

EDITORIAL ARTICLE

Predictors of three-month mortality among patients with kidney failure without access to dialysis in Tanzania

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ABSTRACT

Background: Chronic kidney disease (CKD) is a growing public health concern in Africa, including East Africa, where access to kidney replacement therapy (KRT) remains limited due to economic and infrastructural barriers. As a result, many patients with kidney failure receive unstructured non-dialysis medical care rather than formal conservative kidney management (CKM) programmes. This study aimed to evaluate short-term outcomes and identify predictors of three-month mortality among kidney failure patients on non-dialysis medical management at Muhimbili National Hospital (MNH), Tanzania. **Methods:** We conducted a 90-day prospective cohort study of adults (≥ 18 years) with CKD stage 5 who were eligible for haemodialysis but unable to afford it between October and December 2024. Survival was analysed using Kaplan–Meier methods, and mortality predictors were assessed using Cox regression. Ethical approval was obtained from the MUHAS Research and Publications Committee (Ref: MUHAS-REC-08-2024-2415). **Results:** A total of 172 kidney failure patients were enrolled, with a median age of 60 years and 90-day mortality rate was 24.3%. In multivariate analysis, predictors of mortality included no monthly income (aHR: 3.68, $P = 0.031$), difficulty in breathing at baseline (aHR: 2.59, $P = 0.020$), cancer history (aHR: 4.71, $P = 0.002$), and hyperkalaemia (aHR: 2.34, $P = 0.030$). Our study highlighted that lack of income, difficulty in breathing, malignancy, and hyperkalaemia predicted short-term mortality in kidney failure patients who could not access dialysis, reflecting both clinical and socioeconomic vulnerability. **Conclusion:** There is an urgent need for context-specific CKM guidance and policy interventions to support this underserved population in resource-limited settings.

Keywords: Tanzania, chronic kidney diseases, conservative kidney management, kidney failure, haemodialysis.

INTRODUCTION

Chronic kidney disease (CKD) is an increasing public health challenge in Africa, including Tanzania, where access to kidney replacement therapy (KRT) remains limited [1]. In high-income settings, patients with kidney failure are typically offered dialysis or transplantation, which remain the standard and preferred treatments when clinically appropriate, and conservative kidney management (CKM) is implemented as a structured, multidisciplinary approach for those who choose not to pursue dialysis [2,3]. In contrast, in many resource-

limited settings, access to KRT is constrained by financial and infrastructural barriers [4,5]. As a result, patients who would otherwise be candidates for dialysis often receive non-dialysis medical care that focuses primarily on symptom relief and management of complications, but without the formal structure of established CKM programmes [6].

Across Africa, access to kidney replacement therapy remains far below population need [7]. Kidney replacement therapy (KRT), including dialysis and transplantation

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is the standard and most effective treatment for patients with kidney failure when available [8]. Although dialysis services have expanded in some urban centers, availability is uneven and dependent on financial capacity and geographic proximity to tertiary facilities [7,9]. In Tanzania, uninsured patients must pay for dialysis entirely out of pocket, while those with insurance rely on variable coverage schemes [10]. Similar challenges have been documented across sub-Saharan Africa, where economic constraints and limited infrastructure restrict access to dialysis and transplant services, leaving many patients with kidney failure managed without definitive therapy [7,11].

The outcomes of patients with advanced CKD managed without dialysis vary widely and are influenced by the quality and scope of care available [6]. In high-income countries, CKM is well-organised, involving multidisciplinary teams, and explored among selected patients [4,12]. However, much of the available data on outcomes originates from these settings and largely focuses on elderly patients with multiple comorbidities, limiting its relevance to the context of SSA [6,12]. In SSA, socioeconomic constraints play a dominant role in treatment decisions, and limited access to KRT often leaves even younger patients with kidney failure receiving only basic, unstructured medical care [4,5,13]. This form of non-dialysis management, driven by necessity rather than planned care pathways, remains poorly characterised despite being widespread in the region [14].

To address this critical gap, context-specific data are needed to reflect the characteristics and outcomes of patients with advanced kidney disease who are managed without access to dialysis in low-resource settings. Understanding the characteristics and their outcomes is essential for designing effective care strategies and allocating health-care resources appropriately.

