

Prevalence And Risk Factors Associated with the Occurrence and Outcome of Acute Kidney Injury Among Children at the National Hospital, Abuja, Nigeria

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Abstract

BACKGROUND: Acute kidney injury (AKI) is a sudden decline in kidney function associated with significant childhood morbidity and mortality. In Nigeria, reported prevalence ranges from 30.7% - 82.9%. Many risk factors are preventable, making early recognition and intervention vital.

OBJECTIVE: To determine the prevalence, severity, short-term outcomes, and risk factors of AKI among children aged one month to 15 years admitted to the Emergency Paediatric Unit of the National Hospital, Abuja.

METHODS: A prospective observational study conducted among 270 paediatric admissions between April and September 2022. Using Kidney Disease Improving Global Outcomes (KDIGO) criteria for diagnosis and staging. Serum creatinine was measured at admission, then serially depending on the renal function status until discharge or two weeks in those with AKI. Urine output was monitored. Associations between clinical variables and AKI occurrence and outcome were analyzed.

RESULTS: Fifty-seven children (21.1%) had AKI at admission, of whom 68.4% were in stage 3. Significant risk factors included low socioeconomic status ($P=0.001$), nephrotoxic drug and herbal use ($P<0.001$), and delayed presentation ($P<0.001$). Twelve AKI patients (21.1%) died, 75% of whom were in stage 3. Significantly poorer outcomes were seen in children with Oliguria ($P=0.004$), sepsis ($P=0.022$), and need for dialysis ($P=0.001$).

CONCLUSION: AKI is common among hospitalized children in Abuja, driven largely by preventable factors. Improved community awareness, early detection and intervention are essential to reduce AKI-related morbidity and mortality.

INTRODUCTION

Acute kidney injury (AKI) represents a spectrum of kidney dysfunction ranging from mild biochemical abnormalities to severe renal failure requiring kidney replacement therapy.¹ It is defined by an abrupt decline in glomerular filtration rate, resulting in accumulation of nitrogenous waste products and dysregulation of fluid, electrolyte, and acid–base balance.²

The Kidney Disease: Improving Global Outcomes (KDIGO) classification provides a standardized framework for diagnosing and staging AKI and is widely validated in paediatric populations.^{1,3–6} Despite advances in diagnostic criteria, AKI remains under-recognized, particularly in resource-limited settings.^{7–9}

Globally, AKI affects approximately one in three hospitalized children,¹⁰ with disproportionately higher burden in low- and middle-income countries (LMICs).^{2,11} Reported prevalence in Nigerian paediatric populations varies widely (1%–82.9%),^{12,13,14–16} reflecting differences in study design, diagnostic criteria, and case ascertainment. Importantly, lower estimates likely represent under-detection of milder disease.

The aetiology of paediatric AKI in developing countries is predominantly secondary to preventable conditions such as sepsis, dehydration, malaria, and exposure to nephrotoxins.^{12,17} In contrast, intrinsic kidney diseases predominate in high-income settings. Mortality rates remain unacceptably high, ranging from 7.8% to over 50%,^{18–20} with survivors at risk of long-term sequelae including chronic kidney disease (CKD).

Several risk factors—including delayed presentation, inappropriate medication use, and limited access to specialized care—are modifiable.^{11,17,20–24} The International Society of Nephrology 0by25 initiative underscores the importance of early detection and timely intervention in reducing preventable AKI-related deaths.²⁵

This study aimed to determine the prevalence, severity, risk factors, and short-term outcomes of AKI among children admitted to a tertiary hospital in Abuja, Nigeria.

MATERIALS AND METHODS

This was a prospective observational study conducted at the Emergency Paediatric Unit (EPU) of the National Hospital, Abuja (NHA), a major tertiary referral center in Abuja, the Federal Capital Territory (FCT) of Nigeria.

Children aged 1 month to 15 years who were admitted during the study period (April to September 2022) were eligible. Children with pre-existing CKD, known congenital renal or urologic anomalies, prior haemodialysis or peritoneal dialysis before presentation were excluded.

Using a prevalence estimate of 26 per 1000 children³ and the standard formula for prevalence studies,²⁶ the minimum sample size was calculated as 243 and increased to 270 to account for attrition.

