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ORIGINAL ARTICLE

Dialysis availability for paediatric acute kidney injury in Nigeria

DC Briggs[1], AO Asinobi[2], PA Ekpebe[3], OE Oshomah-Bello[4], KO Oluwatuyi[5], Aliu Rasaki[6], PK Ibitoye[7], AD Ademola[2], RM Akuse[8]

[1]Department of Paediatrics, Faculty of Clinical Sciences, College of Medical Sciences, Rivers State University/ Rivers State University Teaching Hospital, Rivers state, Nigeria; [2]Department of Paediatrics, Faculty of Clinical Sciences, College of Medicine, University of Ibadan/ University College Hospital, Ibadan, Oyo state, Nigeria; [3]Delta State University Teaching Hospital, Oghara/Delta state University, Abraka, Nigeria; [4]Lagos State University Teaching Hospital, Lagos state, Nigeria; [5]Federal Medical Centre, Owo, Ondo state, Nigeria; [6]Federal Teaching Hospital, Gombe/ Gombe State University, Gombe state, Nigeria; [7]Usmanu Danfodiyo University Teaching Hospital/Faculty of Clinical Sciences, College of Health Sciences, Usmanu Danfodiyo University, Sokoto, Sokoto state, Nigeria; [8]Department of Paediatrics, Ahmadu Bello University Teaching Hospital, Zaria/ College of Medical Sciences, Ahmadu Bello University, Kaduna state, Nigeria.

ABSTRACT

Background: Dialysis provides prompt treatment for severe acute kidney injury (AKI) and limits morbidity and mortality. This study compared the current dialysis services for paediatric AKI in Nigeria with earlier studies.
Methods: Twenty-four of 34 conveniently sampled paediatric nephrology units across Nigeria responded to an online questionnaire.
Results: Responding centres (16, 67%) from the six geopolitical zones were urban tertiary federal/state-owned and mainly in the south. Nineteen centres (79%) offered both peritoneal dialysis (PD) and haemodialysis (HD), 4 (17%) provided HD services only, whereas 1 centre offered PD only. Ten (42%) centres also provided dialysis to neonates. Concerning PD consumables, 75% used improvised PD catheters, with the most common (50%) being nasogastric tubes. In 60% of centres, PD catheter insertion was performed by a paediatrician/paediatric nephrologist; 90% used improvised PD fluids, and all performed PD manually. Concerning HD consumables, 10 (44%) facilities 'sometimes' have paediatric dialyzers/bloodlines but mostly these are unavailable for children under five. Challenges with dialysis access include financial constraints, lack of paediatric dialyzers/bloodlines and PD fluids (100%, 75% and 75%, respectively). Compared with earlier studies, current facilities providing dual PD/HD services have significantly ($P = 0.021$) increased but challenges are unchanged.
Conclusion: In Nigeria, dialysis services for paediatric AKI have increased with more facilities providing both HD and PD. Whereas HD is mainly available for older children, acute PD remains predominantly improvised. Continuous kidney replacement therapy is unavailable. There is a need for concerted collaboration between the government and healthcare facilities to ensure consistent availability of age-appropriate dialysis machines/consumables and subsidized paediatric dialysis services.

Keywords: acute kidney injury; haemodialysis; Nigeria; paediatric; peritoneal dialysis.

INTRODUCTION

The global burden of acute kidney injury (AKI) is increasing, leading to high morbidity and mortality [1]. Of particular concern is the increased mortality and long-term sequelae associated with acute kidney injury in children [2]. This problem is more severe in low- and lower-middle-income countries (LLMICs) because of late hospital presentation, delayed recognition and treatment, and lack of access to dialysis [3]. A systematic review of acute kidney injury outcomes in sub-Saharan Africa reported a 34% mortality rate in children, which

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Correspondence: Datonye Briggs, datonye.briggs1@ust.edu.ng.

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rose to 73% in children who needed dialysis but did not receive it [4].

Globally, there is a growing drive for universal dialysis services for severe acute kidney injury as highlighted by the Sustainable Development Goals (SDGs) transformation framework for kidney health [5]. Prompt dialysis for children with severe AKI can significantly reduce morbidity and mortality [4]. High-income countries have successfully reduced the negative effects of acute kidney injury by improving access to dialysis services [6]. Unfortunately, this essential treatment is not readily available in LLMICs including Nigeria, where the incidence of disease is relatively high [7]. This is perturbing, considering that 20–66% of children with severe acute kidney injury in sub-Saharan Africa require dialysis but most are managed conservatively owing to the unavailability of dialysis equipment or financial constraints [6].

In 2005, Akuse and Sambo-Donga [8] surveyed the availability of paediatric dialysis services (PDS) in Nigeria for the first time. These authors reported that the number and spread of services were grossly inadequate with 17 (65%) of the 26 responding centres having at least one form of PDS. Similarly, Esezobor et al. [7] in 2012 found that only 16 (47%) of 34 responding centres provided at least one form of paediatric dialysis service. These studies attributed the limited availability of PDS to the shortage of required equipment and commodities, inadequate skilled manpower to perform dialysis, poor funding needed to support dialysis therapy, and the high cost of the service.

