

## Barriers to Peritoneal Dialysis Utilization among End Stage Kidney Disease Patients in Kenya

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### ABSTRACT

**Aim:** barriers to peritoneal dialysis utilization among end stage kidney disease patients in Kenya.

**Background:** Peritoneal Dialysis (PD) is the use of the capillary rich peritoneal membrane as a dialyzer whereby waste products diffuse from the capillaries into the dialysate during dwell time. Peritoneal Dialysis is a proven viable treatment for Kidney failure (KF) but it is not popularly utilized in Kenya. However, the uptake of PD in Kenya has been shown to be low owing to various barriers that have created a hindrance to utilization of the procedure among patients suffering from end stage kidney disease (ESRD).

**Methodology:** A descriptive – analytical cross sectional study was conducted in 6 government dialysis centres in Kenya purposively selected. The study targeted 346 patients with ESKD, 6 nephrologists, 19 general physicians, 125 nurses in six government owned dialysis centers in Kenya. The targeted policy makers were 6 from each hospital, 4 from the county governments, 2 from the national hospital insurance fund (NHIF) and 2 from the ministry of health (MOH). The nurses and patient participants were sampled through simple random sampling while the doctors and policy makers were sampled by census based on their specialization and/or deployment in dialysis units and their positions respectively. The study sought to establish barriers to utilization of PD among patients with ESKD. The study entailed mixed methods where both quantitative and qualitative data collection methods were employed. Both structured and unstructured questions were utilized in a self-administered / research assisted questionnaire. Quantitative data was analyzed using SPSS Version 22.0. Qualitative data was organized, shared, and managed using N Vivo 11 software and was analyzed using thematic areas. Hypothesis testing was done using chi- squared test whereby P-values of less than 0.05 were considered statistically significant with a 95% confidence interval (CI). Data presentation was done using tables, charts and in narrative form.

**Results:** The research revealed low utilization of PD in the selected Hospitals where only 0.2% (1) was on PD. Chi-square tests of associations revealed that patients who had been educated on PD and patients who were educated on the equipment required for PD were more likely to utilize the PD modality of dialysis ( $p < 0.01$  and  $p = 0.01603$ , respectively). Results from the multivariate logistic regression showed that only patients who had been educated on PD were more likely to choose the PD modality ( $p = 0.01222$ ). Various barriers to PD utilization were identified. From the research findings, the Cost of PD fluids seems to be a major constraint given that many countries in Africa do not have the capacity to manufacture fluids but instead rely heavily on fluids imported from developed countries. Low patient education and motivation was also found to be a major barrier with a huge population unaware of PD. There was lack of expertise/experience for catheter insertion with insufficient PD training for nephrology fellows, which has been a barrier to PD initiation and retention. Some nurses also lacked training and experience in conducting PD procedure. The policy makers in the National Hospital Insurance Fund also confirmed that PD services were not among the services covered by the fund hence patients had to pay for themselves. Additionally, there was no sound policy or a standard Model to guide utilization of PD in Kenya unlike in other countries. The barriers were categorized as patient related, healthcare related as well as policy related.

**Conclusions and Recommendations** Despite similar clinical and humanistic outcomes between HD and PD, PD may be the more convenient and resource-conscious option of dialytic kidney replacement therapy (DKRT). Underutilization of PD is mainly related to lack of PD dieneal solutions, accessories, dearth of trained personnel, social-economic factors, and lack of advocacy to project PD as the first option for Kidney replacement therapy (KRT). In order to address the identified barriers, the development of a functional PD team is essential for a successful patient outcome. There is also need to develop a policy on management of PD services as well as a standard Model to guide PD utilization.

## Keywords

Peritoneal dialysis utilization, ESKD, Barriers to peritoneal dialysis utilization.

## Introduction

The global burden of chronic kidney disease (CKD) and ESKD is high and is a public health issue. It affects over 850 million people globally [1]. Per year, between 5 and 10 million people die because of a lack of access to dialysis for the treatment of KF or acute kidney injury (AKI) [2]. There is a treatment gap that is greatest in low-income countries especially Asia with 1.9 million patients needing KRT but not accessing it and Africa with 430,000 patients. Globally, the need for KRT is forecasted to be 5.4 million patients by 2030 [3]. Peritoneal Dialysis is the use of the capillary rich peritoneal membrane as a dialyzer whereby waste products diffuse from the capillaries into the dialysate during dwell time. Advancements in technology and the delivery of adequate dialysis results have improved outcomes and acceptance of PD as a lifesaving DKRT modality. This is because the kidney residual function (KRF) is preserved in PD than HD [4]. Peritoneal dialysis is a good form of KRT that can help reduce HD demand [5]. Peritoneal dialysis is favoured to HD because it employs a less complex strategy, which results in more incremental physiological improvements. It differs from HD in the sense that blood is cleaned while it is in the patient's own body (intracorporeal circuit) and that there is no water treatment plant required. Patients can handle the procedure of PD at home upon vigorous training, as PD is a self-care modality. Though PD is a proven viable treatment for KF, it is not popularly utilized in Kenya and the uptake of the modality has been shown to be low owing to various barriers that have created a hindrance to utilization of the procedure among patients suffering from ESKD.

