MS No: PJMDS/OA/022/2024

Original Article

Frequency of Diseases Patterns in Internally Displace Children During Flood Disasters at Tertiary Care Hospital Larkana

Allah Bux Bhutto[1], Shanti Lal Bhojwani[2], Nazia[3], Suhail Abbasi[4], Paras[5], Sadam Bhutto[6], Rahmatullah Tunio[7], Farooq Indhar[8], Komal[9], Noor[10].

ABSTRACT

Objective: To determine the frequency of disease patterns in internally displaced children during flood disasters.

Methodology: Shaheed Mohtarma Benazir Bhutto Medical University (SMBBMU) Larkana from July 2022 to March 2023. A total of 507 IDP children, aged 6 months to 15 years, affected by recent floods, were included in the study after taken written informed consent from their parents. All the children were screened for malaria, dengue fever, chikungunya, typhoid fever, gastroenteritis, diarrhea, pneumonia and skin diseases. Data were analyzed using SPSS version 26. Mean ± SD was reported for continuous variables while frequency and percentage were reported for categorical variables.

Results: The mean age of the participants was noted as 4.085 ± 2.9637 years. Out of 507 children (51.7% male, 48.3% female). The prevalence of malaria was found to be higher in the 0.5-4 years group as compared to 4.1-15 years group (p=0.013). Similarly, the younger children had higher rates of gastroenteritis, diarrhea, and pneumonia (P ≤ 0.05). However, skin diseases were more common in the age group 4.1-15-year (p=0.0001). The rate of pneumonia was noted as significantly higher in males as compared to females (p=0.025).

Conclusion: The findings of the current study show that the younger internally displaced children were more susceptible to diarrhea, pneumonia, and gastroenteritis, while skin diseases were more common in older children. The risk of pneumonia was significantly high in younger children. Problems with housing, water, and socioeconomic status may have caused the observed patterns. These findings suggest targeting healthcare for younger children and improving living conditions for displaced populations.

Keywords: Children's health, Disease patterns, Flood disasters, Internally displaced persons, Waterborne diseases

INTRODUCTION

Pakistan, currently grappling with its yearly monsoon season that traditionally brings massive floods to most of the country, has been heavily impacted by climate-induced natural disasters. The particularly heavy monsoon rains every year — which are caused by a succession of low-pressure systems that move from the Bay of Bengal north-east across northern India — inundate rivers, inundate large areas and affect tens of millions of lives[1]. With Pakistan ranked amongst the most flood prone countries across the globe, annually on average more than 500,000 people are affected from floods[2].

Notably, the 2022 apocalyptic floods in which the country recorded 190% rainfall over the normal, led to a displacement of over 8 million people and affected 33 million in 116 districts[3]. The event destroyed infrastructure and severely challenged the healthcare system, which then had to deal with dealing with complex public health problems[4]. There is evidence that the floods led to increases in waterborne and vector-borne diseases, including malaria, dengue and gastrointestinal diseases, especially among displaced people living in crowded and poor conditions[5,6].

Various studies have reported that healthcare facilities in flood-affected areas were overwhelmed, leading to increased numbers of respiratory infections and diarrheal disease cases[7]. One theory for this rapid emergence of infectious diseases is the contamination of water bodies and the shortage of drinking water sources and sanitation[8]. History of predisposing conditions for environmental disease transmission after extremes of weather in Pakistan and neighbouring region has demonstrated this phenomenon[9,10].

In addition, essential healthcare services have been extensively interrupted by the floods, triggering outbreaks of pneumonia, diarrhea, and malaria among displaced children who lack access to care[11]. Status reviews indicate that the health crises from these disasters will have to be addressed with targeted health strategies as a priority, but also that healthcare infrastructure needs to be strengthened[12,13]. This includes both the response to the immediate emergency and the future prevention of climate health shocks in the longer term[14].

Experts urge substantial improvement in the preparation for future floods, wider and adequate disease surveillance systems, and clear public health interventions targeting vulnerable groups[15,16]. Enhanced health systems, wider accessibility of clean drinking water, and increased vaccination conditions should be established to safeguard the population from the health threats of climate change marital aids[17].