It is over a decade since the study by Esezobor et al. [7] and progress has been made in the training and practice of paediatric nephrology in Nigeria. Notable advancements include the Saving Young Lives (SYL) workshop, which equipped paediatricians with acute peritoneal dialysis catheter insertion skills [9]. Nigerians have now benefited from paediatric nephrology fellowships offered by the International Society for Peritoneal Dialysis (ISPD), the International Paediatric Nephrology Association (IPNA) and the International Society of Nephrology (ISN) [10,11]. Virtual and hybrid continuous medical education (CME) lectures and workshops have also been organised in-country and internationally, in collaboration with IPNA and ISN Sister Renal Centres [12]. Additionally, there have been practical demonstration sessions devoted to acute kidney injury and peritoneal dialysis at the scientific meetings of the Paediatric Nephrology Association of Nigeria (PNAN) and the Paediatric Association of Nigeria (PAN). There is also a growing number of paediatricians and paediatric trainees with an interest in paediatric nephrology. Thus, a need has arisen to verify whether similar progress has been made in the availability of acute PDS in the country.

The global initiative launched by the ISN, aimed at reducing preventable deaths from AKI to zero levels by the year 2025 ('0 by 25'), especially in LLMICs [13]. The initiative requests globally applicable strategies that provide room for timely diagnosis and treatment for acute kidney injury patients who have potentially reversible diseases [13]. One of the key goals of the '0 by 25' initiative is to work with the countries most affected to develop a sustainable infrastructure to enable 'need-driven' approaches to education, training and care delivery [13]. The study reported here aimed to assess the current state of acute PDS available for severe AKI in Nigeria compared with earlier studies. The authors consider that the findings from this study will provide evidence of some measure of progress and guide strategies to achieve the overarching goal of improving availability and providing sustainable paediatric dialysis in Nigeria.

METHODS

This cross-sectional survey was conducted over 10 months (9 September 2022 to 9 July 2023). The study targeted paediatricians/paediatric nephrologists practising in paediatric nephrology units in publicly funded federal and state government or private hospitals in the six geopolitical zones of Nigeria that provide dialysis services for children with severe AKI. Nigeria has 36 states and the Federal Capital Territory (FCT) and is subdivided into six geopolitical zones as follows: South East (Abia, Anambra, Ebonyi, Enugu, Imo); South South (Akwa Ibom, Bayelsa, Cross River, Rivers, Delta, Edo); South West (Ekiti, Lagos, Ogun, Ondo, Osun, Oyo); North East (Adamawa, Bauchi, Borno, Gombe, Taraba, Yobe); North Central (Benue, Kogi, Kwara, Nasarawa, Niger, Plateau and Federal Capital Territory); and North West (Jigawa, Kaduna, Kano, Katsina, Kebbi, Sokoto, Zamfara).

A convenience sampling technique [14] was employed and paediatricians/paediatric nephrologists were invited via the social media platforms of the Nephrology Association of Nigeria, the Paediatric Nephrology Association of Nigeria (PNAN) and the Paediatric Association of Nigeria, to complete a questionnaire. Thirty-four identified public and private paediatric nephrology units – recorded through mapping/snowballing – were targeted considering the peculiarity of the survey and the need to know the current dialysis practices among the health centres managing children with severe acute kidney injury across the country. Reminders were sent twice monthly to all social media platforms and to specific individuals.

The questionnaire survey tool was generated via a Google Doc Form. A survey link was created and sent to the

targeted social media groups via WhatsApp and Telegram apps for instant messaging. The questionnaire (https://forms.gle/KuCVu4q8BGS9dPZo6) featured several parts: the first section comprised the demographics of the respondents; the second part explored the availability of paediatric dialysis services for AKI in the facilities – including questions such as the age category of children for whom acute dialysis is made available, the common causes of AKI in the emergency rooms, type of dialysis service provided and the outcome of paediatric AKI in the facilities. The third part of the questionnaire assessed the cost of serum and urine electrolytes. The fourth part examined peritoneal dialysis services including the availability of peritoneal dialysis, the types of PD catheters used, personnel who insert the catheter, and the cost implications. The fifth section then explored the availability of haemodialysis services for paediatric AKI and included questions such as having dedicated haemodialysis machines for children, availability of paediatric dialyzers and bloodlines, the average number of sessions needed and the cost implications of offering haemodialysis services. The sixth part assessed the challenges encountered with providing acute kidney replacement therapy on a 5-point Likert scale.

Approval to conduct the survey was granted by the heads of the NAN and PNAN, to enable a proper understanding of the availability of PDS for the management of children with AKI in Nigeria. All respondents were required to provide formal consent before starting the survey.

For data analysis, the completed questionnaires were automatically imported into an Excel spreadsheet and analysed via SPSS version 25 (IBM Corp., Chicago, IL., USA). All data generated or analysed during this study are included in this article. The results are presented as simple frequencies, and charts and relevant tables were developed. Findings from this study were compared with previously published surveys.

RESULTS

Characteristics of participating health facilities in Nigeria

Twenty-four (70%) of the known 34 healthcare centres across Nigeria offering paediatric nephrology services responded to the survey questionnaire. All respondent facilities were urban-sited, tertiary federal or state government-owned and mostly (88%) teaching hospitals. There were more facilities – 7 (29%) – in the South South region of the country, whereas the part with the least number of representatives (only 2) was the North East (see Table 1). Figure 1 shows the distribution of the respondents' sites providing acute dialysis services.