Data was obtained using a structured proforma capturing sociodemographic characteristics, clinical presentation and duration of illness, exposure to nephrotoxins and herbal medications, and physical examination findings. Socioeconomic status was classified using the Oyedele method.²⁷ Serum creatinine was measured at admission and repeated at 24 and 48 hours, and subsequently as indicated. Urine output was monitored using appropriate methods and recorded at 6-hour intervals.

AKI was defined using KDIGO criteria¹: increase in sCr ≥ 26.5 $\mu\text{mol/L}$ within 48 hours, or ≥ 1.5 times baseline within 7 days, or urine output < 0.5 mL/kg/hour for 6 hours. Severity staging (stages 1–3) followed standard KDIGO classification.

Outcomes at 2 weeks were categorized as full recovery, partial recovery, persistent AKI, or death. Poor outcome was defined as death or persistent stage 3 AKI at 2 weeks.

Ethical approval

was obtained from the Health Research Ethics Committee of National Hospital, Abuja. Written informed consent (and assent where applicable) was obtained. Patient confidentiality was maintained, and all study-related investigations were funded by the researcher.

The data was analyzed using the Statistical Package for Social Sciences (SPSS) Software, version 24.0 (IBM Corp., Chicago IL, United States). Continuous variables were presented as mean $\pm$ standard deviation or median (interquartile range), while categorical variables were expressed as frequencies and percentages.

Associations between AKI and independent variables (age, socioeconomic status, and gender) were assessed using the chi-square test. Variables with significant associations were entered into a logistic regression model to identify independent predictors. Statistical significance was set at $p < 0.05$ with 95% confidence intervals.

RESULTS

Sociodemographic Characteristics

A total of 270 children were recruited into the study, of whom 144 (53.3%) were males, giving a male-to-female ratio of 1.14:1. The ages of the participants ranged from one month to 15 years, with a median (IQR) age of 48 (108) months. One hundred and forty-four (53.4%) of the participants were aged five years or less, while 171 (63.3%) belonged to the upper socioeconomic class. Table I shows the sociodemographic characteristics of the study participants.

TABLE I: Socio-demographic characteristics of 270 study participants

Variables	Frequency	Percentage%
Age groups (years as at last birthday)		
< 1	56	20.7
1 – 5	88	32.6
6 – 10	71	26.3
> 10	55	20.4
Median (IQR); Min, Max (months)	48 (108); 1,186	
Mean±SD (months)	64.44±56.50	
Gender		
Male	144	53.3
Female	126	46.7
Socio Economic Class group		
Upper class	171	63.3
Middle class	67	24.8
Lower class	32	11.9

Prevalence and Severity of AKI

Acute kidney injury (AKI) was diagnosed in 57 out of the 270 children, giving a prevalence of 21.1%. Figure 1 illustrates the prevalence of AKI among the study participants.

AKI diagnosis based on the KDIGO serum creatinine criteria alone was made in 45 (78.9%) cases, while 12 (21.1%) cases required both serum creatinine levels and urine output quantification per kg body weight per hour. All cases of AKI were identified on the day of admission.

Of the 57 children with AKI, 39 (68.4%) were classified as Stage 3 based on KDIGO severity criteria. The remaining 18 (31.6%) were equally distributed between Stage 1 and Stage 2 [9 (15.8%) each]. Figure 2 shows the severity stages at diagnosis and outcomes at 72 hours.

TABLE III: Severity stages of children with AKI at diagnosis, outcomes at 72 hours and at two weeks using the KDIGO classification system¹

AT DIAGNOSIS		AT 72 HOURS		AT TWO WEEKS	
Severity Stages					
	Number of children (n = 57)	Outcome	Frequency n (%)	Outcome	Frequency n(%)
Stage 1	9	Normal	6.0(66.7%)	Discharged	6(66.7)
		Stage 1	0.0(0.0%)	died	1(11.1)
		Stage 2	2.0(22.2%)	Still on admission	2(22.2)
		Stage 3	0.0(0.0%)		
		Died	1.0 (11.1%)		
		Normal	5.0(55.6%)	Discharged	4(44.5)
Stage 2	9	Stage 1	2.0 (22.2%)	Died	2(22.5)
		Stage 2	1.0 (11.1%)	Still on admission	3(33.5)
		Stage 3	0.0 (0.0%)		
		Died	1.0 (11.1%)		
		Normal	2.0 (5.1%)	Discharged	14(35.5)
Stage 3	39	Stage 1	4.0 (10.3%)	Died	9(23.1)
		Stage 2	6.0 (15.4%)	Still on admission	16(41.0)
		Stage 3	23.0(59.0%)		
		Died	4.0 (10.3%)		

Abbreviation(s): KDIGO = Kidney disease improving global outcomes

Factors Associated with Occurrence of AKI

There was no statistically significant association between AKI occurrence and demographic variables such as age and sex (p = 0.251 and 0.632, respectively).