This study therefore aims to evaluate short-term outcomes and identify predictors of three-month mortality among kidney failure patients managed without dialysis at Muhimbili National Hospital (MNH) in Tanzania. The findings will provide foundational data to inform clinical practice, guide treatment decisions, and offer critical insights into the burden of kidney failure among patients who are unable to access KRT. Additionally, the study may serve as a reference for similar settings across sub-Saharan Africa, where limited access to dialysis and kidney transplantation necessitates reliance on conservative management strategies.

METHODS

A hospital-based prospective cohort study was conducted at MNH, the largest tertiary referral hospital in Tanzania, with a capacity of 1,500 beds. The study was conducted

over six months, comprising three months of patient recruitment and three months of follow-up in the renal unit, between 1 October 2024 and 30 March 2025.

We consecutively enrolled patients aged 18 years and above who were diagnosed with Stage 5 chronic kidney disease (CKD), defined as an estimated glomerular filtration rate (eGFR) of ≤ 15 mL/min/1.73m² using the CKD-EPI 2021 formula which does not include a race-based coefficient, and who were not receiving any form of kidney replacement therapy (KRT), including haemodialysis, peritoneal dialysis, or kidney transplantation. Since there is no standardised conservative kidney management (CKM) programme in our setting, non-dialysis medical management was defined as any form of medical care provided to patients with CKD stage 5 who did not receive dialysis, including symptom relief, pharmacologic treatment, and routine follow-up as deemed appropriate by the attending clinicians. Some patients were clinically eligible for dialysis but unable to initiate treatment due to financial or systemic barriers. All participants receiving non-dialysis medical management focused on symptom management and treatment of comorbid conditions. Patients who had previously received dialysis but later discontinued treatment were excluded. Eligible patients were identified during routine outpatient visits or inpatient admissions. Written informed consent was obtained following a detailed explanation of the study's objectives, procedures, risks, and benefits. Following recruitment, participants continued receiving routine outpatient care, which included scheduled monthly visits to for medication refills and symptom evaluation. To track survival outcomes, patients or their caregivers were contacted by phone every month throughout the 90-day follow-up period for those managed at home, while hospital records were reviewed for patients who remained admitted.

Data were collected through structured, interviewer-administered questionnaires and review of the hospital's electronic medical record system. Variables collected included demographic characteristics (age, sex, education level, income status, marital status, and employment), comorbid conditions, and presenting symptoms. Laboratory parameters at the time of enrolment were collected and included serum creatinine, eGFR, potassium, sodium, calcium, phosphate, haemoglobin, blood urea nitrogen (BUN) and serum albumin. The primary outcome was survival at 90 days. Participants were categorised as alive without dialysis, deceased, or initiated on dialysis during follow-up. For the purpose of survival analysis, patients who transitioned to dialysis were censored at the time of initiation, allowing for an unbiased estimation of mortality under non-dialysis management alone.

Data analysis was performed using Stata software. Descriptive statistics were used to summarise baseline demographic, clinical, and laboratory characteristics. Continuous variables were assessed for normality and reported as means with standard deviations (SD) or medians with interquartile ranges (IQR), as appropriate. Categorical variables were presented as frequencies and percentages. Kaplan–Meier survival analysis was used to estimate survival probabilities over the 90-day follow-up period. Patients who were initiated dialysis or were lost to follow-up were right-censored at the time of the event. Univariate and multivariate Cox proportional hazards regression models were used to identify predictors of mortality. Variables with a P value < 0.2 in univariate analysis were included in the multivariate model. Adjusted hazard ratios (aHRs) with 95% confidence intervals (CIs) were reported, and statistical significance was defined as a P value < 0.05.

All information related to study participants will remain confidential and will be identifiable only by codes known to the researcher. To ensure participant privacy, all personal identifiers will be replaced with unique codes. Only the primary researcher will have access to the code key linking participants to their data. This process will safeguard participant confidentiality throughout the study.