Table 1. Distribution of the participating facilities across Nigeria.

Geopolitical zone	Frequency	Percent
South South	7	29
South West	6	25
South East	3	13
North West	3	13
North Central	3	13
North East	2	8

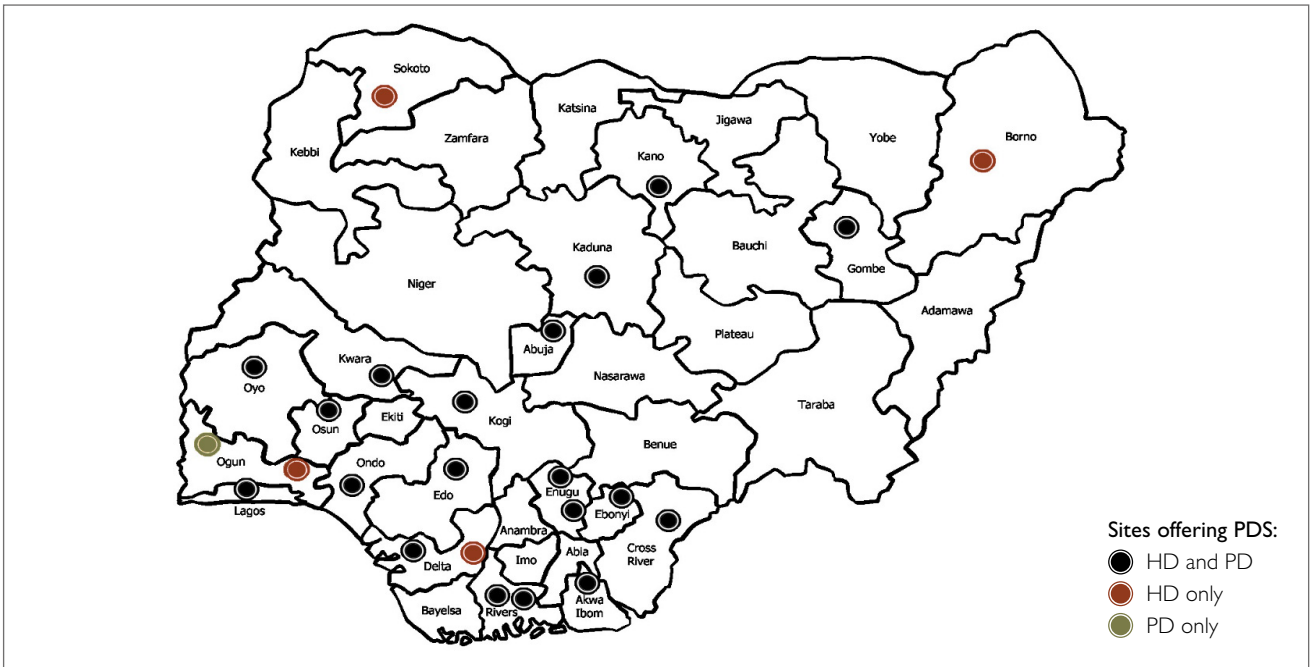

Figure 1. Distribution of surveyed sites providing acute paediatric dialysis services in Nigeria.

Types of paediatric dialysis services available at participating facilities

Table 2 lists the types of paediatric facilities available in the different centres. Most (19, 79%) offer both peritoneal dialysis and haemodialysis, whereas 4 facilities offer haemodialysis only, and one centre provides only peritoneal dialysis for their children needing dialysis. Ten (42%) facilities can offer dialysis for patients from neonates to those aged 18 years. The leading causes of AKI were septicaemia, malaria and acute watery diarrhoea as reported by 22 (92%), 16 (67%) and 15 (42%) health facilities, respectively.

Respondents' rating of the outcome of paediatric AKI at their centres

Respondents from 9 facilities subjectively rated the outcome of the paediatric acute kidney injury as 'very good' following dialysis at their different centres, whereas 8 respondents ranked their corresponding outcomes as 'good'. However, one respondent indicated a 'poor' outcome. (Figure 2).

Peritoneal dialysis services for paediatric patients in Nigeria

Among the 20 facilities that conduct peritoneal dialysis, 6 (30%) use a Tenckhoff catheter and 5 (25%) employ rigid catheters for the procedure. Fifteen (75%) centres used improvised catheters including nasogastric tubes (50%) and short-term haemodialysis catheters (15%). Eleven facilities (55%) use commercial peritoneal dialysis fluids, whereas 18 centres (90%) improvise peritoneal dialysis fluids using locally available intravenous fluids. Only 4 centres undertake manual peritoneal dialysis with a standard PD setup; others conduct PD manually via improvised PD (Table 3).

Table 2. Type of paediatric dialysis services available and common causes of AKI recorded by participating facilities.