However, socioeconomic class, use of potentially nephrotoxic drugs and herbal medications, delayed presentation to the hospital, and dehydration were significantly associated with the occurrence of AKI ($p < 0.05$ for each). Table II presents the logistic regression analysis of these risk factors.

Children from middle socioeconomic class (95%CI,1.693-6.277, $p=0.001$) were twice as likely to develop AKI compared to those from other classes. Additionally, children with a history of exposure to nephrotoxic medications (95%CI-2.479-9.336, $p<0.001$) or herbal remedies (95%CI-2.279-11.307, $p<0.001$), and those presenting with dehydration (95%CI-2.335-8.085, $p<0.001$), were four times and three times more likely, respectively, to develop AKI compared to those without such risk factors.

TABLE II: Logistic regression analysis for significant factors related to AKI occurrence

Variable	OR	95% CI for OR	<i>p</i> -value
Socio-economic class			
Upper class	RC		
Middle class	3.260	1.693 – 6.277	0.001**
Lower class	1.947	0.787 – 4.815	0.230
Exposure to potential nephrotoxic medication(s)			
Yes	4.811		
No	RC	2.479 – 9.336	<0.001**
Use of herbs			
Yes	5.077		
No	RC	2.279 – 11.307	<0.001**
Presence of dehydration			
Yes	4.345		
No	RC	2.335 – 8.085	<0.001**
Delay in hospital presentation			
No	RC		
Yes	5.019	2.410 – 10.453	<0.001**

RC – Reference category, OR – odds ratio, CI- confidence interval,

***Statistically significant p-value.*

Short-Term Outcome of AKI

Within 72 hours of diagnosis, six children (10.5%) died. Of these, four had Stage 3 AKI, while one death each occurred among children with Stage 1 and Stage 2 AKI.

Clinical improvement was observed in 6 (66.7%) and 8 (77.8%) of children with Stage 1 and Stage 2 AKI, respectively. Among the 39 children with Stage 3 AKI, 12 (30.8%) showed improvement, while 23 (59.0%) remained in Stage 3 after 72 hours.

Overall, 12 children (21.1%) died, of whom 9 (75%) had Stage 3 AKI. A higher proportion of children with Stage 1 AKI (66.7%) were discharged compared to those in Stage 2 (44.5%) and Stage 3 (35.9%), although these differences were not statistically tested.

The progression and outcomes at 72 hours and two weeks are shown in Table III, while Figure 3 illustrates outcomes in terms of full recovery, partial recovery, non-recovery, and death.

All 10 children who had indications for dialysis at admission had unfavourable outcomes. Among the four children who required but did not receive dialysis, two (50%) died, while the remaining two, along with the six who received dialysis, remained in Stage 3 at two weeks. Treatment modalities are presented in Table IV.

TABLE IV: Management modalities among the respondents diagnosed with AKI

Treatment Modalities	Frequency (n = 57)	Percentage
Conservative only	51	89.5
Dialysis	6	10.5
Total dialysis indicated	10	17.5
Dialysis indicated (10)		
Dialysis done	6	60.0
Dialysis not done	4	40.0
Type of dialysis done (6)		
Peritoneal dialysis	1	16.7
Haemodialysis	5	83.3
Reasons for not doing dialysis (4)		
Financial constraint	3	75.0
Non-availability of dialysis space	1	25.0

Risk Factors Associated with Outcome of AKI

Oliguria/anuria, aetiology of AKI, thrombocytopaenia, and treatment modality were significantly associated with AKI outcomes ($p = 0.010, 0.006, 0.037, \text{ and } 0.046$, respectively).

In contrast, age, sex, socioeconomic status, anaemia, leucocytosis, fluid overload, and length of hospital stay were not significantly associated with outcomes.

