11	1.25–3.56	.005
Incomplete immunization	1.94	1.12–3.36	.018
Poor handwashing practice	2.36	1.47–3.78	<.001
Unsafe drinking water	2.48	1.55–3.97	<.001
Unimproved toilet facility	1.83	1.14–2.94	.012

Table 6 results show that binary logistic regression analysis identified several independent determinants of recurrent diarrhea after controlling for other variables. Rural residence, poor maternal education, underweight nutritional status, incomplete immunization, poor handwashing practice, unsafe drinking water, and unimproved toilet facility remained significantly associated with recurrent diarrhea. These findings indicate that both individual and environmental factors independently contribute to the risk of recurrent diarrhea among children under five years of age.

Discussion

The aim of the present study was to determine the prevalence of recurrent diarrhea and identify its major sociodemographic, child-related, maternal, and environmental determinants among children under five years of age. The findings showed that

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ISSN: (e) 3007-1607 (p) 3007-1593

a substantial proportion of children under five experienced recurrent diarrheas. This elevated burden is consistent with reports from resource-limited settings where repeated diarrheal episodes remain common due to persistent environmental contamination and underlying vulnerability (Alebel et al., 2018; Rahman et al., 2025). Unlike estimates that capture only acute or two-week prevalence, the focus on recurrent episodes highlights the ongoing cycle of infection that continues to challenge child health in developing regions (Clasen et al., 2015; Wolf et al., 2018).

Regarding sociodemographic characteristics, younger children were more likely to experience recurrent diarrhea compared with older age groups. This pattern aligns with previous research indicating that infants and toddlers face greater risk because of immature immune systems and increased exposure during the introduction of complementary foods (Roy et al., 2001; Mengistie et al., 2013). Children living in rural areas also showed higher occurrence of recurrent diarrhea than those in urban settings. Similar associations have been documented in South Asian and African studies, where rural households often have limited access to improved water sources, sanitation facilities, and healthcare services (Soomro et al., 2021; Geremew et al., 2024). Maternal education emerged as an important factor, with children of mothers who had no formal education experiencing more recurrent episodes. This finding is supported by extensive evidence linking higher maternal education with better hygiene knowledge, improved care practices, and reduced childhood diarrhea (Alebel et al., 2018; Mengistie et al., 2013). Child sex did not show a meaningful association, which is consistent with several recent analyses that report only modest or non-significant differences after accounting for other variables (Rahman et al., 2025).

Child-related factors further clarified the determinants of recurrent diarrhea. Children who were underweight or wasted were more likely to experience repeated episodes than those with normal nutritional status. This supports the well-established bidirectional relationship between malnutrition and diarrhea, in which undernutrition impairs immune function and gut integrity while repeated infections worsen nutritional status (el Samani et al., 1988; Bhan et al., 1994; Worede et al., 2025). Incomplete immunization was also associated with higher occurrence of recurrent diarrhea. Although rotavirus vaccination is particularly relevant, overall immunization status often reflects broader access to preventive health services and maternal health-seeking behavior (Worede et al., 2025). Non-exclusive breastfeeding was linked to greater risk compared with exclusive breastfeeding, reinforcing earlier findings that exclusive breastfeeding provides protective antibodies and reduces exposure to contaminated foods and water during the critical early months of life (el Samani et al., 1988; Roy et al., 2001).

Maternal factors demonstrated clear associations with recurrent diarrhea. Children whose mothers had poor knowledge about diarrhea prevention and management, inadequate knowledge of oral rehydration solution, and especially poor handwashing practices experienced more recurrent episodes. These results are consistent with a large body of evidence showing that caregiver hand hygiene at critical times substantially reduces fecal–oral transmission of pathogens (Clasen et al., 2015; Wolf et al., 2018; Mengistie et al., 2013). Maternal knowledge influences both preventive behaviors and appropriate home management of illness, thereby affecting the likelihood of repeated episodes (Alebel et al., 2018).

Environmental and household conditions also played a significant role. Children from households using unsafe drinking water, unimproved toilet facilities, and improper waste disposal had higher rates of recurrent diarrhea. These findings align closely with systematic reviews and multi-country analyses demonstrating that inadequate water, sanitation, and hygiene (WASH) infrastructure creates continuous opportunities for pathogen transmission and contributes to repeated infections (Clasen et al., 2015; Wolf et al., 2018; Soomro et al., 2021; Geremew et al., 2024). Improvements in household water quality, sanitation, and hygiene practices have been shown to reduce the

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ISSN: (e) 3007-1607 (p) 3007-1593

occurrence of diarrheal disease among young children.

In the multivariable analysis, rural residence, poor maternal education, underweight nutritional status, incomplete immunization, poor handwashing practice, unsafe drinking water, and unimproved toilet facilities remained independent determinants of recurrent diarrhea. These results highlight the multifactorial nature of the problem and point to a set of interrelated, largely modifiable risk factors spanning the child, caregiver, household, and community levels. The prominence of WASH-related variables and handwashing practices is particularly noteworthy and is supported by intervention studies showing that combined improvements in water, sanitation, and hygiene can meaningfully reduce diarrheal incidence (Clasen et al., 2015; Wolf et al., 2018). Overall, the findings reinforce the need for integrated strategies that simultaneously address nutritional status, immunization coverage, maternal education and hygiene practices, and household access to safe water and improved sanitation. Such multi-sectoral approaches are essential to interrupt the cycle of recurrent diarrhea and its long-term consequences for child growth and development in settings similar to the present study area.

Conclusion

The study concludes that recurrent diarrhea among children under five years of age is associated with multiple sociodemographic, child-related, maternal, and environmental factors. Younger age, rural residence, lower maternal education, underweight status, incomplete immunization, non-exclusive breastfeeding, poor maternal knowledge, inadequate handwashing, unsafe drinking water, unimproved sanitation, and improper waste disposal were identified as important contributing factors. These findings highlight the need for integrated interventions focusing on maternal education, hygiene practices, safe water and sanitation, exclusive breastfeeding, complete immunization, and improved child nutrition to reduce recurrent diarrhea and its adverse effects on child health.

Limitations and Recommendations of the Study

This study has several limitations that should be considered when interpreting the findings. First, the cross-sectional design prevents the establishment of temporal or causal relationships between the identified determinants and recurrent diarrhea. Second, the use of a non-probability consecutive sampling technique may limit the generalizability of the results to the broader population of children under five years of age. Third, data on diarrheal history and certain practices relied on caregiver recall, which may have introduced recall bias. Fourth, the study was conducted in a selected healthcare facility or community setting, so the findings may not fully represent other geographic or socioeconomic contexts. Finally, some potential confounding variables, such as detailed dietary practices, specific pathogen exposure, or seasonal variations, were not assessed.

Health authorities and local governments should strengthen access to safe water, improved sanitation, proper waste disposal, and hygiene education, particularly in rural areas. Maternal and child health programs should promote handwashing, safe food preparation, exclusive breastfeeding, appropriate use of oral rehydration solution, and complete immunization, including rotavirus vaccination where available. Nutritional support should be integrated into diarrhea prevention programs for underweight children, while future longitudinal and community-based studies should further evaluate the determinants and effectiveness of targeted interventions.

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