Characteristics	Frequency (N = 24)	Percentage
Type of dialysis service provided in the facilities		
Both	19	79
Haemodialysis only	4	17
Peritoneal dialysis only	1	4
Age category of children for which dialysis is available		
>1 month to 5 years	1	4
>5 years to 18 years	3	13
>1 month to 18 years	10	42
Neonate to 18 years	10	42
Common causes of AKI in the facility[a]		
Sepsis	22	92
Malaria	16	67
Acute watery diarrhoea	15	63
Acute glomerulonephritis	10	42
Nephrotic syndrome	6	25
Haemolytic-uraemic syndrome	3	13
Others[b]	4	17

[a]Multiple options apply; [b]Others include nephrotoxin, post-surgery AKI, perinatal asphyxia and congenital anomalies of the kidney and urinary tract (CAKUT).

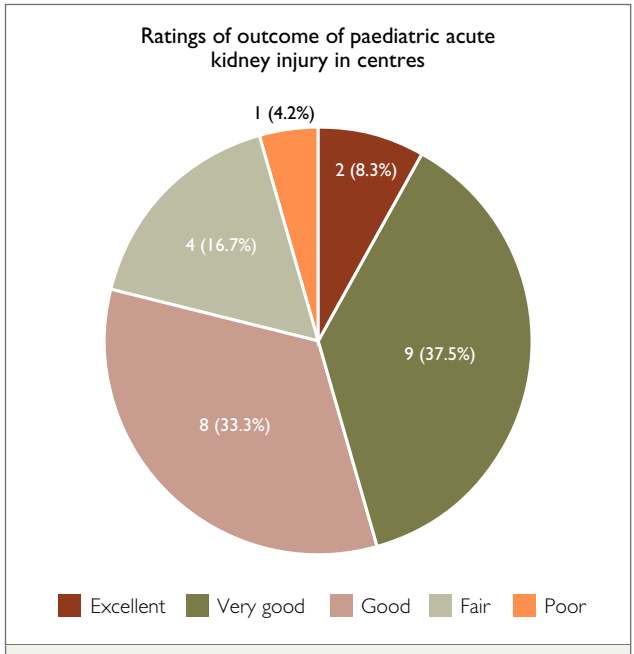

Figure 2. Ratings of the outcome of paediatric AKI at the participating facilities.

Table 3. Availability of PD consumables: catheter, fluid used for peritoneal dialysis and form of peritoneal dialysis in participating facilities in Nigeria.

Characteristics	Frequency (N = 20)	Percentage
Use Tenckhoff catheters for PD		
Yes	6	30
Other standard PD catheters used		
Cook's catheter	1	4
Rigid catheter	5	25
Facility uses an improvised PD catheter		
Yes	15	75
Types of improvised PD catheters used in facility		
Nasogastric tube	10	50
Haemodialysis catheter	3	15
Foley's catheter	1	5
Chest tube drain	1	5
Facility uses commercial PD fluids		
Yes	11	55
Facility uses locally improvised PD fluid		
Yes	18	90
Type of PD performed in facilities		
Manual PD with an improvised setup	16	80
Manual PD with a standard setup	4	20
Automated PD with standard setup	0	0

PD, Peritoneal dialysis; standard setup refers to the use of either a Tenckhoff or standard catheter with commercial PD fluids; improvised setup refers to the use of an improvised PD catheter (ISPD minimum standard recommendation)[15] with either commercial or improvised (locally prepared) PD fluids.

Medical professional who inserts PD catheters at different facilities

Different cadres of professionals insert the peritoneal catheter, with paediatric nephrologists/paediatricians being responsible for 60% of the acute PD catheter insertions in their facilities (Figure 3).

Cost of consumables for peritoneal dialysis for paediatric AKI in Nigeria

The median costs of a PD catheter, 2 litres of commercial PD fluid bag and 2 litres of local improvised PD fluid were ₦7,000 (US$ 6), ₦10,000 (US$ 9) and ₦3,200 (US$ 3), respectively (Table 4). The median number of PDs performed to restore normal kidney function in these facilities is 21 sessions, ranging between 3 and 40 PD sessions.

Haemodialysis service availability for paediatric AKI and cost of treatment in Nigeria

Although none of the units has a dedicated paediatric dialysis unit, 20 of the 23 facilities have dedicated paediatric dialysis machines at their centres. No facility offered continuous kidney replacement therapy (CKRT). Six facilities offering paediatric HD reported 'always' having access to paediatric dialyzers and bloodlines. Ten centres listed having these consumables 'sometimes.' The average cost of the first session of haemodialysis was ₦35,000 (US$ 30), with a range between ₦11,000 and ₦70,000 (US$ 10–60).

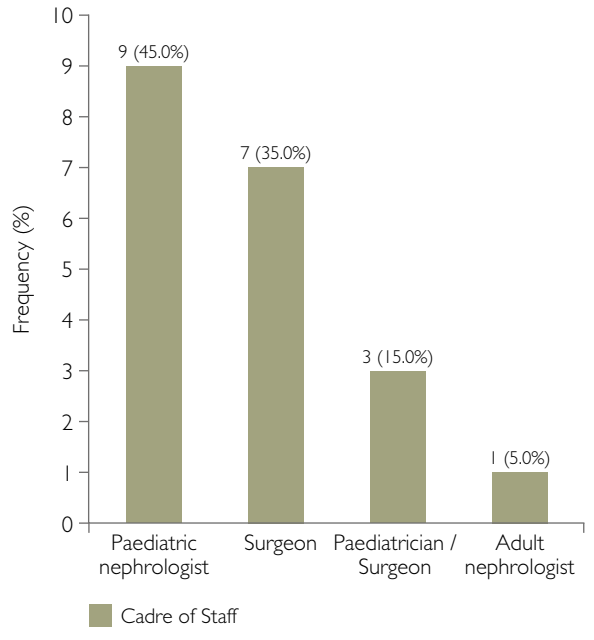

Figure 3. Medical professionals (N = 20) who insert peritoneal dialysis catheters in health facilities.