Logistic regression analysis (Table V) showed that children with oliguria/anuria (95%CI-1.720-31.704, $p = 0.004$) were six times more likely to have poor outcomes compared to those with normal urine output. Additionally, children who underwent dialysis (95%CI-2.023-4.286, $p=0.001$) were twice as likely to have poor outcomes compared to those managed conservatively. Children with sepsis (95%CI-1.175-11.096, $p=0.022$) were two times more likely to have poor outcomes.

TABLE V: Logistic regression analysis for significant predictors of poor outcomes of AKI patients

Variable	OR	95% CI for OR	p-value
Modality of treatment			
Conservative only	RC		
Conservative then dialysis	2.944	2.023 – 4.286	0.001**
Oliguria			
Yes	7.385	1.720 – 31.704	0.004**
No	RC		
Thrombocytopaenia			
	0.998	0.995 – 0.99	0.046**
Aetiology of AKI			
Sepsis	3.611	1.175 – 11.096	0.022**
Others	RC		

RC – reference category; OR – odds' ratio; CI – confidence interval;

** statistically significant Predicted poor outcome

DISCUSSION

AKI remains an important cause of morbidity and mortality among hospitalized children, particularly in low-resource settings where delayed presentation and limited access to specialized care are common. In the present study, the prevalence of AKI was 21.1%, comparable to reports from Jos, Nigeria (21.3%) and India (19.28%).^{15,28} The similarity with the Indian study may reflect the use of the Kidney Disease: Improving Global Outcomes (KDIGO) criteria in both studies, allowing for more standardized case identification. By contrast, the higher prevalence rates reported from Ibadan and Enugu (33.8%–56%)^{29,30} may be explained by differences in study populations, inclusion of more critically ill children, and the use of alternative diagnostic criteria such as pRIFLE. Conversely, the lower prevalence reported in other Nigerian and West African studies^{12–14,16} may similarly reflect methodological differences and under-recognition of milder AKI.

More than two-thirds of children with AKI presented with Stage 3 disease, indicating advanced kidney injury at presentation. This finding is consistent with previous Nigerian studies^{12,14,29} and highlights the persistent challenge of delayed healthcare seeking and referral. The significant association between

delayed presentation and AKI observed in this study likely reflects a combination of factors, including initial treatment at peripheral health facilities, self-medication, use of traditional remedies, financial constraints, and limited access to specialist services.

Socioeconomic status, nephrotoxin exposure, and delayed presentation were independently associated with AKI. Although a greater proportion of affected children belonged to middle- and upper-socioeconomic groups, this likely reflects the demographic profile of the study population rather than a true epidemiological pattern. Exposure to non-steroidal anti-inflammatory drugs (NSAIDs) and herbal medications was common among children with AKI, consistent with previous reports identifying these agents as important contributors to kidney injury in resource-constrained settings.^{10,13,31–35} Their widespread accessibility and frequent use before presentation may increase the risk of nephrotoxicity while also contributing to delays in appropriate care.

Dehydration emerged as a strong predictor of AKI, in keeping with findings from studies in Nigeria, Tanzania, and Iran.^{36–38} This underscores the continuing importance of preventable prerenal causes of AKI in children. In many low-resource settings, inadequate implementation of early oral rehydration therapy and delayed healthcare utilization remain important contributors to dehydration-related kidney injury. Sepsis was also a significant predictor of AKI and poor outcome, consistent with reports from several low- and middle-income countries where infection remains a major driver of paediatric AKI.^{12,21,24,33,41,42} Similarly, the association between oliguria and poor outcome observed in this study aligns with previous reports and likely reflects more severe renal impairment and systemic illness among affected patients.^{39,40}

An unexpected finding in this study was the association between thrombocytopaenia and a reduced risk of poor outcome. This contrasts with previous studies that identified thrombocytopaenia as a marker of disease severity and adverse outcomes.^{12,43} The reason for this observation is unclear but may relate to differences in underlying diagnoses, sample size, or residual confounding. Further studies are needed to clarify this relationship. In contrast, leucocytosis, anaemia, fluid overload, and AKI severity were not significantly associated with outcome, unlike findings from some previous reports.^{9,12,22,44} Differences in patient characteristics, timing of presentation, and availability of supportive care may account for these variations.

