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Original Article

Epidemiological Trends and Burden of Acute Watery Diarrhea during 2022 in Khyber Pakhtunkhwa, Pakistan

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Abstract

Background: In developing countries like Pakistan, diarrheal disease remains a major cause of morbidity and mortality. Despite improved diagnosis and treatment, key risk factors persist.
Objective: This study assessed the trends and burden of acute watery diarrhea (AWD) in Khyber Pakhtunkhwa (KP) in 2022 to guide targeted interventions.
Methods: Retrospective one year data on AWD was extracted from the District Health Information System 2 (DHIS2) event visualizer, from primary and secondary health facilities across 26 districts of KP. Only stool culture confirmed bacterial cases were included. Standardized case report forms captured demographic, clinical, risk factor, laboratory, and outcome data. Severe cases were referred for stool culture. Data was cleaned, analyzed, and presented using tables, graphs, and maps using Epi Info 7.2.1.
Results: A total of 322 cases were recorded, with 56% males. The mean age was 19.5 years, with the 15-30 years group most affected. Passage of three or more watery stools in 24 hours was the most common symptom (74%). Cases began on 5 May 2022 and peaked on 3 June with 41 cases reported in a single day. Most cases were from Malakand, followed by Swat and Nowshera. Spring water was the main drinking source (81%), while only 10% reported using water treatment methods.
Conclusion: The findings suggest a substantial AWD burden, likely underestimated. Key risk factors include younger age, overcrowding, shared sanitation, untreated water, and seasonal variation. Strengthening prevention through safe water, improved sanitation, health education, and integrated disease surveillance is essential for early detection and control.
Key words: DHIS2, surveillance, acute watery diarrhea, KPK.

Introduction

Diarrhea is the eighth leading cause of mortality worldwide. Acute watery Diarrhea (AWD) is characterized by the passage of three or more loose stools within 24 hours which may be caused by microorganism including bacteria, viral and parasites, but sometimes it may be due to some non-infectious causes. The condition may last from hours to days and is a leading cause of morbidity and mortality. Consumption of contaminated food and water is usually the cause of infection or can result from person-to-person transmission of infection.[1]

In recent years, diarrhea is amongst the top 10 diseases which contribute to global Disability Adjusted Life Years (DALY, s). Further it remains the most common disease among children under 5 years.[2] The Global Burden of Diseases, Injuries, and Risk factor Study 2015 (GBD 2015) revealed that diarrheal disease was a significant cause of mortality in all generations, 499,000 deaths, 95% UI 447,000–558,000. However, due to advancement in public health intervention and through health promotions, mortality associated with diarrhea reduced by 20.8% (95% UI 15.4–26.1) over 10

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Authors Contribution

NJ conceptualized the project. NN, JA & KA did the data collection. NJ, MZB & NN performed the statistical analysis. NJ, SA & MAB did the literature search. Drafting, revision & writing of manuscript were done by all authors. MAK, MAR, MWM & MS did acquisition of data, overall guidance and supervision.

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years e.g., from 2005 to 2015. Though the problem is distributed globally, the burden of morbidity and mortality has its impact more on low- and middle-income countries (LMICs).[3] Poverty, mobility, compromised living, malnutrition, infection, environmental transformations especially in urban but also in rural areas are among the predisposing factors for diarrhea. Moreover, due to poor health seeking behaviors and accessibility of health care facilities, by the time individuals reach the hospital, disease is in quite advanced stage.

The District Health Information System Version 2 (DHIS2) is an open-source configurable platform [4] currently operational in more than 73 low- and middle-income countries for routine health information reporting [5] including in Pakistan. To monitor and tract the burden of priority diseases, the govt of Pakistan with technical assistance from UKHSA has established Integrated Disease Surveillance and Response System (IDSR), and used DHIS2, a digital platform for health data management. DHIS2 is a powerful tool to assess the burden at district and national level. Though the current system is capturing aggregate data only, the system has capacity to record case-based surveillance (CBS) data as well.

On May 5th, 2022, the District Health officer, first case AWD was reported through the Integrated Disease Surveillance &Response System (IDSR) confirmed by Provincial health department, KPK. The first case was followed by a rise in cases from other parts of the province. An outbreak response team was immediately mobilized to the affected areas to control the spread of disease. At the same time, AWD CBS form was activated for data entry into DHIS2.

In Pakistan, surveillance for diarrheal diseases is largely based on aggregate reporting through routine health information systems, with limited implementation of comprehensive case-based surveillance. This gap restricts timely detection of outbreaks, detailed epidemiological characterization, and rapid public health response, highlighting the need for strengthened case-based surveillance mechanisms. The current study was conducted to assess the trends and burden of AWD during the year 2022 in KPK.