Table 4. Costs of consumables for peritoneal dialysis in different facilities in Nigeria.

Characteristics	Cost (₦) Median (range)	US$[§] Median (range)
PD catheter used in the facility	7,000 (135–100,000)*	6 (0.11–87)
2-litre commercial PD fluid	10,000 (5,000–25,000)**	9 (4.3–21.7)
2-litre locally improvised PD fluid[#]	3,200 (2,000–6,000)	3 (1.7–5.2)

Note: *PD catheter cost ranged widely from ₦135 (US$ 0.12) for nasogastric tubes to ₦100,000 (US$87) for the ISPD-recommended Tenckhoff catheter. **The cost of commercial PD fluids vary depending on the location of the facility and procuring agent. [#]Locally made PD fluids were mainly a mixture of Ringer's lactate and dextrose. [§]Exchange rate (2023): 1 US$ = N1,150.

The average number of sessions to restore kidney function was 4 and ranged between 2 and 7.

Challenges in the availability of dialysis services for paediatric AKI in Nigeria

As shown in Table 5, all 24 respondents strongly agreed that financial constraints are a challenge to paediatric patients requiring acute dialysis services in Nigeria. Other principal difficulties recognized were the lack of paediatric dialyzers and bloodlines, to which 18 respondents (75%) either 'agreed' (33%) or 'strongly agreed' (42%) and the unavailability of peritoneal dialysis fluids, as cited by 18 respondents (75%), who also either 'agreed' (25%) or 'strongly agreed' 12 (50%) as barriers to the availability of PDS.

Comparison of the availability of PDS in Nigeria from 2005 to 2023

The study by Akuse and Sambo-Donga [8] recorded 37 dialysis centres, but 26 responded in 2008. Of these, 17 (65%) reported providing PDS services with 19.2%, 26.9%, and 19.2% offering peritoneal dialysis (PD) or haemodialysis (HD) or both, respectively (located in 12 of 36 states and the FCT). In 2012, the study by Esezobor and colleagues [7] revealed that 12.5%, 31.3% and 56.3% provided PD, HD or both, respectively, from 16 of 34 responding centres (located in 31 of 36 states and the FCT). In our study, all 34 facilities noted had functioning paediatric nephrology units, but only 24 responded. Of these, 4.1%, 16.7% and 79.2% provided PD, HD or both services, located in 21 of 36 states and the FCT.

Table 6 shows that significantly (P = 0.021) more health facilities offer both acute PD and HD services (19% vs 56% vs 79%). Additionally, PD catheter insertion by paediatric nephrologists was significantly more common (P = 0.039) than performed by surgeons. Also, manual PD was a significantly (P = 0.013) more common modality than automated PD (100% vs 0.0%).

Table 5. Responses to the challenges facing PDS availability in Nigeria.

Characteristics	Responses (N = 24)				
	Strongly disagree	Disagree	Neutral	Agreed	Strongly agree
Financial constraint	0	0	0	0	24
Lack of PD catheter	1	1	6	4	12
Lack of paediatric dialyzers/HD lines	0	2	4	8	10
No dedicated paediatric HD unit	1	4	4	4	12
Unavailability of PD fluid	1	3	2	6	12
Lack of human resources	3	1	5	9	6
Lack of skills in HD	2	13	6	3	0
Lack of skills in PD	6	7	6	4	1
Lack of consent	7	8	6	3	0

Table 6. Comparison of PDS available in Nigeria from 2005 to 2023.

Characteristic	2008 study [8]	2012 study [7]	Present study	P value
No. of facilities with PDS	17/26	16/34	24/34	
Hospital type				0.411
Teaching	12	14	21	
Non-teaching	5	2	3	
Hospital location				-
North Central	NR	3	3	
North West	NR	3	3	
North East	NR	2	2	
South South	NR	3	7	
South West	NR	4	6	
South East	NR	1	3	
Subgroup by zones				-
Northern zones	NR	8	8	
Southern zones	NR	8	16	
Dialysis service provided				0.021*
Peritoneal only	5	2	1	
Haemodialysis only	7	5	4	
Both PD and HD	5	9	19	
CKRT	0	0	0	
Who inserts the PD catheter (n = 20)				-
Paediatric nephrologist	NR	5	9	
Surgeon	NR	6	7	
Either of paed. neph./surgeon	–	–	3	
Adult nephrologist	–	–	1	
Personnel who perform the PD				0.039*
Paediatric nephrologist	NR	8	18	
Adult nephrologist	NR	4	1	
Both	NR	4	1	
Type of PD catheter used				0.703
Standard	NR	4	4	
Improvised	NR	5	10	
Both	NR	2	6	
APD (cycler) used for PD				0.013*
Yes	0	3	0	
No	10	8	20	

CKRT, continuous kidney replacement therapy; NR, not reported; *statistically significant; APD, automated peritoneal dialysis.