In the absence of a formal Conservative Kidney Management (CKM) programme at our institution, patients not receiving dialysis continued routine medical care within the renal clinic or general medical services. This typically included symptom-directed pharmacologic therapy (e.g., diuretics, antihypertensives, anaemia management), dietary counselling, and periodic laboratory monitoring where affordable. Follow-up was generally monthly in the out-patient renal clinic for medication review and symptom assessment. Patients living far from Dar es Salaam were sometimes referred to regional hospitals or local clinics for ongoing care, although structured multidisciplinary CKM services and advance care planning were not routinely available.

RESULTS

A total of 172 participants were included in the study. The majority were >50 years (68.6%), with a median age of 60 years (IQR: 46–70), female (57.0%), with primary or secondary education level (64.6%) with no employment (32.6%) and no monthly income (47.1%). Out-of-pocket payment, defined as direct cash payment by uninsured patients at the point of care, was the most common mode of covering hospital costs (61.0%). Additionally, 19.2% and 7.0% of participants reported current of previous alcohol use or cigarette smoking respectively (Table 1).

Table 1. Socio-demographic characteristics of the study participants (N=172).

Variable	Frequency (n)	Percent (%)
Age group (years)		
< 50	54	31.4
≥ 50	118	68.6
Median age in years (IQR)	60 (46, 70)	
Sex		
Male	74	43.0
Female	98	57.0
Residence (Region)		
Dar es Salaam	128	74.4
Outside Dar es Salaam	44	25.6
Marital status		
Married	125	72.7
Not married	19	11.0
Divorced	5	2.9
Widow	23	13.4
Level of education		
No formal education	22	12.8
Primary	55	32.0
Secondary	56	32.6
Tertiary	39	22.7
Employment status		
Employed	39	22.7
Self-employed	55	32.0
Not employed	56	32.6
Student	2	1.2
Retired	20	11.6
Average monthly income (USD)		
No income	81	47.1
Some income (< 200)	43	25.0
200 – 500	45	26.2
>500	3	1.7
Mode of paying hospital cost		
Insurance coverage	67	39.0
Cash payment	105	61.0
History of alcohol consumption (Current/previous)		
Yes	33	19.2
No	139	80.9
History of smoking (Current/previous)		
Yes	12	7.0
No	160	93.0

Hypertension was the most common comorbid condition, affecting 95.9% of participants, with almost all participants reporting reduced urine output during recruitment (95.9%) followed by lower limb swelling (89.0%). Most participants (59.3%) had an estimated glomerular filtration rate (eGFR) between 6–10 mL/min/1.73m², with hyperkalaemia being present in 31.3%, hyponatraemia in 53.4%, hypocalcaemia in 61.6%, and hyperphosphataemia in 72.6% of participants. Anaemia was highly prevalent, with 88.4% having haemoglobin levels below 11 g/dL. Among participants with available albumin results, 73.1% had low serum albumin levels (Table 2).

Table 2. Clinical and laboratory characteristics of the study participants (N=172).

Variable	Frequency (n)	Percent (%)
Comorbidities		
Hypertension	165	95.9
HIV	15	8.7
Diabetes mellitus	8	4.7
Hepatitis B infection	4	2.3
Others	4	2.3
Clinical symptoms at recruitment		
Reduced urine output	164	95.5
Lower limb swelling	153	89.0
Difficulty in breathing	83	48.8
Vomiting	30	18.0
Others	18	10.4
EGFR category (mls/min)		
≤ 5	63	36.6
6 – 10	102	59.3
11 – 14	7	4.1
Creatinine category (mmol/L)		
≤ 500	52	30.2
501 – 1000	81	47.1
1001 – 1500	24	14.0
1501 – 2000	15	8.7
Potassium category (mmol/L)		
Normal (≤ 5.4)	118	68.6
Mild to moderate hyperkalaemia (5.5–6.4)	46	26.7
Moderate (≥6.5)	8	4.6
Sodium category (mmol/L)		
Normal (≥ 135)	80	46.5
Mild hyponatraemia (130–134)	52	30.2
Moderate hyponatraemia (125–129)	26	15.1
Severe hyponatraemia (≤ 124)	14	8.1
Blood Urea Nitrogen (BUN) category (mmol/L)		
7.6 – 12.5	11	6.4
12.6 – 17.5	27	15.7
17.6 – 22.5	45	26.2
≥ 22.6	89	51.7
Calcium category (mmol/L)		
Normal (≥ 2.2)	66	38.4
Mild hypocalcaemia (1.90–2.19)	60	34.9
Moderate to severe hypocalcaemia (≤ 1.89)	46	26.7
Haemoglobin category (g/dl)		
Normal haemoglobin (≥ 11.0)	20	11.6
Mild to moderate anaemia (8.0–10.9)	87	50.6
Severe anaemia (≤ 7.9)	65	37.8
PO4 category (mmol/L)		
Low (≤ 1.5)	47	27.3
Normal (1.6 – 2.5)	95	55.2
Mild hyperphosphataemia (2.6–3.5)	19	11.0
Marked hyperphosphataemia ≥ 3.6	11	6.4
Albumin category (n = 41) (g/L)		
Normal (≥ 40)	11	26.8
Mild to moderate hypoalbuminemia (31 – 39)	16	39.0
Severe hypoalbuminemia (≤ 30)	14	34.1