The mortality rate of 21.1% observed in this study remains substantial, although it falls within the range reported from other developing countries.^{14,15,36,42} Mortality from paediatric AKI remains considerably lower in high-income settings, where access to early diagnosis, intensive care support, renal replacement therapy, and universal health coverage is generally better.^{18,22} Nevertheless, recent Nigerian studies suggest a gradual decline in mortality, possibly reflecting improvements in awareness, early detection, and paediatric nephrology services.^{14,29,30,45} Slightly more than half of the children achieved complete renal recovery comparable to reports from some studies in Asia,^{46,47} while over one-third had poor outcomes, including death or persistent renal dysfunction. Similar outcome patterns have been reported

in other resource-limited settings.^{15,23,33} These findings underscore the burden of AKI beyond the acute phase and highlight the importance of long-term follow-up for survivors, given the risk of progression to chronic kidney disease.

No significant associations were observed between outcome and age, sex, socioeconomic class, or duration of hospital stay. Although some studies have reported demographic differences in AKI outcomes,^{16,43,48} such associations were not evident in our cohort, suggesting that disease severity and clinical factors may be more important determinants of outcome than demographic characteristics.

Overall, our findings show that AKI remains a common and serious complication among hospitalized children, with dehydration, sepsis, nephrotoxin exposure, and delayed presentation playing important roles in its occurrence and outcomes. The high proportion of children presenting with advanced disease and the substantial mortality observed underscore the need for strategies focused on prevention, early recognition, and timely referral. Strengthening primary healthcare systems, promoting rational use of potentially nephrotoxic medications, improving community awareness, and expanding access to paediatric nephrology services may help reduce the burden of AKI and improve outcomes in similar settings.

Declarations

Conflict of interest –

None

Author Contribution

ETZ,OO - Developed the research concept, wrote the draft, designed the questionnaire, data collection
ETZ, OO and PO - Designed the study protocol, data analysis, and drafted the discussion
ETZ and PO - constructed the tables and charts in the result section
ETZ, PO, and PDI - Wrote and drafted the main manuscript text.
All authors reviewed the manuscript.

Data Availability

Requests for information regarding the data should be directed to the corresponding author (ETZ).