DISCUSSION

We conducted a nationwide survey comparing current paediatric dialysis services available in Nigeria for severe acute kidney injury with earlier studies. The findings provide evidence of progress and guide strategies to improve the availability and sustainability of these services, which have increased in the six geopolitical zones of the country. Furthermore, progress has been made in both the type of services and expertise offered with the inclusion of neonatal dialysis services in some facilities. However, the barriers to providing quality services were not different from those in earlier studies.

The studies conducted previously by Akuse and Sambo-Donga [8] and by Esezobor and colleagues [7] recorded that paediatric dialysis services were available in only 17 and 16 centres, respectively, spanning 12 to 31 states in the country. However, today these services are available in 24 responding centres across 21 states. Most centres are in urban areas and are mainly sited in the south of the country. This uneven distribution of the availability of PDS probably reflects the corresponding uneven availability of trained paediatric nephrologists, which would limit the access to dialysis of children requiring it who reside in rural and other vulnerable areas [11,16]. Our findings also show that paediatricians practising nephrology do so in mainly tertiary (teaching) hospitals, as reported in earlier studies [7,17].

Acute intermittent haemodialysis and peritoneal dialysis services are the primary modalities of PDS in Nigeria, although the availability of both options at health facilities has increased [7,8], probably the result of the expansion of training in paediatric nephrology and growing interest among paediatricians and trainees. Haemodialysis services remain the more common modality, as previously reported [7]. This is possibly due to the advanced state of adult nephrology in centres offering dialysis, which allows paediatricians to leverage existing infrastructure for service provision. Our study revealed also that increasingly more facilities now offer both acute intermittent haemodialysis and peritoneal dialysis modalities, which is an improvement on the past [7,8]. Nonetheless, the current availability of PDS in Nigeria still falls short of standard recommendations compared with access to paediatric dialysis in more resource-rich settings [18,19].

Approximately two-fifths of the Nigerian facilities offer neonatal dialysis services, which is an improvement on earlier studies, in which this special category was not mentioned [7,8]. This is noteworthy given the ethical, technical, and heightened risk of complications associated with neonatal dialysis [20]. Indeed, increasing the provision of dialysis services for younger children would have been more feasible using acute peritoneal dialysis. Compared with other forms of acute kidney replacement therapy, peritoneal dialysis is easier to perform and has fewer technical requirements. Peritoneal dialysis for AKI has been associated with acceptable outcomes globally and in Nigeria [21-23]. It is also the preferred first modality of dialysis in children in other countries in sub-Saharan Africa [24]. Furthermore, two-thirds of our centres had a paediatric nephrologist/paediatrician who inserted the acute peritoneal dialysis catheter, which is encouraging. This progress could be attributed to the benefits gained from training paediatric nephrologists supported by IPNA, ISN and ISPD through teaching courses, conferences and fellowship programmes over the years [10,11].

As noted in previous studies [7,17], the provision of PDS in Nigeria continues to face significant challenges, despite the available options for dialysis treatment. A major obstacle is the shortage of commercially available peritoneal dialysis fluids and consumables, because such fluids and supplies are not manufactured locally that meet the ISPD guidelines [15]. However, whenever standard commercial PD fluids are available, they are often procured in limited quantities because of their high costs, and relatively low market demand compared to adult consumables, which is made worse by fluctuating foreign exchange rates. Caregivers are commonly unable to afford these costs. Additionally, there are often delays in the delivery of these consumables when they are urgently needed. As a result, healthcare providers resort to improvising PD fluid constitution and using improvised PD catheters, which poses risks such as peritonitis and a strain on manpower resources [21,25]. Of concern also was that no centre reported offering automated peritoneal dialysis services. Automated PD (cycler) may reduce complications associated with peritoneal dialysis and save on manpower, especially in the face of the shortage of health personnel occasioned by their large exodus to other countries in search of "greener pastures". However, the automated PD (cycler) would need a standard continuous ambulatory peritoneal dialysis (CAPD) circuit and a dependable power source. Recently, a local company in North Central Nigeria has re-started the production of CAPD fluid [26], which some paediatric nephrologists now use for manual peritoneal dialysis in children with acute kidney injury. This development is laudable, and the initiative should be supported more widely to become nationally available.

Only a few facilities reported having access to paediatric dialyzers and bloodlines for haemodialysis. Most centres that offer haemodialysis services do so in established dialysis

centres with HD machines for adults and grapple with using adult-sized dialyzers and extracorporeal circuits. This increases the risk of HD-related complications and delays access to paediatric dialysis services, which could lead to poorer outcomes. Almost all facilities were inadequately equipped to offer HD services to children under the age of five, except for one [6], which reported having carried out haemodialysis on children weighing 12 kg. However, this service was offered only when dialysers and bloodlines were available. Poor access to paediatric dialyzers and bloodlines has long remained a challenge in Nigeria [8] with other issues like difficulty with securing vascular access appropriate for the size of the child, precise control of ultrafiltration and low-volume tubing systems also being major impediments. Furthermore, no facility offered acute continuous kidney replacement therapy. To date, no centre provides chronic dialysis on a routine basis. Indeed, children with severe AKI who progress to chronic kidney disease and require long-term dialysis are unable to access such services, leading to fatal outcomes.