## Methods

### Study design

A descriptive – analytical cross sectional study /Mixed-research methods.

### Study site

Six government dialysis centres in Kenya purposively selected

### Data collection

Both qualitative and quantitative data collection methods were used.

### Research instruments

Both structured and unstructured questions were utilized in a self-administered / research assisted questionnaire.

### Sample size

Study subjects were recruited using simple random sampling for the ESKD patients as well as nurses and census for physicians, nephrologists, and policy makers. The study targeted 346 patients with ESKD, 6 nephrologists, 19 general physicians, 125 nurses in six government owned dialysis centers in Kenya. The targeted

policy makers were 6 from each hospital, 4 from the county governments, 2 from the national hospital insurance fund (NHIF) and 2 from the ministry of health (MOH).

### Main objective

The study sought to establish barriers to utilization of PD among patients with ESKD.

### Data analysis

Quantitative data was analyzed using SPSS Version 22.0. Qualitative data was organized, shared, and managed using N Vivo 11 software and was analyzed using thematic areas. Hypothesis testing was done using chi-square test whereby P-values of less than 0.05 were considered statistically significant with a 95% confidence interval (CI).

### Data presentation

Data was presented using frequency tables, proportions, bar graphs, relative frequencies, pie charts, cross tabulations and contingency tables, descriptive statistics (mean, standard deviation and percentage) was used to describe sample characteristics. Themes and verbatim reporting were used to present qualitative evidence.

## Results

### Response rate

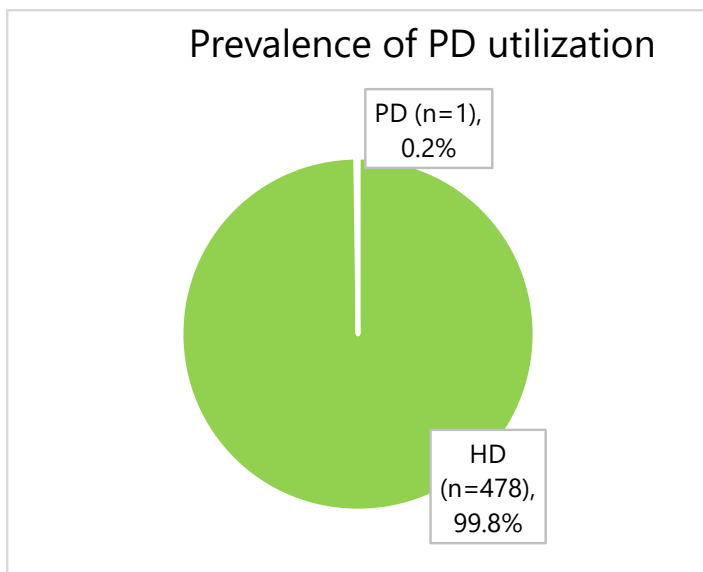
The response rate for the study subjects were- nephrologists 83.3%, nurses 62.4%, physicians, fellows in nephrology and medical officers 70%, ESKD patients 92.2%, hospital administrators 100%, County governments' officers of health 75%, NHIF Policy makers 100% response rate, MOH policy makers 100%. According to Lindemann, the acceptance average response rate is 30%. A response rate of 50% and above is considered excellent. This research has met the recommended excellent response rate of above 50%. This is indicated in (Table 1).

