

# Impact of flood disaster on dialysis care in Maiduguri Northeastern Nigeria

Mustapha Lawan, Zannah M. Tijjani, Mohammad M. Sulaiman

Nephrology Division, Department of Internal Medicine, University of Maiduguri, Maiduguri, Borno State, Nigeria

Correspondence to Mohammad M. Sulaiman, Department of Internal Medicine, University of Maiduguri, PMB 1069, Maiduguri 600104, Borno State, Nigeria  
Tel: +234 806 598 0029;  
E-mail: drsmmaina@unimaid.edu.ng

**Received** 12 January 2026

**Revised** 19 February 2026

**Accepted** 08 April 2026

**Published** 29 June 2026

**Arab Journal of Nephrology and Transplantation**  
2026, 8:77–80

## Introduction

Flood disasters present significant challenges to health systems, particularly in resource-constrained settings. In 2025, unprecedented flood affected Maiduguri and its environs, severely disrupting essential healthcare services, with dialysis care among the most critically affected.

## Aim

This study was aimed at determining the impact of the flood disaster on patients with end-stage kidney disease in Maiduguri, northeastern Nigeria.

## Patients and methods

This was a cross-sectional study conducted among patients with end-stage kidney disease receiving maintenance hemodialysis at the two dialysis centers located at the University of Maiduguri Teaching Hospital and State Specialist Hospital Maiduguri, northeast Nigeria.

## Results

A total of 120 patients who were receiving maintenance hemodialysis at the two centers (State Specialist Hospital Maiduguri and University of Maiduguri Teaching Hospital) were included in the study. Their mean age was  $39.29 \pm 9.79$  years and 66.7% (80) were male. About half of the patient cohort missed at least a session of dialysis during the disaster. One of the dialysis units was closed for over 10 days during the flood disaster. Forty-eight (40%) patients required emergency room visit due to missed hemodialysis during the flood.

## Conclusion

Flooding has a significant and multifaceted impact on dialysis services and patients in Maiduguri. Strengthening resilient infrastructure, developing emergency dialysis protocols, and integrating chronic disease management into disaster response planning are essential to protect dialysis-dependent populations in flood-prone regions.

## Keywords:

disaster preparedness, end-stage kidney disease, flood disaster, hemodialysis, Nigeria

Arab J Nephrol Transplant 8:77–80

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1858-554X

## Introduction

The sudden collapse of the Alau Dam in the outskirts of Maiduguri on the September 10, 2024 resulted in devastating flood affecting an estimated 40–70% of the town and disrupting dialysis services in the two dialysis centers in Maiduguri [1]. Nearly one million people were displaced from their flooded homes while several thousands of residents were stranded by major disruptions due to flooded roadways and damaged infrastructure [1,2]. Climate-associated heavy precipitation is projected to cause severe flooding in the coming years in Nigeria.

Disasters have serious consequences for the delivery of dialysis to people with end-stage kidney disease (ESKD) who rely on infrastructure such as transportation, electricity, and water supply to sustain their lives. The effect of climate change is set to increase the frequency of adverse weather conditions [3]. The hurricane Katrina caused severe devastation to Louisiana disrupting the care to ESKD patients [4]. That disaster exposed numerous gaps in emergency preparedness for dialysis patients, facilities, and

providers [5]. Many changes were made in the United States of America to increase disaster preparedness for dialysis patients [6].

During earthquakes, crush injuries result in increased risk of acute kidney injury and the need for kidney replacement therapy increases [7].

In developing countries like Nigeria, the needs of ESKD patients are often not considered during and after disasters. Borno State, with an estimated population of five million has only two dialysis centers located within the capital city – Maiduguri; disruption in the services provided by the centers leave patients without an alternative. This cross-sectional study was conducted to determine the impact of flood on dialysis patients in Maiduguri, northeastern Nigeria.

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## Patients and methods

This was a cross-sectional study conducted among ESKD patients receiving maintenance hemodialysis at the two dialysis centers located at the University of Maiduguri Teaching Hospital (UMTH) and State Specialist Hospital Maiduguri (SSHM), northeast Nigeria. The study was conducted over 2 weeks between September 16 and 30, 2024.

The study population comprised of the entire adult (>18 years) patients on maintenance hemodialysis in either SSHM or UMTH. Sociodemographic data, duration and frequency of dialysis, number of missed sessions, and location of dialysis were collected from all patients and entered into a well-structured questionnaire.

## Statistical analysis

Data obtained was entered into SPSS (IBM Inc, Chicago IL 2015), version 23 and analyzed. Continuous variables were expressed as mean and SDs were as categorical variables were expressed as percentages. Relationship between categorical variables was analyzed using  $\chi^2$  test and Student *t* test was used to compare the means of continuous variable. A *P* value of less than 0.05 was considered significant.

## Ethical considerations

Informed written consent was obtained from each study participant. Institutional ethics clearance was obtained from the ethics committees of SSHM and UMTH.

## Results

A total of 120 patients who were receiving maintenance hemodialysis at two centers (SSHM and UMTH) were included in the study. Their mean age was  $39.29 \pm 9.79$  years and 66.7% (80) were male. About half of the patient cohort missed at least a session of dialysis during the disaster. One dialysis unit was closed for over 10 [8] days during the flood disaster. Forty-eight (40%) patients required emergency room visit due to missed hemodialysis during the flood disaster. Table 1 shows the characteristics of the study population.

As shown in Table 2, comparing study participants in SSHM and UMTH showed that patients who were receiving their dialysis in the UMTH were older with a mean age of  $46.00 \pm 12.47$  and  $35.56 \pm 5.855$  in the SSHM (*P* = 0.08). Other parameters were statistically similar between the two groups.