Besides the technical aspects, financial constraints were another serious challenge across all facilities for accessing acute PDS. Our findings corroborate the reports from earlier studies that lack of funding remains a significant obstacle for Nigerian children with severe acute kidney injury needing care [6,21,22,27,28]. This has often led to lower treatment rates, limited access to and acceptance of services, increased instances of discharge against medical advice, and deaths from delayed access to dialysis [27]. Regrettably, this remains the reality for many Nigerian children presenting with severe kidney injury and requiring kidney replacement therapy; it is a silent, often unrecognized, contributor to childhood mortality.

Currently, the National Health Insurance service (NHIS) provides limited coverage for patients needing dialysis and includes only 6 sessions of HD for adults [29]. Specifically, consideration should be given to having a designated number of free HD sessions for children under 18 years, as is done for adults. There is also a need to include peritoneal dialysis in the NHIS and expand it to cover children. Equal importance should be placed on making age-appropriate PD/HD consumables and machines for dialysis available to children. It will certainly be of benefit if the government purchases paediatric consumables centrally, to minimize cost and distribute them to the hospitals that carry out PD or HD.

It was encouraging to discover that most respondents disagreed that the lack of skills to perform either HD or PD was the main challenge in providing PDS. This signifies that the efforts invested in training paediatricians and paediatric nephrologists have been productive. However, the principal obstacle to providing acute paediatric dialysis services in Nigeria is the lack of human and material resources.

Despite a protracted period of poor availability of PDS in the country, this study acknowledges some improvements in the expertise available and care provided. These efforts from international societies such as ISN, IPNA, SYL and ISPD have contributed to the steady improvement in the management of children with severe acute kidney injury and paediatric nephrology services in our setting. This has been demonstrated through supportive approaches to aid in continuous education, training and care delivery. There is a need for continuing support from all the international nephrology communities for sustained progress in PDS in our country, as well as in other developing states.

Strengths and limitations of the study

Our study is limited due to its sampling technique. Additionally, the costs associated with dialysis sessions were estimated. The unresponsiveness of some public and potential private hospitals, despite being invited to contribute, limits comprehensive nationwide data, which would have been desirable. Also, the estimated number of annual AKI cases and paediatric admissions per centre were not assessed. However, the respondents interrogated were all renowned paediatric nephrologists/paediatricians serving in large referral facilities across the country's six geopolitical zones. These findings are most likely representative of PDS for severe AKI in Nigeria. The strength of the study lies in its ability to compare previous studies and provide progress updates to all stakeholders.

Recommendations

The government should support local companies in producing pediatric-specific dialysis medical supplies and adding paediatric PD fluids and dialyzers to the National Essential Medicines list to improve accessibility and affordability. The NHIS should incorporate peritoneal dialysis into its coverage and extend its provisions to include children requiring both PD and HD services.

The Paediatric Nephrology Association of Nigeria should establish a national registry for paediatric dialysis services. Such a registry would help identify the availability, distribution, and challenges in public and private hospitals for national planning and resource allocation.

Moreover, advocacy should be strengthened between the Paediatric Association of Nigeria, the Paediatric Nephrology Association of Nigeria and the government to address the gaps identified.

CONCLUSION

Dialysis services for paediatric AKI in Nigeria have been expanding and ever more facilities provide both HD and PD today. Whereas acute haemodialysis is mainly available for older children, acute peritoneal dialysis remains predominantly improvised. The dialysis services for children with AKI remain unevenly distributed across the country. Common barriers to the availability of paediatric dialysis services are financial constraints and lack of both PD/HD dialysis consumables. There is an urgent need for concerted efforts to improve government and facility collaboration to provide paediatric age-appropriate dialysis machines/consumables and subsidize paediatric dialysis services in the country.

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Conflict of interest

The authors have no conflicts of interest to declare.