**Table 1:** Illustrating the study subject's response rate.

Subjects	Selected sample size	Study subjects who participated in the study	Response rate in percentage
Nephrologists	6	5	83.3%
Nurses	125	78	62.4%
Physicians/Medical officers/ fellows in nephrology	10	7	70.0%
ESKD patients	346	319	92.2%
<b>Policy makers</b>			
Hospital	6	6	100%
County government	4	3	75%
NHIF	2	2	100%
MOH	2	2	100%

### PD prevalence

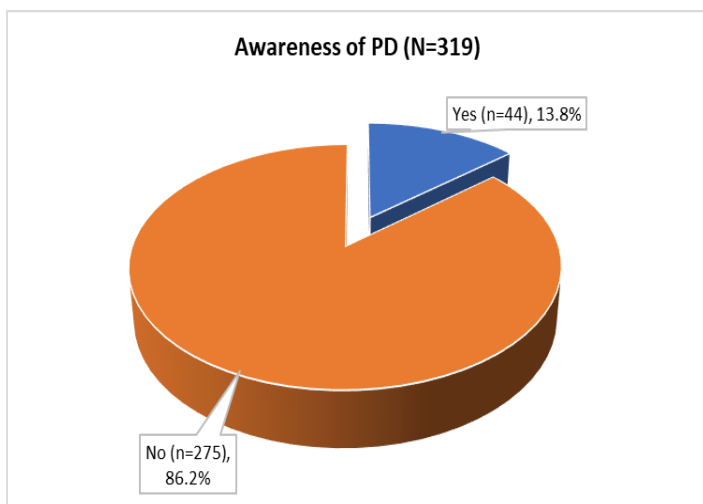
The research revealed low utilization of PD in the selected Hospitals where only 0.2% (1) was on PD as indicated in (Figure 1).



**Figure 1:** Utilization of PD services in selected centers.

### Awareness of PD among ESKD patients

The study findings showed that majority of the patients 82.2%(275) had not heard about PD while a small population of 13.8% (44) had heard about PD as shown in (Figure 2).

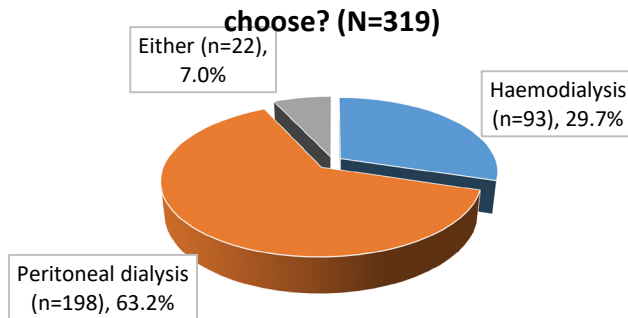


**Figure 2:** Heard about PD before.

All the patients in the study population were taught on PD by the researcher and research assistants. They were counselled on the types of dialyses, told about the options available, and were asked to choose the form of DKRT they would choose if given an opportunity to do so again and majority accounting to 63.2 % (198 ) chose PD, while 29.7% (93) chose HD. Those who chose either were 7.0% (22). This is shown in (Figure 3). Chi-square tests of associations revealed that patients who had been educated on PD and patients who were educated on the equipment required for PD were more likely to utilize the PD method of dialysis ( $p < 0.01$  and  $p = 0.01603$ , respectively). Results from the multivariate logistic regression showed that only patients who had been educated on

PD were more likely to choose the PD modality ( $p = 0.01222$ ). Results from the bivariate logistic regression revealed that awareness of PD was significantly associated with PD utilization among the ESKD patients ( $P = 0.04415$ ). The patients expressed lack of awareness of PD to be one of the barriers they have been experiencing in PD utilization.

### Given opportunity today, which modality would you choose? (N=319)



**Figure 3:** The form of dialytic kidney replacement therapy the patient would choose if given an opportunity today

### Modality choice

Majority of the patients 83.4% (266) were on HD as the only choice they were given while 9.1% were explained and preferred HD, 2.2% (n=7) found HD to be cheaper as shown in (Figure 4).

### Barriers to PD utilization

Various barriers to utilization of PD services were identified as follows:

#### Patient related barriers

These were identified where majority of the patients 38.3% (97) had lack of strength, 32.4% (82) had no medical barriers to PD utilization, 18.2% (46) had poor vision, 17.4% (44) had poor health status and 16.6% (42) was lack mobility as shown in (Figure 5). Majority of the patients accounting to 39.2 % (125) verbalized no psychological barriers, 32.9% (81) verbalized fear of doing their own dialysis at home, 13.6% (36) felt that dialysis should be done in Hospital, 10.2% (25) felt they lacked motivation, 2.8% (7) felt that they would be isolated as shown in (Figure 6).