Methods

A retrospective analysis was conducted to find out the trends and burden of AWD in KPK during 2022. The study included all laboratory-confirmed acute watery diarrhea (AWD) cases reported through DHIS2 from 1 January to 31 December 2022 across 26 districts of Khyber Pakhtunkhwa. A census approach was employed rather than sampling, and retrospective data were retrieved from DHIS2 following approval from the Institutional Review Board (IRB) of the National Institutes of Health Pakistan (copy attached).

Any patient ≥ 2 years presenting with three or more watery, non-bloody stools (rice watery stools) in last 24-hour, and severe dehydration or dying from acute watery diarrhea. A confirmed case

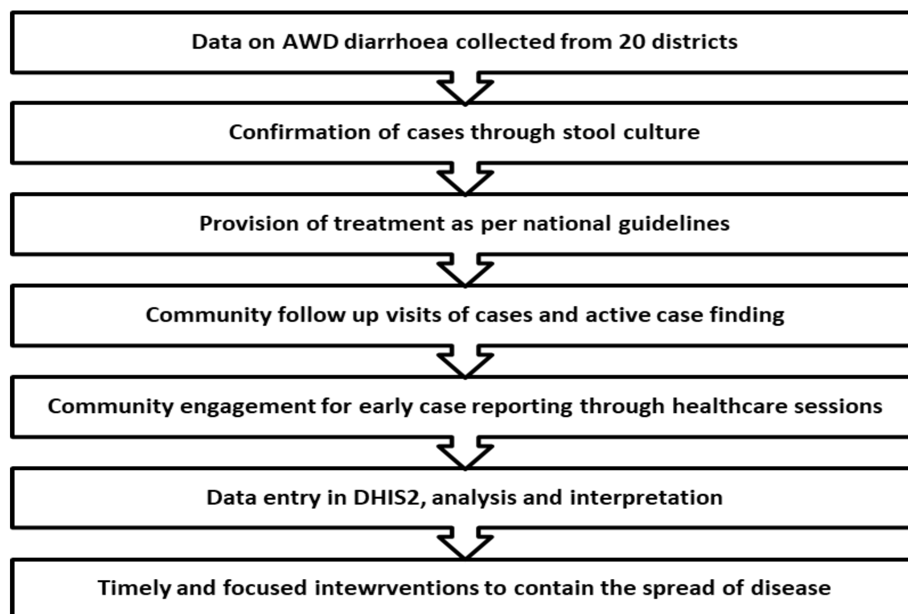

Figure: Flow diagram for the study.

was a suspected case with V. cholerae isolated from stool samples by stool culture.

Patients younger than 2 years; cases without laboratory confirmation and those presenting with bloody diarrhea or non-watery loose stools.

Acute watery diarrhea was dependent variable, denoted as yes (1) or no (0). The independent variables were demographic, clinical features, information on risk and protective factors, lab information and patient status.

Information about AWD was retrieved from event visualizer feature of DHIS2. It was data from 1st Jan to 31 Dec. 2022, reported from all primary and secondary health facilities of 26 districts on acute watery diarrhea. Only stool culture confirmed cases of AWD were entered into the system. For each patient visiting the health facility presenting with diarrhea, a case report form describing demographic, clinical features, information on risk and protective factors, lab information and patient status (Appendix 1) was filled and uploaded on DHIS2. The DHIS2 Android app allows for offline data capture with local validation, reducing errors even in areas with poor connectivity. Rectal swabs were also obtained and sent to Khyber Medical University (KMU), public health laboratory, Peshawar. Treatment was provided in accordance with national guidelines. The available data was cleaned, analyzed and findings were summarized in the form of graphs and tables. For distribution of cases, maps were created.

Results

A total of 322 patients' information was entered. Males (56%) were affected the most. Mean age was 19.5 years, 15-30 years group being the most affected (Figure-1) Passage of 3 or more watery stools in last 24 hours was the most common presenting symptom 239(74%) followed by vomiting 190 (61%) and 176 (55%) fever).

Cases of AWD started reporting from 5th May 2022 whereas cases peaked on 3rd June when 41 cases reported in a day (Figure-2).