**Table 1 Characteristics of the study participants**

| Variables                                        | Characteristics [n (%)] |
|--------------------------------------------------|-------------------------|
| Age (years)                                      | 39.29±9.79              |
| Sex                                              |                         |
| Male                                             | 80 (66.7)               |
| Female                                           | 40 (33.3)               |
| Duration of hemodialysis (months)                | 9.29±9.68               |
| Type of dialysis access                          |                         |
| AV fistula                                       | 10 (8.3)                |
| Tunneled jugular catheter                        | 63 (52.5)               |
| Subclavian catheter                              | 36 (30.0)               |
| Femoral catheter                                 | 11 (9.2)                |
| Did you miss dialysis during the flood disaster? |                         |
| Yes                                              | 61 (50.8)               |
| No                                               | 59 (49.2)               |
| Number of sessions missed                        |                         |
| 1                                                | 23 (37.7)               |
| 2                                                | 31 (50.8)               |
| ≥3                                               | 7 (11.5)                |
| Do you require emergency room visit?             |                         |
| Yes                                              | 48 (40.0)               |
| No                                               | 72 (60.0)               |

## Discussion

This study examined the impact of flooding on dialysis services and patients in Maiduguri, a region already facing significant healthcare and security challenges. The findings demonstrate that flooding had a substantial negative effect on dialysis delivery, patient access to care, and treatment continuity. These results highlight the vulnerability of patients with ESKD during environmental disasters, particularly in low-resource and conflict-affected settings [9].

One of the major impacts observed was the disruption of dialysis services. Flooding damaged health facility infrastructure at UMTH necessitating closure for at least 10 days, disrupted electricity and water supply, and limited the availability of functional dialysis machines. Dialysis depends heavily on clean water, stable power, and sterile environments; therefore, flooding directly compromised service delivery. Similar findings have been reported in other disaster-prone regions, where floods and storms led to temporary or prolonged closure of dialysis units and reduced treatment capacity [8,10].

The study also found that patient access to dialysis was significantly affected, about half of our study participants missed at least a session of dialysis and required emergency room visit. Flooded roads, displacement of communities, and lack of transportation prevented many patients from attending scheduled dialysis sessions. Missed or delayed dialysis sessions can lead to serious complications such as fluid overload, electrolyte imbalance, and increased mortality risk. In Maiduguri, where many patients already travel long distances for dialysis, flooding further worsened access barriers.

**Table 2 Comparison between study participants in the study participants in State Specialist Hospital Maiduguri and University of Maiduguri Teaching Hospital**

| Variables                             | SSHM ( <i>n</i> =80) | UMTH ( <i>n</i> =40) | $\chi^2$ <i>P</i>                  |
|---------------------------------------|----------------------|----------------------|------------------------------------|
| Age (years)                           | 35.56±5.855          | 46.00±12.47          | <i>P</i> =0.08                     |
| Sex: male                             | 67 (83.8)            | 28 (70)              | 0.600; <i>P</i> =0.438             |
| Female                                | 13 (16.2)            | 12 (30)              |                                    |
| Duration of dialysis (months)         | 10.7±11.15           | 5.75±3.2             | <i>P</i> =0.180                    |
| Number of missed sessions             |                      |                      |                                    |
| 1                                     | 7 (8.8)              | 16 (40)              | $\chi^2$ =0.735<br><i>P</i> =0.241 |
| 2                                     | 11 (13.8)            | 20 (50)              |                                    |
| ≥3                                    | 2 (2.5)              | 4 (10)               |                                    |
| Did you require emergency room visit? |                      |                      |                                    |
| Yes                                   | 18 (22.5)            | 30 (75)              | $\chi^2$ =0.478<br><i>P</i> =0.241 |
| No                                    | 62 (77.5)            | 10 (25)              |                                    |

Another important finding was the financial burden imposed by flooding. Many patients experienced loss of income, increased transportation costs, or additional expenses related to relocation and emergency healthcare. Dialysis is already expensive in Nigeria, and the added economic strain during floods may have forced some patients to reduce treatment frequency or discontinue care altogether. This aligns with previous studies showing that disasters disproportionately affect patients with chronic illnesses due to increased costs and reduced coping capacity [11–13].

Flooding also contributed to psychological stress and anxiety among dialysis patients. Fear of missing treatment, uncertainty about service availability, and displacement from homes may negatively affect mental well-being. Although this study did not formally assess mental health outcomes, patient reports suggest that psychological distress is an important indirect consequence of flooding that deserves further investigation.

The findings underscore the need for disaster preparedness and resilience planning in dialysis centers in Maiduguri. Strategies such as flood-resistant facility design, backup power and water systems, emergency dialysis plans, patient tracking systems, and interfacility collaboration could reduce service disruption during floods. Government agencies and healthcare stakeholders should integrate renal care into broader disaster risk management frameworks.

This study has some limitations. The sample size may be limited, and data may rely partly on self-reported patient experiences, which are subject to recall bias. Additionally, the study focused on a specific geographic area, which may limit generalizability to other regions. Despite these limitations, the study provides valuable insights into the real-world challenges faced by dialysis patients during floods.

## Conclusion

Flooding has a significant and multifaceted impact on dialysis services and patients in Maiduguri. Addressing these challenges requires coordinated efforts in infrastructure development, emergency preparedness, and financial support for patients, and policy-level interventions to protect vulnerable populations during environmental disasters.

## Financial support and sponsorship

Nil.

## Conflicts of interest

There are no conflicts of interest.

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