#### Social cultural barriers to PD utilization

Majority of the respondents expressed that the cost of PD is the greatest hurdle to PD utilization accounting to 81.5 % (247), followed by lack of money 66.3% (202), lack of accessibility to treatment 19.5% (59), family declining 6.9% (21), lack of social support 4.3 % (13), lack of space 3% (9), lack of time 2% (6), language barrier 3.3% (10). This is illustrated in Figure 7. Some of the patients expressed no social cultural barriers 4.7% (15). The chi-square tests of association revealed that none of the barriers (knowledge barriers, medical barriers, psycholocial barriers and social cultural barriers) was associated with PD utilization. Most patients 92.3% (281).

### Reasons for selecting modality (N=319)

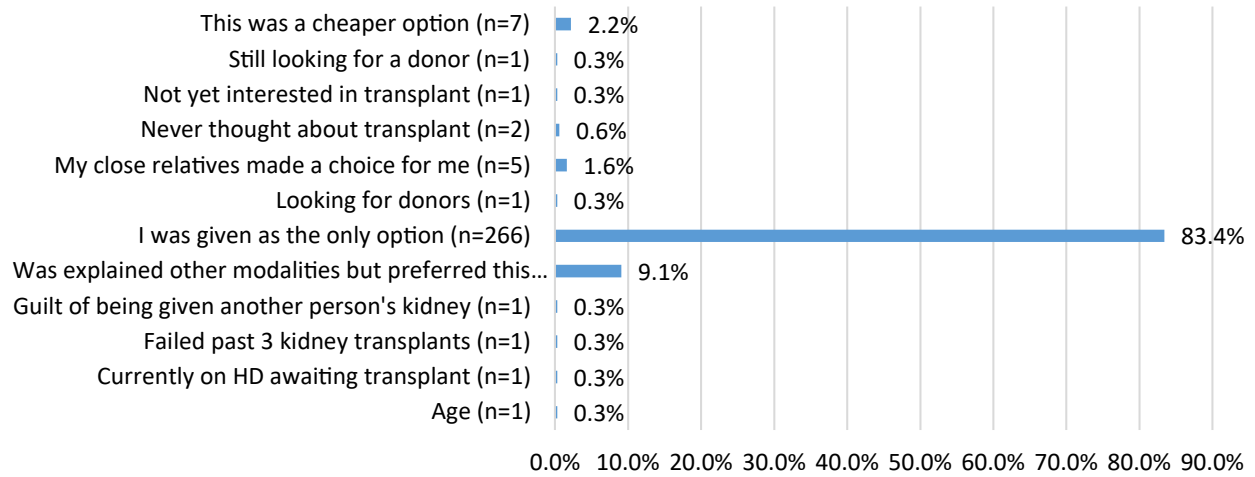


Figure 4: Showing the reason for selecting the current modality of treatment

### Patient related barriers

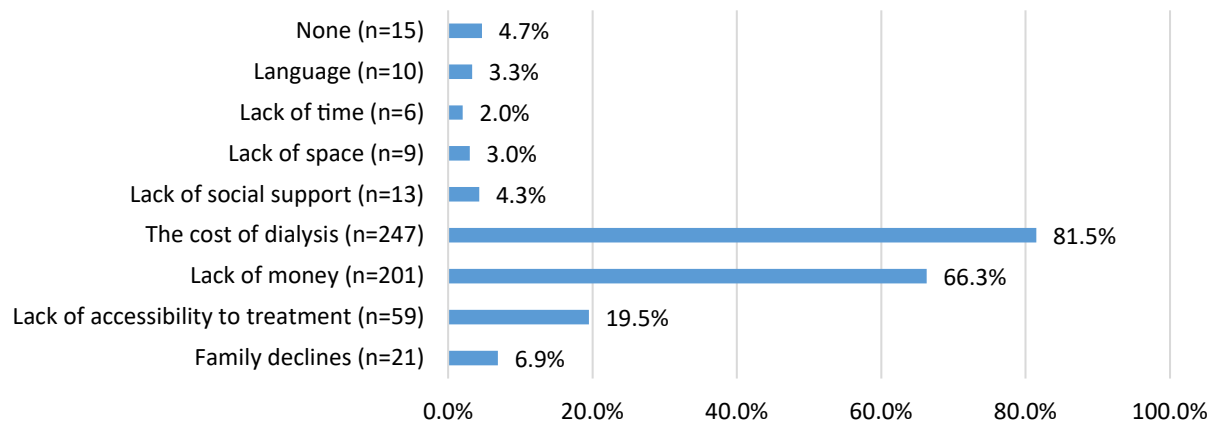


Figure 5: Patient related barriers to PD utilization

### Psychological factors (N=319)

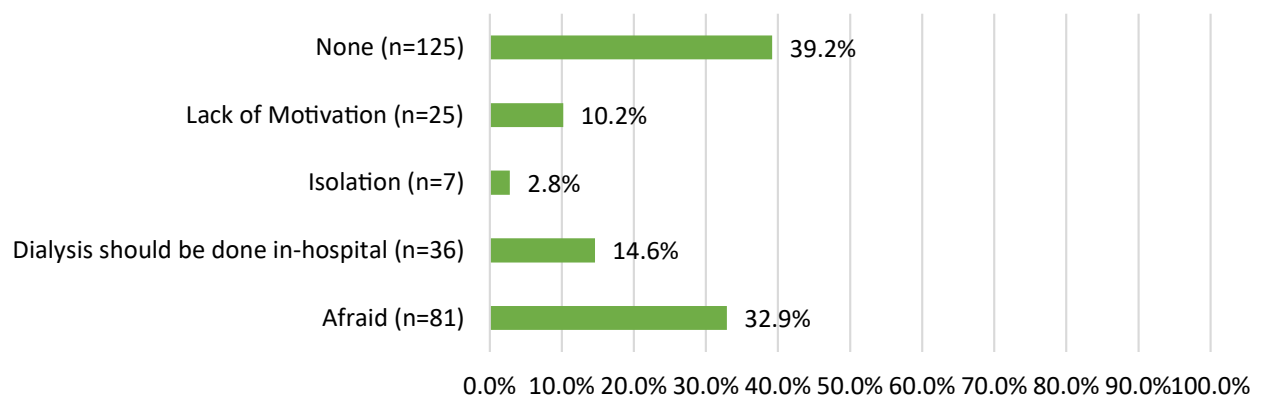


Figure 6: Psychological barriers to PD utilization

## Socio-cultural factors (N=319)

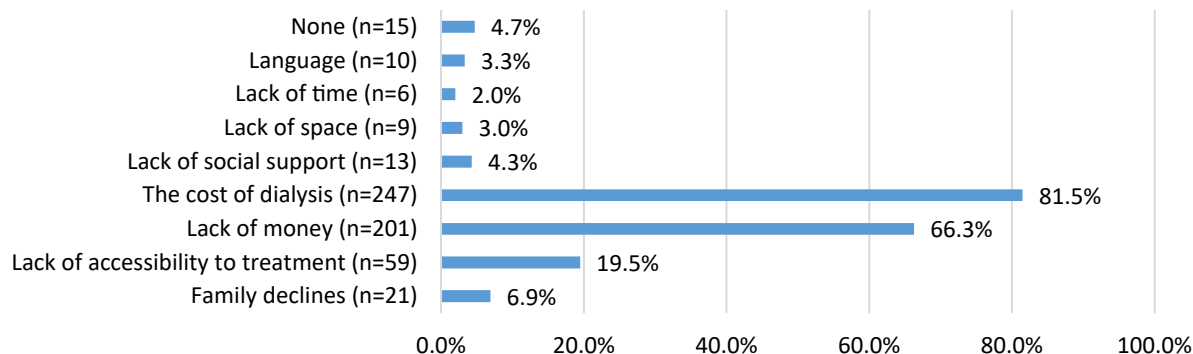


Figure 7: Social cultural barriers to PD utilization

### Industry Barriers

Patients were asked whether they were aware whether PD fluids were manufactured in the country. Majority accounting to 76.1% (233) were aware the fluids are not manufactured in the country while 22.2% (68) did not know whether they are manufactured in the country, 1.7% (5) said they were manufactured in the country as shown in (Figure 8). Majority of the patients 72.7% (221) said there were no PD fluids supplies in the country while 26.7% (81) did not know and 0.6% (2) said PD fluids were enough as shown in (Figure 9). Among the industry factors, the Chi-square tests of association revealed that only availability of enough supply of fluids was associated with PD utilization ( $p < 0.001$ ). This was not significant in the multivariate analyses. Knowledge of a local manufacturing industry was not associated with PD utilization ( $P = 0.8571$ ). The Chi-square test revealed that availability of enough supply of fluids was associated with PD utilization ( $p < 0.001$ ). This was not significant in the multivariate analyses. However, knowledge of a local manufacturing industry was not associated with PD utilization.