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Figures

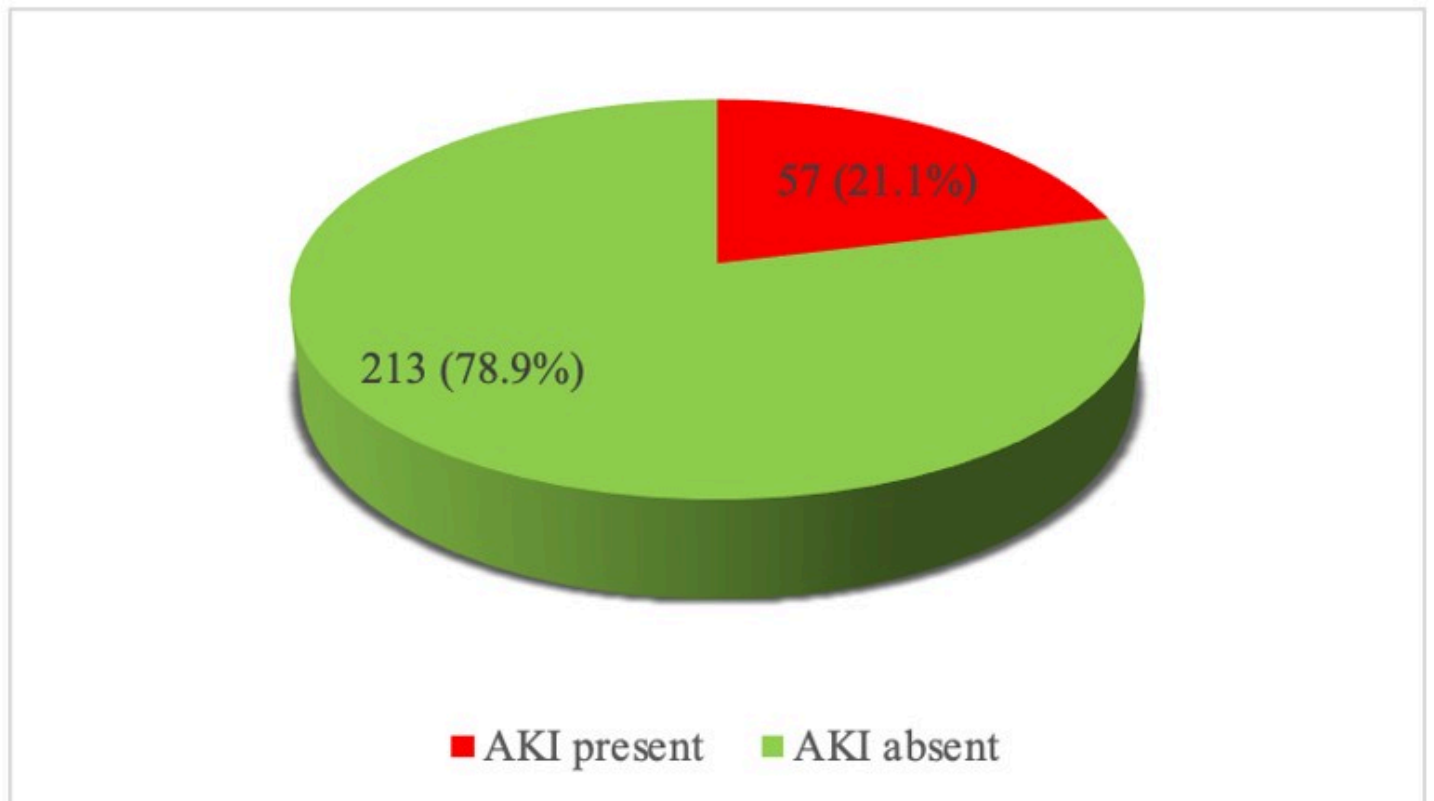


Figure 1

Prevalence of AKI among the study participants.