Displacement of vulnerable populations, particularly children during flood disasters in Pakistan increases the risk of adverse outcomes. With inadequate sanitation, malnourishment and lack of health care, internally displaced children are more exposed to diseases. Knowledge of the incidence and prevalence of these diseases in epidemics and pandemics are important for decision-making regarding the possibility of implementation of targeted interventions, the allocation of financial and human resources, and for improvement of health outcomes in strong disruption of the health system in such events.

Corresponding Author
Allah Bux Bhutto
Email: allahbuxbhutto1@gmail.com

Affiliations:
Shaheed Mohtarma Benazir Bhutto Medical University (SMBBMU), Children's Hospital, Larkana

Postgraduate Trainee[1,4,5,6,7,8,9,10]

Professor & Chairman of the Pediatric Medicine Department[2]

Assistant Professor of Pediatric Medicine[3]

Submitted: September 13, 2024
Revised: November 20, 2024
Accepted: November 21, 2024

METHODOLOGY

This descriptive cross-sectional study was conducted in the Department of Pediatrics at Shaheed Mohtarma Benazir Bhutto Medical University (SMBBMU) Larkana from July 2022 to March 2023 to assess the disease patterns in internally displaced children registered during flood disasters, visiting a tertiary care hospital in Larkana. The study was a cross-sectional study, and in total, 507 children participated through non-probability purposive sampling. We calculated a sample size from the Open EPI online sample size calculator (www.OpenEPI.com) using a 13.33% frequency of pneumonia in internally displaced children, from pilot data, a 3% margin of error, and a 95% level of confidence. This study included both genders of internally displaced flood victims, aged 6 months up to 15 years were included in the study. Children with congenital heart disease or congenital anomaly, chronic respiratory illnesses (e.g., asthma, cystic fibrosis) or other chronic conditions that could mimic or confound infectious disease presentations were excluded from the study. Subjects who fulfilled the inclusion criteria were included in the study after written informed consent was obtained from parents/guardians. They were assured of the confidentiality of the information, their right to withdraw from the study at any time without providing a reason and were informed in simple and understandable language about the purpose and nature of the study.

Children with high-grade fever (>101°F) accompanied by symptoms such as headache, body aches, nausea, and rash were diagnosed with dengue fever following confirmation through a positive dengue virus antigen test in blood. Identification of malaria in children with fever, chills and shivering was defined by positive malaria parasite immunochromatographic test (MP ICT). Pneumonia was defined as a cough or difficulty breathing of less than four weeks duration, elevated respiratory rate (>50/min for children aged 2-11 months or >40/min for children aged 12-59 months), or lower chest wall in-drawing on clinical examination, with supporting evidence of consolidation or infiltrates on chest x-ray.

SPSS version 26.0 was used to analyze the collected data. Descriptive statistics were calculated in terms of Mean ± Standard Deviation and frequency with percentage. The Chi-square test was applied to assess the statistical significance at 5% level of significance.

RESULTS

Table I shows that the participants' mean age was 4.085 ± 2.9637 years, and balanced distribution of study population in two age groups (0.5-4 years, 54.6% vs 4.1-15 years, 45.4%). Gender distribution showed, 51.7% male and 48.3% female. The majority of the mothers had no education (40.2%) followed by primary education (33.5%), secondary (13.4%) and tertiary education (12.8%). The distribution of family monthly income of households showed that 179 (35.3%) had a low monthly income, 170 (33.5%) had a medium monthly income, and 158 of the respondents (31.2%) belonged to high-income households, which indicate that the socio-economic distribution was skewed towards lower-income groups. The overwhelming majority of the study subjects lived in Kacha houses (68.6%), demonstrating inadequate housing status and majority of the subject's (63.7%) utilized unimproved drinking water sources which can be an integral risk factor for waterborne diseases.