REFERENCES

1. Uwaezuoke S. Pediatric acute kidney injury in the developing world: How realizable is the goal of the zero preventable deaths by 2025 initiative? Int J Nephrol Kidney Fail. 2016;2.
2. Cho MH. Pediatric acute kidney injury: Focusing on diagnosis and management. Child Kidney Dis. 2020;24:19-26.
3. Anigilaje E, Adebayo A, Ocheni S. Acute kidney injury in children: A study of etiology, clinical profile, and short-term outcomes at the University of Abuja Teaching Hospital, Gwagwalada, Abuja, Nigeria. Saudi J Kidney Dis Transpl. 2019;30:439.
4. Olowu WA, Niang A, Osafo C, Ashuntantang G, Arogundade FA, Porter J, et al. Outcomes of acute kidney injury in children and adults in sub-Saharan Africa: a systematic review. Lancet Glob Health. 2016;4: e242-e250.
5. Luyckx VA, Al-Aly Z, Bello AK, Bellorin-Font E, Carlini RG, Fabian J, et al. Sustainable Development Goals relevant to kidney health: an update on progress. Nat Rev Nephrol. 2021;17:15-32.
6. Asinobi AO, Ademola AD, Alao MA. Haemodialysis for paediatric acute kidney injury in a low resource setting: experience from a tertiary hospital in South West Nigeria. Clin. Kidney J. 2016;9:63-68.
7. Esezobor CI, Oniyangi O, Eke F. Paediatric dialysis services in Nigeria: availability, distribution and challenges. West Afr J Med. 2012;31:181-185.
8. Akuse RM, Sambo-Donga E. The availability of paediatric dialysis in Nigeria and problems associated with its delivery. Tropical J Nephrol. 2008;3:35-40.
9. Smoyer WE, Finkelstein FO, McCulloch M, Carter M, Brusselmans A, Feehally J. Saving young lives: provision of acute dialysis in low-resource settings. Lancet. 2015;386:2056.
10. McCulloch MI, Argent AC, Morrow B, Nourse P, Coetzee A, Du Buisson C, et al. Lessons learned from regional training of paediatric nephrology fellows in Africa. Pediatr Nephrol. 2023;38:3757-3768.
11. Esezobor CI, Alakaloko AE, Admani B, Ellidir R, Nourse P, McCulloch MI. Paediatric nephrology in Africa. Curr Pediatr Rep. 2021;9:134-141.
12. Paediatric Nephrology Workshop and IPNA teaching course organized by the Ibadan–Calgary and Port Harcourt–New York ISN sister renal centre pairs. In: International Paediatric Nephrology Association (IPNA) online [cited 11 Jul 2024]. Available: https://theipna.org/upcoming-events/paediatric-nephrology-workshop-and-ipna-teaching-course-organized-by-the-ibadan-calgary-and-port-harcourt-new-york-isn-sister-renal-centre-pairs/
13. Mehta RL, Cerdá J, Burdmann EA, Tonelli M, García-García G, Jha V, et al. International Society of Nephrology's 0by25 initiative for acute kidney injury (zero preventable deaths by 2025): a human rights case for nephrology. Lancet. 2015;385:2616-2643.
14. Jager J, Putnick DL, Bornstein MH. More than just convenient: the scientific merits of homogeneous convenience samples. Monogr Soc Res Child Dev. 2017;82:13-30.
15. Nourse P, Cullis B, Finkelstein F, Numanoglu A, Warady B, Antwi S, et al. ISPD guidelines for peritoneal dialysis in acute kidney injury: 2020 update (paediatrics). Perit Dial Int. 2021;41:139-157.
16. Obichukwu C, Odetunde O, Chinawa J, Okafor H, Adiele D, Ibe B. Community-acquired acute kidney injury in critically ill children as seen in the emergency unit of a tertiary hospital in Enugu, Southeast Nigeria. Niger J Clin Pract. 2017;20:746-753.
17. Adekanmbi A, Ogunlesi T, Fetuga M, Akodu S. Renal replacement therapy in acute kidney injury in children: available options in Nigeria. J Rech Sci Univ Lomé. 2019;21:1-6.
18. de Galasso L, Picca S, Guzzo I. Dialysis modalities for the management of pediatric acute kidney injury. Pediatr Nephrol. 2020;35:753-765.
19. Ranchin B, Schmitt CP, Warady BA, Hataya H, Jones J, Lalji R, et al. Technical requirements and devices available for long-term hemodialysis in children – mind the gap! Pediatr Nephrol. 2024;39:2579-2591.
20. Ranchin B, Plaisant F, Demède D, de Guillebon J-M, Javouhey E, Bacchetta J. Review: Neonatal dialysis is technically feasible but ethical and global issues need to be addressed. Acta Paediatr. 2021;110:781-788.
21. Esezobor CI, Ladapo TA, Lesi FE. Peritoneal dialysis for children with acute kidney injury in Lagos, Nigeria: experience with adaptations. Perit Dial Int. 2014;34:534-538.
22. Anochie IC. Paediatric acute peritoneal dialysis in southern Nigeria. Postgrad Med J. 2006;82:228-230.
23. Alao MA, Ibrahim OR, Asinobi AO, Akinsola A. Long-term survival of children following acute peritoneal dialysis in a resource-limited setting. Kidney Res Clin Pract. 2020;39:469-478.
24. McCulloch MI, Luyckx VA, Morrow B, Nourse P, Coetzee A, Reddy D, et al. Dialysis for paediatric acute kidney injury in Cape Town, South Africa. Pediatr Nephrol. 2024;39(9):2807-2818.
25. Ibitoye P, Jiya-Bello F. Paediatric acute peritoneal dialysis in Sokoto: review and outcome. CMJ. 2021;2:507-512.
26. Fakrogha PE, Emem-Chioma P, Dimitrios P, Lewis D, Erekosima I. POS-682 goal directed incremental peritoneal dialysis treatment using clinical indicators and patient reported outcome measures in Nigeria – study design. Kidney Inter Rep. 2022;7:S294.
27. Odetunde OI, Okafor HU, Uwaezuoke SN, Ezeonwu BU, Ukoha OM. Renal replacement therapy in children in the developing world: Challenges and outcome in a tertiary hospital in southeast Nigeria. Scientific World J. 2014;2014:1-6.
28. Obiagwu PN, Abdu A, Abubakar ND. Haemodialysis treatment among children with kidney failure in north-western Nigeria: A three-year review. Tropical J Nephrol. 2012;6: 33-37.
29. Ajayi S, Raji Y, Bello T, Jinadu L, Salako B. Unaffordability of renal replacement therapy in Nigeria. Hong Kong J. Nephrol. 2016;18:15-19.