PO4-Phosphate.

Table 3. Survival rate among patients with chronic kidney disease without access to dialysis therapy.

Time of follow up (days)	Number at risk	Number died	Survival	95% CI
15	156	13	0.923	0.883–0.964
30	142	7	0.880	0.832–0.931
60	111	12	0.801	0.741–0.866
90	91	9	0.732	0.664–0.807

Out of 169 participants with complete follow-up data with 3 lost to follow up, there were 41 deaths, corresponding to an overall mortality rate of 24.3% and an incidence rate of 3.57 deaths per 1,000 person-days (95% CI: 2.63–4.85) (Table 3).

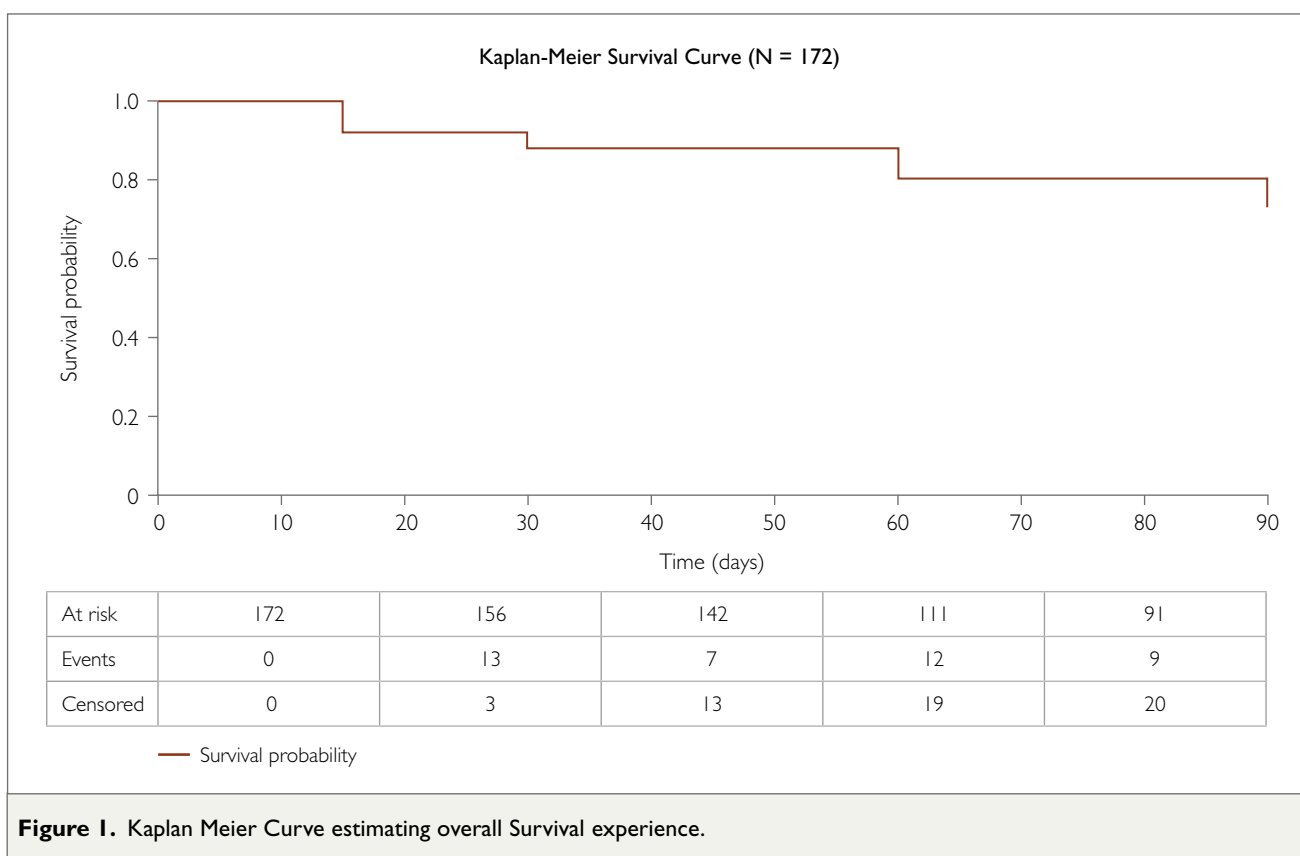
The Kaplan–Meier survival analysis showed a steady decline in overall survival probability over the 90-day follow-up period. By day 90, the estimated survival probability was approximately 73.2%, with a total of 41 events (deaths) observed among the 169 participants (Figure 1).