The analysis of disease patterns among men and women were mentioned in **Table II**, rates for most diseases were nearly identical between both genders, with statistically significant differences being only in respect of pneumonia. Males had a higher rate of pneumonia than females (74.8% compared to 65.7%), with a p value of 0.025, and OR of 1.549. This indicates that men were roughly 1.5 times more likely as women to contract the pneumonia. Males suffer from malaria with the rate of (54.6%), females (53.1%), yet no statistically significant difference was seen here (P=0.732). Similarly, like Dengue fever (males: 24.4%, females: 26.1%), chikungunya (males: 14.9%, females: 14.7%) and typhoid fever (males: 24.4%, females: 24.1%) also had no evident gender variations at all in numbers of sufferers. Only in diseases such as gastroenteritis was there any conspicuous difference between the sexes: women, 56.3% of them, are more liable to get this than men (63.7%). But even so, the difference in numbers was not great enough to reach statistical significance (P=0.088). Skin diseases and diarrhea show almost equal distribution in males and females, having p values of 0.714 and 0.472, respectively.

In **Table III**, comparing disease patterns between the two age groups (0.5–4 and 4.1–15 years), several conditions showed extreme differences. This suggests an age-related pattern. Younger children (0.5-4 years) had a significantly higher rate of malaria than older children. The incidence of malaria among the children between the age group (0.5–4) years was 58.8% and (4.1---15) years was 47.8%, and p value was found to be as 0.013. This is equivalent to odds ratio 1.560 which indicates that the odds of having malaria in younger children 1.56 times more likely in younger age as compared to older children. Similarly, the prevalence of gastroenteritis was significantly high in the younger age group (65.7% v/s 53.5%; p= 0.005). Diarrhea was significantly more prevalent in younger children as compared to older ones (84.5% v/s 71.3%, p=0.0001, OR=2.190). Consequently, these findings suggest that younger children literally have twice the chances of suffering from diarrhea as compared to older ones. Pneumonia was also significantly more common in the younger group (75.5% vs. 64.3%, p=0.006, OR=1.703), indicating their greater risk of respiratory infections. Conversely, for the older group (4.1-15 years), there was a significantly higher prevalence of skin diseases than the younger age children. This is demonstrated by the fact that prevalence was 60.0% in older as opposed to just under a quarter (24.9%) for younger ones (p=0.0001). Dengue fever and chikungunya did not show significant differences of any kind between the age groups. The P values for these two diseases were noted as p=0.848 and p=0.130, respectively. Similarly, we found insignificant differences in the prevalence of typhoid fever between younger (23.1%) and older children (25.7%, p=0.505).

Table I: Demographic Characteristics of Study Participants (n=507)	
Variable	**n (%)**
Age (Mean ± SD) = 4.085 ± 2.9637 years	
0.5 – 4.0 years	277 (54.6)
4.1 – 15.0 years	230 (45.4)
Gender	
Male	262 (51.7)
Female	245 (48.3)
Mother's Education	
No education	204 (40.2)
Primary	170 (33.5)
Secondary	68 (13.4)
Higher	65 (12.8)
Family's Monthly Income	
Low	179 (35.3)
Medium	170 (33.5)
High	158 (31.2)
Type of House	
Kacha	348 (68.6)
Pakka	159 (31.4)
Source of Drinking Water	
Improved	184 (36.3)
Unimproved	323 (63.7)

Table II: Comparison of Diseases Pattern with Gender (n=507)				
Diseases Pattern	**Gender**			**P-Value**
	Male	**Female**	**O.R 95% C. I**	
Malaria, n (%)	143 (54.6)	130 (53.1)	1.063 (0.750 ---- 1.508)	0.732
Dengue Fever, n (%)	64 (24.4)	64 (26.1)	0.914 (0.612 ---- 1.365)	0.661
Chikungunya, n (%)	39 (14.9)	36 (14.7)	1.015 (0.622 ---- 1.659)	0.952
Typhoid Fever, n (%)	64 (24.4)	59 (24.1)	1.019 (0.679 ---- 1.530)	0.928
Gastroenteritis, n (%)	167 (63.7)	138 (56.3)	1.363 (0.954 ---- 1.947)	0.088
Diarrhea, n (%)	209 (79.8)	189 (77.1)	1.168 (0.765 ---- 1.785)	0.472
Pneumonia, n (%)	196 (74.8)	161 (65.7)	1.549 (1.055 ---- 2.275)	0.025
Skin Diseases, n (%)	109 (41.6)	98 (40.0)	1.069 (0.750 ---- 1.523)	0.714