Maximum cases were from Malakand district 174 (54%) followed by Swat and Nowshera districts. (Figure-3)

Most of the cases were males, in accordance with culture in the area, where males are more frequently going out for multiple reasons compared to girls. Consumption of raw water without treatment and use of spring water are found to be the contributing factors for diarrhea in our study. There is minimal information available for water treatment used by the cases. Overcrowding, cases living with more than 5 people at home facilitated the person-to-person transmission of the disease. Furthermore, shared toilets/ toiletries with confirmed case, history of attending any social gathering or visited/dined with AWD, all facilitated the development of diarrhea among the cases. However, out of 322 cases, 32 (27%) recovered and only one died. (Table) The percentages reflect the use of multiple water sources by some individuals. Several patients reported consuming water from more than one source (e.g., both spring and well water) (Table).

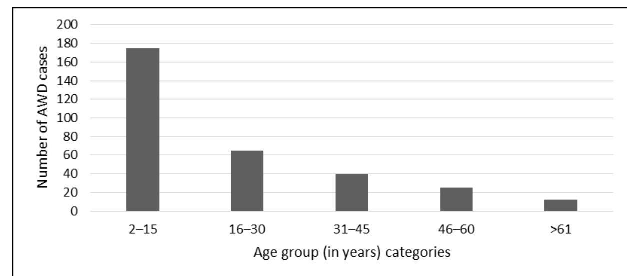

Figure 1: Distribution of AWD cases according to age groups-KPK.

Discussion

Our study is the first to evaluate the use of the DHIS2 platform for capturing real-time, case-based data from public sector health facilities in Khyber Pakhtunkhwa (KPK), Pakistan. Its primary objective was to determine the prevalence of acute watery diarrhea (AWD) and identify associated factors using DHIS2-reported data. A total of 322 AWD cases were recorded, with males and individuals in younger age groups more commonly affected. This pattern may reflect socio-cultural norms in the region, where males tend to spend more time outside the home.

Several risk factors were identified, including the use of untreated or spring water for drinking and households with more than five members. Overcrowding and contact with infected individuals appeared to facilitate household transmission of AWD, consistent with earlier findings that younger age is a strong predictor of diarrheal illness.[6,7] Similar observations have been reported in Bangladesh, where household members under 15 years of age had a higher risk of infection, possibly due to age-related eating behaviors.[8] Overcrowding and consumption of untreated water have also been linked to increased diarrheal morbidity in other studies.[9] Although river water

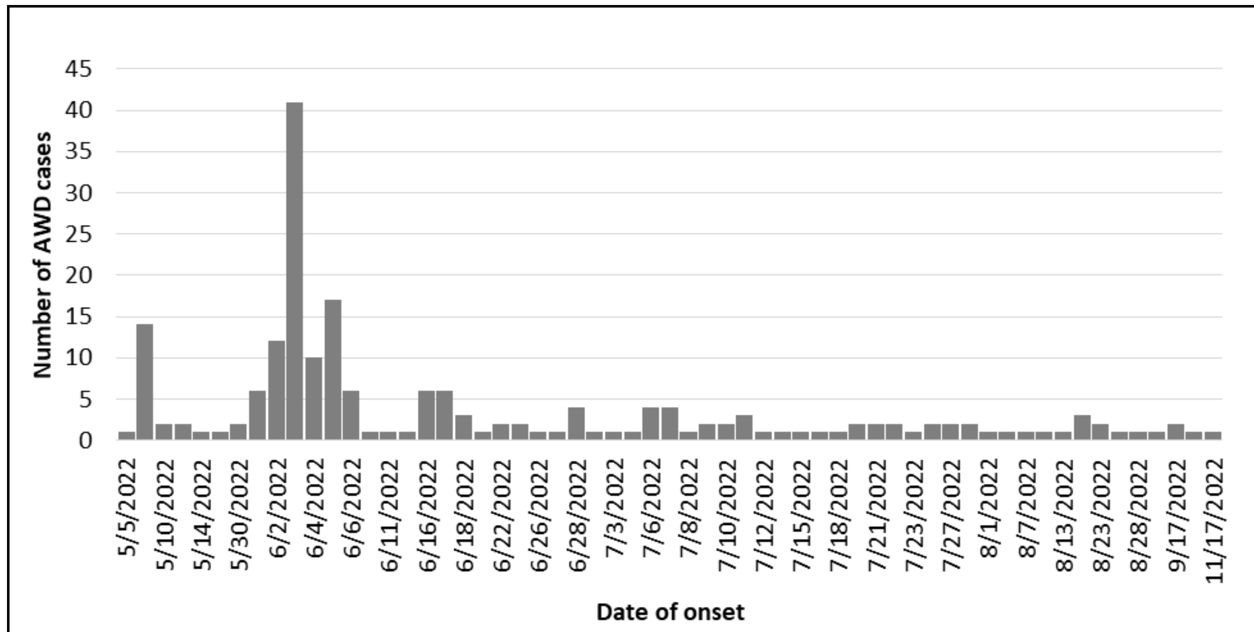

Figure 2: Showing the number of cases with onset dates.