In the adjusted multivariate analysis, the following factors were significantly associated with increased mortality among patients with kidney failure who could not access haemodialysis therapy, having no monthly income (aHR: 3.68, 95% CI: 1.89–25.50, $P = 0.031$), presence of difficulty in breathing at recruitment (aHR: 2.59, 95% CI: 1.16–5.77, $P = 0.020$), history of cancer (aHR: 4.71, 95% CI: 1.78–12.42, $P = 0.002$) and elevated potassium levels (≥ 5.5) (aHR: 2.34, 95% CI: 1.09–5.06, $P = 0.030$). Other variables did not show statistically significant associations with mortality after adjustment (Table 4).

DISCUSSION

Our study provides important insights into the short-term outcomes of patients with kidney failure managed without dialysis in a resource-limited setting in Tanzania. The majority of participants had no monthly income and paid out of pocket for medical care. Hypertension was the most common comorbidity, affecting nine out of ten patients, and over half had an estimated glomerular filtration rate (eGFR) below 10 mL/min/1.73m² at the time of recruitment. Approximately one-quarter of patients died within three months. Independent predictors of three-month mortality included lack of monthly income, presence of difficulty in breathing at presentation, history of cancer, and elevated potassium.

Almost one-third of our study participants were aged below 50 years, reflecting a pattern commonly reported



across sub-Saharan Africa (SSA), where a substantial proportion of patients with advanced CKD are relatively young [2]. This contrasts with trends in high-income countries (HICs), where conservative kidney management (CKM) is predominantly offered to older adults with multiple comorbidities, limited functional status, or reduced life expectancy [6]. In such settings, CKM is often chosen to minimise treatment burden while optimising quality of life and symptom control [15]. However, the application of non-dialysis care among younger adults in our cohort raises critical concerns. For many of these individuals, definitive interventions such as kidney transplantation could offer the opportunity to regain functional capacity, return to the workforce, and lead productive lives [16]. In Tanzania, however, the reliance on non-dialysis care in this younger population likely reflects systemic barriers to dialysis and transplantation, rather than informed clinical decision-making or patient preference. The care provided is often limited to basic medical management of symptoms and comorbidities, without the structured, multidisciplinary support typical of formal CKM programmes.

CKM should ideally be a supportive, structured care approach for people with advanced CKD, chosen through shared decision-making that aligns with the patient's goals, values, and best interests [17]. However, in our study, many participants had no income, paid out of pocket, or

were enrolled in insurance schemes that did not cover haemodialysis, suggesting that the decision not to initiate dialysis was largely driven by financial constraints rather than informed choice. This pattern is consistent with reports from other African settings, where limited dialysis access and economic barriers result in non-dialysis care by necessity, rather than deliberate CKM pathways [6, 18]. The association between no monthly income and mortality likely reflects broader socioeconomic vulnerability beyond dialysis access alone. Limited ability to afford essential medications, laboratory monitoring, and transportation for follow-up visits may contribute to delayed presentation and suboptimal management of complications. Income status may therefore serve as a proxy marker for structural health system barriers. These realities highlight the urgent need to strengthen kidney care models in resource-limited settings to ensure patients receive appropriate support when dialysis is not accessible [17].