Table III: Comparison of Diseases Pattern with Age Group (n=507)				
Diseases Pattern	Age Group (Years)			P-Value
	0.5 to 4 (Years)	4.1 to 15 (Years)	O.R 95% C. I	
Malaria, n (%)	163 (58.8)	110 (47.8)	1.560 (1.097 ---- 2.219)	0.013*
Dengue Fever, n (%)	69 (24.9)	59 (25.7)	0.961 (0.643 ---- 1.437)	0.848
Chikungunya, n (%)	47 (17.0)	28 (12.2)	1.474 (0.890 ---- 2.442)	0.130
Typhoid Fever, n (%)	64 (23.1)	59 (25.7)	0.871 (0.580 ---- 1.308)	0.505
Gastroenteritis, n (%)	182 (65.7)	123 (53.5)	1.667 (1.164 ---- 2.386)	0.005*
Diarrhea, n (%)	234 (84.5)	164 (71.3)	2.190 (1.421 ---- 3.376)	0.0001*
Pneumonia, n (%)	209 (75.5)	148 (64.3)	1.703 (1.160 ---- 2.501)	0.006*
Skin Diseases, n (%)	69 (24.9)	138 (60.0)	0.221 (0.151 ---- 0.323)	0.0001*

* p-value < 0.005 is significant

DISCUSSION

The findings of current study highlight a new perspective to the incidence of disease among children displaced by flooding in Pakistan during the year 2022. Waterborne and respiratory diseases, such as diarrhea, pneumonia, and gastroenteritis were noted significantly high among younger children (0.5-4 years old). These findings concur with previous studies showing that children in this age group were more susceptible to infections due to their immature immune systems and heavy exposure to polluted water and unhygienic living conditions during times of displacement[5,7].

In comparison, older age groups (4.1 to 15 years old) had a higher prevalence of skin diseases, due to longer exposure to flood waters and lack of appropriate clean hygiene sites, which had been reported in previous studies[12,18]. Except for the higher incidence of pneumonia in males than females, gender-based differences were negligible between males and females, which is in agreement with what is already known about gender-based differences in respiratory infections[11,13].

This study demonstrates a high prevalence of various infectious diseases, which indicates considerable public health challenges. Malaria prevalence of 58.8% indicates the endemic nature of malaria with insufficient vector control, inadequate supply of antimalarial medicines and limited education campaigns in the community. Dengue was dominant in 24.9% of cases, in line with above regions endemic data, indicating the requirement of large-scale mosquito prevention and vaccination programs.

Chikungunya was found in 17.0% of the cases demonstrating a considerable disease burden with limited diagnostic accuracy and public awareness leading to suboptimal disease management. Typhoid fever was noted in 23.1% and documented as a leading cause of diarrheal disease which associated with continued problems with water quality and sanitation, indicating improvements are needed that provide access to clean water, hygiene and ongoing vaccination to mitigate these diseases.

The most common clinical manifestation was gastroenteritis involving 65.7% of cases which is again much higher than that reported by Ahmed Z, et al[19], having prevalence of only 30%. The above disparity may be due to regional variations in sanitation and food safety, highlighting the crucial need for hygiene education and food safety regulations. Diarrhea was found in 84.5% of patients, which was lower than the 91.5% prevalence by Wang P, et al[20] but significantly higher than the 7.02% observed by Saha J, et al[21]. Differences in demographics, geographic location, or methodologies could explain variations in prevalence. Focusing on sanitation improvements, access to clean water, and education on rehydration therapy to treat disorders like diarrhea are still critically important.

Pulmonary disease was heavily represented, with pneumonia being comorbid in 75.5% of cases. Increased vaccination coverage and prompt medical treatment are critical to mitigate its impact. Skin diseases were seen in 24.9% of the cases, while Ahmed Z, et al[19] reported a prevalence of 33% which might be due to difference and/or accessibility of healthcare in one region as compared to the other. Understanding the aetiologies and risk factors of skin infections can lead to targeted interventions.