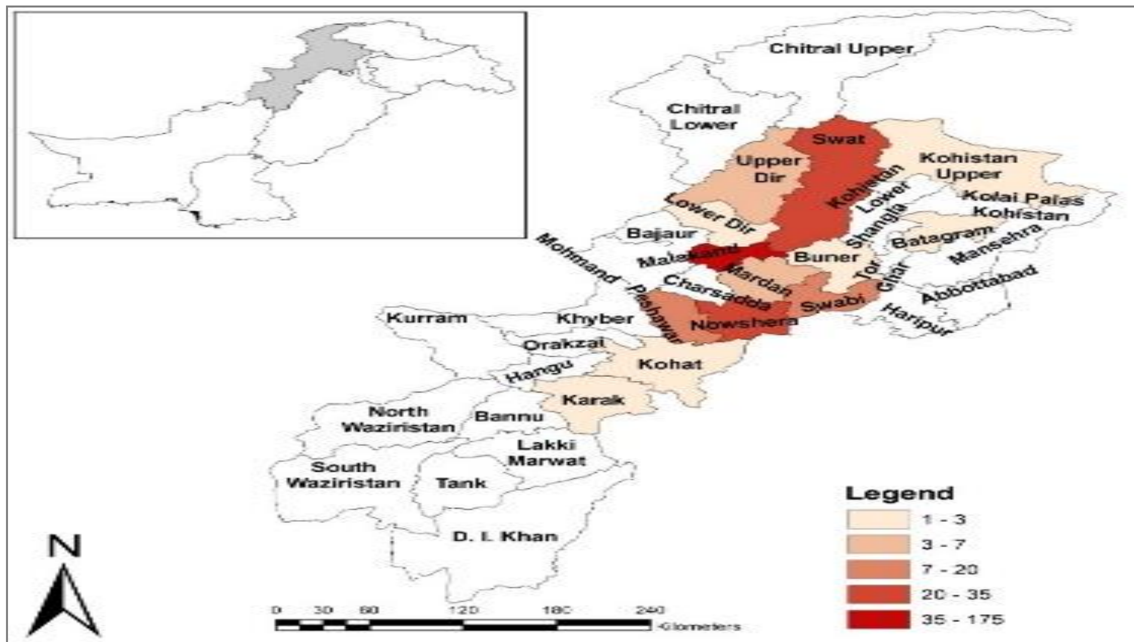

Figure 3: Map of KPK province, showing the location of AWD cases.

consumption and inadequate hand hygiene have been recognized as additional risk factors during diarrheal outbreaks.[10] such information was not available in our dataset.

The districts with the highest number of AWD cases were Malakand and Swat, both hilly areas where residents often depend on stored, spring, or well water. These sources are typically untreated and may become contaminated during storage. The presence of a confirmed case in a household can contribute to community-wide spread, as contaminated drinking water sources frequently trigger outbreaks.[11] This aligns with our findings, where households with confirmed AWD cases reported more infections, likely due to shared sanitation facilities and contaminated water.

Table: Factors affecting the occurrence of diarrhea in KPK.

Variables			*Percentages*
Gender	Male gender	163	56
Sources of water for drinking purposes (322)	Use of bore water	261	81
	Municipal water	22	10
	Spring water	159	49
	Well water	15	7
Water treatment methods used by affected individuals (31)	Chemical (chlorination)	10	32
	Filtration	11	35
	Any other	10	32
Number of households living with affected individuals (322)	>5-10 people living at home	29	9
	>10 people living at home	6	2
	Number of symptomatic households	31	10
Clinical features (322)	03 or more watery stools (non-bloody) within 24 hours	239	74
	Vomiting	196	61
	Fever	176	55
	Severe dehydration	219	68
Risk factors (146)	Shared toilet/ toiletries with confirmed case	19	13
	Used raw/ non-boiled milk	12	13
	Used uncooked/ unwashed fruits/ vegetables	23	21
	Attended any social gathering	07	5
	Visited/ dined with AWD patient	15	10
Status of cases (119)	Died	1	0.84
	Home isolated	59	50
	Hospitalized	27	23
	Recovered	32	27

Although diarrheal diseases in Pakistan commonly peak during the summer, they may occur in both rainy and dry seasons. In our study, cases first appeared in May and continued through July to October 2022. Previous research also indicates that diarrheal burden rises during both wet and dry periods.[12]