Globally, up to three-quarters of people with kidney failure may die prematurely due to limited access to KRT [18]. In SSA, survival data for patients managed without dialysis are limited, with most available evidence derived from HICs where CKM is typically reserved for older adults with multiple comorbidities [19]. In our study, short-term survival outcomes were modest despite the younger age of participants, likely due to advanced disease at presentation

Table 4. Univariate and multivariate analysis of the factors associated with mortality among kidney failure patients who could not access haemodialysis therapy.

Variable	Univariate analysis			Multivariate analysis		
	cHR	95% CI	P value	aHR	95% CI	P value
Age (years)	0.99	0.98 – 1.02	0.773			
Sex						
Male	0.77	0.41 – 1.44	0.411			
Female	Ref					
Education						
No formal	5.30	1.41 – 19.97	0.014	0.84	0.17 – 4.28	0.834
Primary	4.85	1.42 – 16.55	0.012	1.66	0.42 – 6.59	0.473
Secondary	3.16	0.90 – 11.10	0.072	1.62	0.39 – 6.64	0.504
University/College	Ref					
Monthly income (Tsh/=)						
No income (USD)	3.20	1.22 – 8.40	0.018	3.68	1.13 – 12.03	0.031
< 200	3.01	1.06 – 8.54	0.039	1.76	0.55 – 5.70	0.344
≥ 200	Ref					
Payment						
Cash	3.83	1.70 – 8.65	0.001	1.90	0.72 – 5.04	0.197
Insurance	Ref					
Alcohol						
Yes	1.02	0.47 – 2.21	0.960			
No	Ref					
Smoking						
Yes	2.42	1.02 – 5.77	0.045	2.14	0.79 – 5.80	0.134
No	Ref					
Vomiting						
Yes	2.26	1.15 – 4.44	0.018	1.19	0.54 – 2.61	0.663
No	Ref					
Difficulty breathing						
Yes	3.64	1.82 – 7.28	< 0.001	2.59	1.16–5.77	0.020
No	Ref					
HIV						
Yes	2.67	1.18 – 6.03	0.018	0.52	0.16 – 1.70	0.281
No	Ref					
Cancer						
Yes	4.97	2.60 – 9.53	< 0.001	4.71	1.78–12.42	0.002
No	Ref					
eGFR						
≤ 5	5.57	2.87 – 10.82	< 0.001	1.34	0.53 – 3.37	0.533
>5	Ref					
Creatinine (µmol/L)						
>500	5.42	1.93 – 15.24	0.001	1.40	0.39 – 5.03	0.609
≤ 500	Ref					
Potassium (mmol/L)						
Elevated (> 5.4)	4.21	2.26 – 7.86	< 0.001	2.34	1.09–5.06	0.030
Normal (≤ 5.4)	Ref					
Sodium (mmol/L)						
Abnormal (< 135)	3.21	1.57 – 6.55	0.001	1.46	0.66 – 3.25	0.349
Normal (≥ 135)	Ref					
BUN (mmol/l)						
Abnormal (>12.5)	3.50	0.48 – 25.44	0.217			
Normal (≤ 12.5)	Ref					
Calcium (mmol/L)						
Hypo (< 2.2)	1.75	0.89 – 3.43	0.103	0.94	0.40 – 2.24	0.891
Normal (≥ 2.2)	Ref					
Haemoglobin (g/dL)						
< 11.0	3.08	0.74 – 12.77	0.121	1.28	0.27 – 6.17	0.755
A≥ 11.0	Ref					
PO4 (mmol/L)						
>1.5	3.31	1.30 – 8.43	0.012	2.88	0.94 – 8.77	0.063
≤ 1.5	Ref					

Abbreviations: cHR: crude Hazard Ratio, aHR: adjusted Hazard Ratio, Ref: Reference, PO4-Phosphate.