Strengths of the study include its large, representative sample size and the focus on disease patterns that are pertinent to both gender and specific age-groups. Such an in-depth process allows for distinguishing between the specifications of health vulnerabilities as a result of disaster, making this an informative foundation for possible targeted interventions. Moreover, the combination of statistical measures such as odds ratios and confidence intervals consistently utilized within the study provides a reliable and significant contribution to disaster medicine.

Still, study has some significant limitations. The use of cross-sectional design limits the ability to draw cause and effect conclusions between displacement and disease outcomes. Furthermore, hospital-based data collection may cause

selection bias in that many children with uncomplicated symptoms or lacking healthcare access may not have been captured. This population also suffered from severe food insecurity and important socioeconomic factors were unfavorably skewed toward lower education and income levels. Such social determinants likely were some of the most salient pre-existing conditions in the spread and virulence of disease and should therefore be investigated within longitudinal studies.

To address the health risks highlighted by this study, it is recommended that disaster response strategies prioritize the healthcare needs of displaced children. Immediate measures should include ensuring access to clean drinking water, sanitation facilities, and routine healthcare services, such as immunizations and respiratory infection management. Strengthening disease surveillance systems in flood-prone regions is crucial for early outbreak detection and control. Long-term strategies must focus on improving infrastructure, promoting health education, and bolstering the resilience of healthcare systems to withstand the impacts of climate-induced disasters. Such interventions are essential to mitigate the long-term health consequences of displacement and to protect vulnerable populations from future environmental crises.

CONCLUSION

The findings of the current study show that younger internally displaced children were more susceptible to diarrhea, pneumonia, and gastroenteritis, while skin diseases were more common in older children. The risk of pneumonia was significantly high in younger children. Problems with housing, water, and socioeconomic status may have caused the observed patterns. These findings suggest targeting healthcare for younger children and improving living conditions for displaced populations.

Conflict of Interest: Authors declare that there is no conflict of interest.

Source of Funding: Nil.

Authors' Contributions: All authors took part in this study to an equal extent. **Allah Bux B:** led the study's design, data collection, analysis, and manuscript preparation. **Shanti Lal B:** supervised the study and critically reviewed the manuscript. Nazia: supported data interpretation and revisions. **Suhail A, Paras, Sadam B, Rahmatullah T, Farooq I, Komal,** and **Noor:** contributed to data collection, literature review, and manuscript drafting. All authors reviewed the final manuscript.