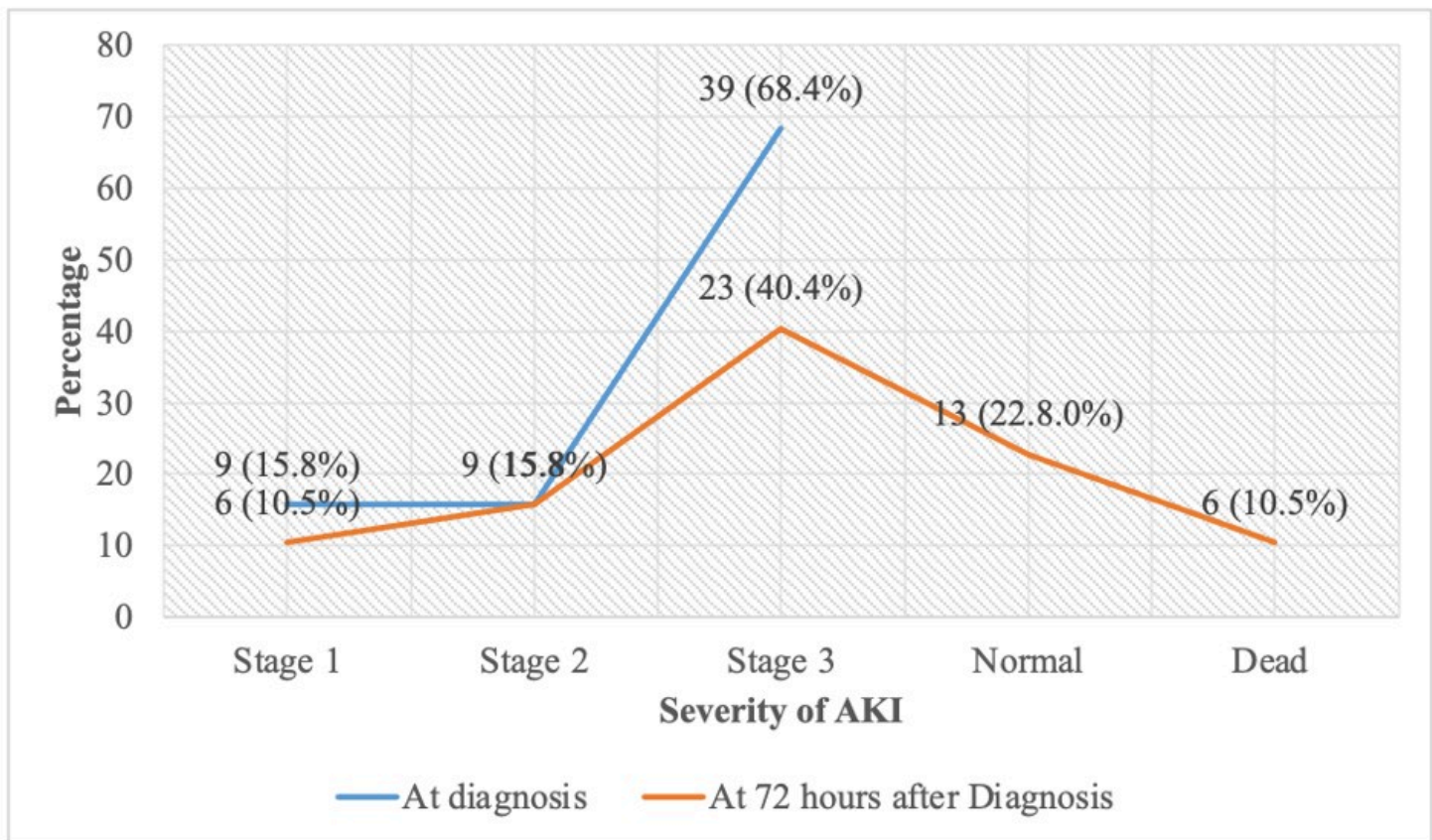


Figure 2

Severity stages of AKI at diagnosis and at 72 hours after diagnosis

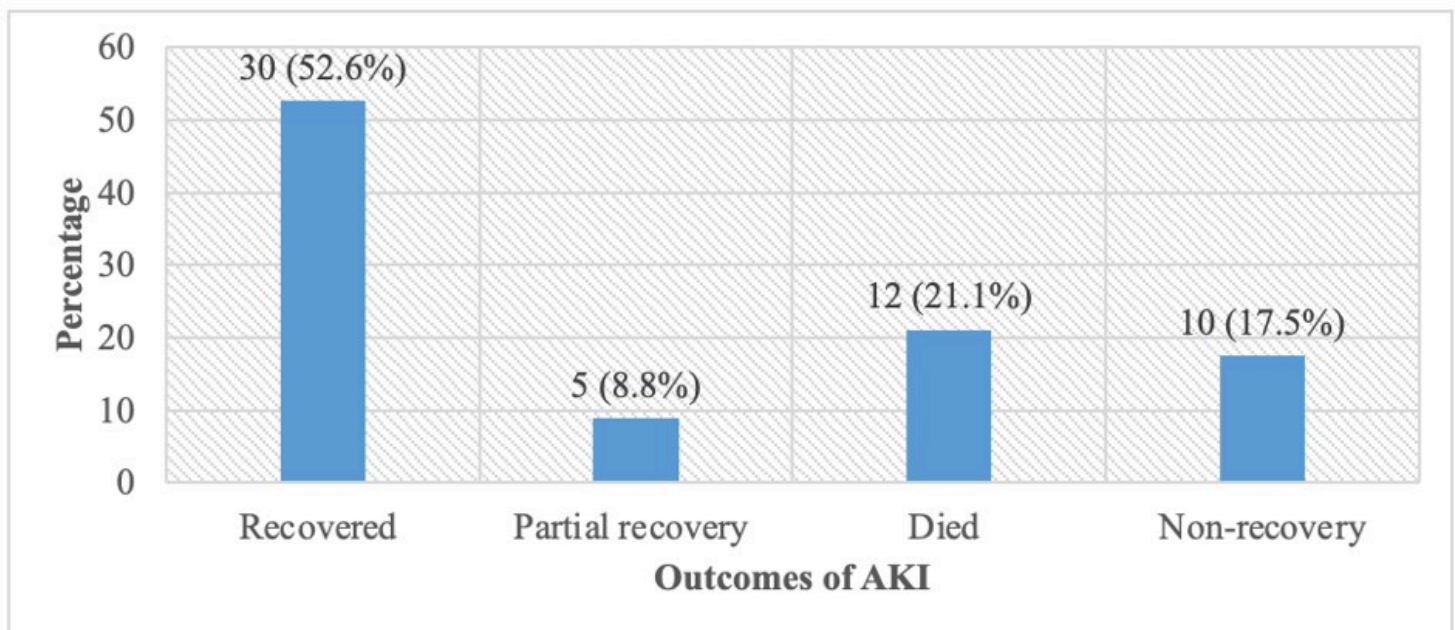


Figure 3

Outcome of AKI at two weeks from diagnosis.