The findings highlight important implications for local public health policy. Strengthening water quality monitoring, improving sanitation infrastructure, and promoting safe water storage at the household level are essential interventions to reduce the risk of acute watery diarrhea outbreaks. In addition, strengthening community-based surveillance and rapid response mechanisms can support early detection and timely control of diarrheal disease clusters in vulnerable communities. Similar approaches have been recommended in global diarrheal disease prevention strategies emphasizing water, sanitation, and hygiene (WASH) interventions and improved surveillance systems.[13,14]

Conclusion

In conclusion, the DHIS2 platform proved valuable for real-time monitoring of AWD cases and identifying associated risk factors in KPK. The study highlights a considerable burden of acute watery diarrhea (AWD) in Khyber Pakhtunkhwa, with a clear temporal peak and geographic clustering in specific districts. Young adults were disproportionately affected, and untreated spring water emerged as a key risk factor. These findings underscore the need for targeted water safety interventions, improved hygiene practices, and strengthened surveillance systems. Focused public health measures in high-burden districts could significantly reduce disease transmission and associated morbidity.

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Availability of Data: The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Ethical Approval: The Institutional Review Board of National Institute of Health, Islamabad approved the study via letter no. F.1-5/RAPiD/2024-25/IRB dated 20/05/2025.

Conflict of Interest: None declared.

References

1. GBD 2016 Diarrhoeal Disease Collaborators. Estimates of the global, regional, and national morbidity, mortality, and aetiologies of diarrhoea in 195 countries: a systematic analysis for the Global Burden of Disease Study 2016. Lancet Infect Dis 2018; 18: 1211-28.
2. Fischer Walker CL, Perin J, Aryee MJ, Boschi-Pinto C, Black RE. Diarrhea incidence in low- and middle-income countries in 1990 and 2010: a systematic review. BMC Public Health 2012; 12: 220.

3. GBD Diarrhoeal Diseases Collaborators. Estimates of global, regional, and national morbidity, mortality, and aetiologies of diarrhoeal diseases: a systematic analysis for the Global Burden of Disease Study 2015. Lancet Infect Dis 2017; 17(9): 909-48.
4. Health Information Systems Program. District Health Information Software Version 2 (DHIS2). 2018. (Accessed on 16th March, 2026) Available from https://www.dhis2.org/.
5. Health Information Systems Program, University of Oslo. DHIS2 in action. (Accessed on 16th March, 2026) Available from https://dhis2.org/in-action
6. Sur D, Deen JL, Manna B, Niyogi SK, Deb AK, Kanungo S, et al. The burden of cholera in the slums of Kolkata, India: data from a prospective, community-based study. Arch Dis Child 2005; 90(11):1175-81.
7. Sauvageot D, Njanpop-Lafourcade BM, Akilimali L, Anne JC, Bidjada P, Bompangue D, et al. Cholera incidence and mortality in sub-Saharan African sites during multi-country surveillance. PLoS Negl Trop Dis 2016; 10(5): e0004679.
8. Weil AA, Khan AI, Chowdhury F, LaRocque RC, Faruque AS, Ryan ET, et al. Clinical outcomes in household contacts of patients with cholera in Bangladesh. Clin Infect Dis 2009; 49: 1473-9.
9. Teklemariam S, Getaneh T, Bekele F. Environmental determinants of diarrheal morbidity in under-five children, Keffa-Sheka zone, southwest Ethiopia. Ethiop Med J 2000; 38(1): 27-34.
10. Dan-Nwafor CC, Ogbonna U, Onyiah P, Gidado S, Bashorun A, Nguku P, Nsubuga P. A cholera outbreak in a rural north central Nigerian community: an unmatched case-control study. BMC Public Health 2019; 19(1): 112.
11. Rebaudet S, Sudre B, Faucher B, Piarroux R. Cholera in coastal Africa: a systematic review of its heterogeneous environmental determinants. J Infect Dis 2013; 208(Suppl 1): S98-106.
12. Dan-Nwafor CC, Ogbonna U, Onyiah P, Gidado S, Adebiyi B, Eteng W, et al. A cholera outbreak in a rural north central Nigerian community: an unmatched case-control study. BMC Public Health 2019; 19: 112.
13. World Health Organization. Diarrhoeal disease. Geneva: WHO; 2024. (Accessed on 16th March, 2026) Available from https://www.who.int/news-room/fact-sheets/detail/diarrhoeal-disease
14. United Nations Children’s Fund, World Health Organization. Progress on household drinking water, sanitation and hygiene 2000–2022: special focus on WASH and health. New York: UNICEF; 2023.