REFERENCES

1. Pradhan NA, Najmi R, Fatmi Z. District health systems capacity to maintain healthcare service delivery in Pakistan during floods: a qualitative study. Int J Disaster Risk Reduct. 2022;78:103092.
2. Rehmat A, Ahmad SM, Danish S, Umar A, Khaver A, Khan RM. Claiming reparation for loss and damage due to floods 2022: the case of Pakistan. Sustainable Development Policy Institute (SDPI); 2022 [cited 2024 Sep 01]. Available from: https://sdpi.org/assets/lib/uploads/Claiming%20Reparation%20for%20Loss%20and%20Damage%20Due%20to%20Floods%202022.pdf
3. OCHA. Pakistan: 2022 Monsoon Floods - Situation Report No. 14 (As of 6 February 2023) [Internet]. ReliefWeb; 2023 Feb 7 [cited 2024 Sep 02]. Available from: https://reliefweb.int/report/pakistan/pakistan-2022-monsoon-floods-situation-report-no-14-6-february-2023.
4. Zaidi S, Memon Z. Pakistan floods: breaking the logjam of spiraling health shocks. EBioMedicine. 2023;93:104707.
5. UNICEF. More than three million children at risk as devastating floods hit Pakistan [Internet]. 2022 Aug 31 [cited 2024 Sep 05].Available from: https://www.unicef.org/press-releases/more-three-million-children-risk-devastating-floods-hit-pakistan
6. Waseem HB, Rana IA. Floods in Pakistan: a state-of-the-art review. Nat Hazards Res. 2023;3(3):359-73.
7. Alied M, Salam A, Sediqi SM, Kwaah PA, Tran L, Huy NT. Disaster after disaster: the outbreak of infectious diseases in Pakistan in the wake of 2022 floods. Ann Med Surg. 2024;86(2):891-8.
8. Shamsul H, Kashima S. The health effects of the 2020 Bangladesh floods in the rural and isolated areas. ISEE Conference Abstracts. 2022;2022(1)
9. Minicucci C, Rest E, Zhang E. Flood recovery and resilience in Pakistan [Internet]. Yale Institute for Global Health; 2023 [cited 2024 Sep 07]. Available from: https://files-profile.medicine.yale.edu/documents/43bd3d13-a10e-4e0e-8bee-e3888536f6ae
10. Yavarian J, Shafiei-Jandaghi NZ, Mokhtari-Azad T. Possible viral infections in flood disasters: a review considering 2019 spring floods in Iran. Iran J Microbiol. 2019;11(2):85-9.
11. Das JK, Siddiqui F, Padhani ZA, Khan MH, Jabeen S, Mirani M, et al. Health behaviors and care seeking practices for childhood diarrhea and pneumonia in a rural district of Pakistan: a qualitative study. PLoS One. 2023;18(5):e0285868.
12. Pakistan floods 2022: lessons learned - update #9 - 6 October [Internet]. ReliefWeb; 2022 Oct 6 [cited 2024 Sep 07]. Available from: https://reliefweb.int/report/pakistan/pakistan-floods-2022-lessons-learned-update-9-6-october
13. Government of Pakistan, United Nations Development Programme. Pakistan floods 2022: Post-disaster needs assessment - Supplemental report [Internet]. Islamabad: Government of Pakistan; 2022 [cited 2024 Sep 08]. Available from: https://www.undp.org/
14. Government of Pakistan, UN Country Team in Pakistan. Joint launch of 2022 Pakistan floods response plan by Government of Pakistan and the United Nations [Internet]. ReliefWeb; 2022 Aug 30 [cited 2024 Sep 10]. Available from: https://reliefweb.int/report/pakistan/joint-launch-2022-pakistan-floods-response-plan-government-pakistan-and-united-nations
15. Bhutta ZA, Bhutta SZ, Raza S, Sheikh AT. Addressing the human costs and consequences of the Pakistan flood disaster. Lancet. 2022;400(10360):1287-9.
16. World Health Organization. Major health risks unfolding amid floods in Pakistan [Internet]. ReliefWeb; 2022 Aug 30 [cited 2024 Sep 08]. Available from: https://reliefweb.int/report/pakistan/major-health-risks-unfolding-amid-floods-pakistan

17. Khoja A, Ali NA, Kazim F. Flood in Pakistan and infectious diseases-the way forward. J Coll Physicians Surg Pak. 2023;33(09):1080-1.
18. Nashwan AJ, Ahmed SH, Shaikh TG, Waseem S. Impact of natural disasters on health disparities in low-to middle-income countries. Discov Health Syst. 2023;2(1):23.
19. Ahmed Z, Khan AA, Nisar N. Frequency of infectious diseases among flood affected people at district Rajanpur, Pakistan. Pak J Med Sci. 2011;27(4):866-9.
20. Wang P, Asare EO, Pitzer VE, Dubrow R, Chen K. Floods and diarrhea risk in young children in low-and middle-income countries. JAMA Pediatr. 2023;177(11):1206-14.
21. Saha J, Hussain D, Debsarma D. Exploring the association between floods and diarrhea among under-five children in rural India. Disaster Med Public Health Prep. 2024;18:e142.

How to cite: Allah B, Shanti LB, Nazia, Suhail A, Paras, Sadam B, Rahmatullah T, Farooq I, Komal, Noor. Frequency of Diseases Patterns in Internally Displace Children During Flood Disasters at Tertiary Care Hospital Larkana. Pak J Med Dent Sci. 2024;1(2):45-50