with reduced eGFR, and complications such as hyperkalaemia and dyspnoea, reflecting fluid overload. While patients with hyperkalaemia receive dietary counselling, oral potassium binders were not routinely used due to cost barriers, potentially contributing to poorer outcomes. The history of cancer was also associated with increased mortality, potentially due to limited access to oncology care in patients with CKD. Additionally, lack of income was linked to mortality risk, due to an inability to afford basic medications and appropriate management of CKD-related complications. This socioeconomic vulnerability is further underscored by the finding that ~70% of our cohort had no or minimal income far exceeding the national unemployment rate (~8–9%) suggesting that many patients are either too ill to work or are engaged in informal labour not captured by official statistics. In contrast to studies from high-income countries, where predictors of mortality among kidney failure patients on dialysis often include older age, cardiovascular disease, and diabetes, our findings highlight non-traditional predictors such as lack of income, difficulty in breathing, and hyperkalaemia factors likely reflecting late presentation and inability to access dialysis [20].

The lack of access to dialysis for younger kidney failure patients in our setting raises profound ethical concerns, particularly in the context of unaffordable healthcare expenses and systemic rationing of care. In Tanzania, as in much of SSA, patients are often required to pay for dialysis entirely out of pocket, creating a significant financial barrier for many families [11]. This disproportionately affects younger patients who are otherwise potentially productive and could benefit from treatment [1]. Such inequities highlight the urgent need for policy reforms to ensure equitable access to life-saving kidney replacement therapies.

Our study highlights lack of income, difficulty in breathing at presentation, history of malignancy, and hyperkalaemia as independent predictors of short-term mortality among kidney failure patients receiving non-dialysis care. These factors reflect the compounded effects of socioeconomic vulnerability, high symptom burden, advanced disease severity, and structural gaps in care that urgently need to be addressed. Tackling this challenge requires strong political commitment and systemic solutions. Government-led interventions such as expanding public funding for dialysis, establishing subsidised conservative kidney management (CKM) programmes, and strengthening infrastructure for kidney transplantation are essential. Importantly, this is not a challenge unique to Tanzania but a shared burden across sub-Saharan Africa and other low-income regions, calling for regionally coordinated, equity-focused health reforms.

LIMITATION

Although our study was conducted at a single center, it was carried out at a national referral public hospital that serves a wide and diverse population, making the findings broadly reflective of real-world non-dialysis care in low-resource settings. It provides valuable insights into short-term outcomes and mortality predictors in a context where such data are scarce. However, a key limitation is the lack of standardised documentation regarding the specific care and interventions patients received, making it difficult to assess the consistency or completeness of symptom management. Additionally, serum albumin, a known predictor of mortality, was only measured in a small subset of patients, limiting its inclusion in the analysis. Due to resource constraints, other potentially relevant clinical markers, such as inflammatory parameters, could not be assessed. We also acknowledge the possibility of selection bias, as patients who declined dialysis due to cost or other factors may differ in unmeasured ways (e.g., functional, or cognitive status) from those who accepted or were ineligible for dialysis. Moreover, as a hospital-based study, our cohort may not capture patients from rural areas or those who die at home without accessing tertiary care. Some adjusted hazard ratios, particularly for variables such as income had wide confidence intervals, suggesting statistical imprecision. As such, we have avoided overinterpreting specific HR magnitudes and focused instead on the direction and clinical plausibility of observed associations. The aetiology of kidney failure was not systematically determined due to limited diagnostic capacity (including lack of routine kidney biopsy), with hypertension used as a proxy given its high prevalence, and baseline cardiovascular disease may have been underreported due to incomplete documentation. Despite these limitations, the study offers important evidence to guide non-dialysis kidney care strategies in resource-constrained environments.

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Ethical statement

Ethical clearance was obtained from the Muhimbili University of Health and Allied Sciences (MUHAS) Research and Publication Committee with MUHAS-REC-08-2024-2415. Permission to conduct the study was granted by Muhimbili National Hospital (MNH). Written informed consent (English and Swahili) was obtained from all participants before enrolment. Data were de-identified to ensure confidentiality throughout the study.

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Conflict of interest

The authors have no conflicts of interest to declare.

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