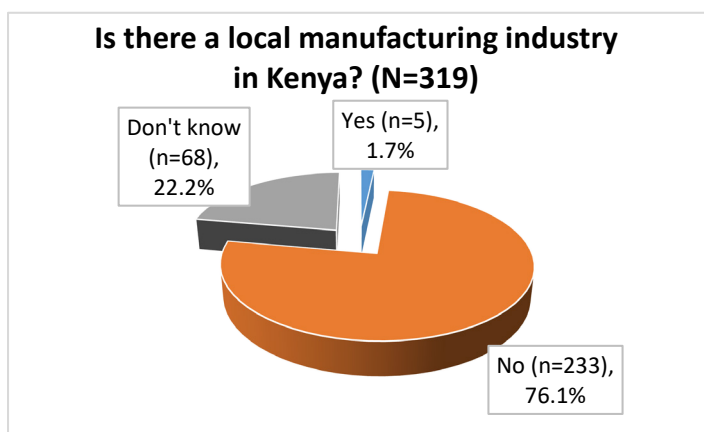


Figure 8: Patient knowledge on local manufacturing of PD fluids

### Health system barriers

Among the health system factors assessed, neither knowledge of availability of PD covered by an insurance nor knowledge of availability of PD favoured first policy or PD first policy

were associated with PD utilization ( $P = 0.8454$  and  $P = 0.8353$ , respectively). This is shown in (Table 2).

Table 2: Showing the association between barriers to PD utilization and PD utilization among the ESKD patients.

Variable	P-value
<b>Knowledge barriers</b>	
Lack of awareness	0.5739
Lack of explanation of options	0.4962
Lack of understanding	0.1226
<b>Medical barriers</b>	
Lack of strength	0.3904
Lack of mobility	0.6019
Poor health status	0.5153
Poor vision	0.5739
Poor hearing	0.8729
Poor memory	0.7993
<b>Psychological barriers</b>	
Afraid	0.4403
Dialysis should be done in hospital	0.6271
Isolation	0.832
Lack of motivation	0.684
<b>Socio-cultural barriers</b>	
Language	0.7993
Lack of space	0.8096
Lack of time	0.8444
Lack of social support	0.7714
Family declines	0.7101
Lack of money	0.34
Lack of accessibility to treatment	0.5271
Cost of dialysis	0.08374
<b>Cost barriers</b>	
	0.9232
<b>Industry factors</b>	
Knowledge of a local manufacturing industry	0.8571
Availability of enough supply of fluids	$< 2.2e-16^*$
<b>Health system factors</b>	
Knowledge of availability of PD insurance covered by an insurance	0.8454
Knowledge of availability of PD favoured first policy or PD first policy	0.8353

\*p-value less than 0.05.



The patients were requested to suggest possible ways in which PD utilization can be boosted in Kenya and the qualitative finding was as follows: there is need to create awareness and educate patients on PD, the government should ensure that PD is covered by the National Hospital Insurance Fund (NHIF), Government intervention is necessary through subsidization of PD costs, catering for the cost through Universal health care (UHC) and NHIF, make the modality available at the facilities, law enforcement through policies, equipment, and supplies, Patients should be given PD among the options to choose from at the health facilities and that there is need to train enough personnel to support and provide the PD method. This will ensure that there is no overcrowding and long queues at the health facilities.

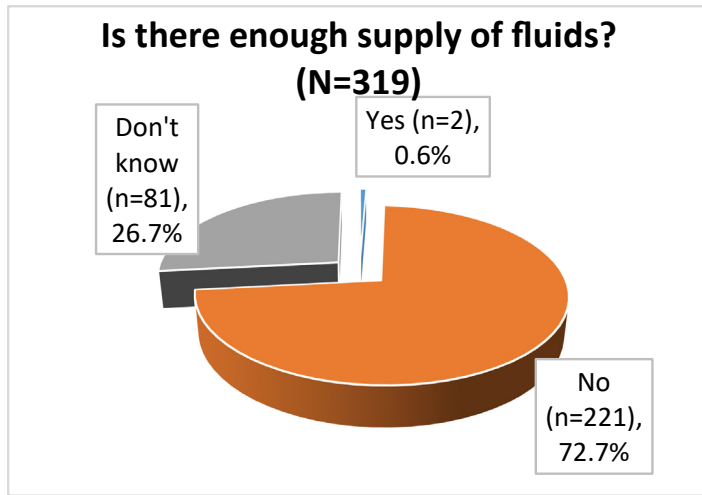


Figure 9: Awareness of PD fluids supplies

#### Health service providers related barriers to PD utilization

These were as follows:

**PD catheter insertions:** majority 66.7% (62) of the health service providers said there were surgeons to insert PD catheters while 29% (27) said there were none as shown in (Figure 10).

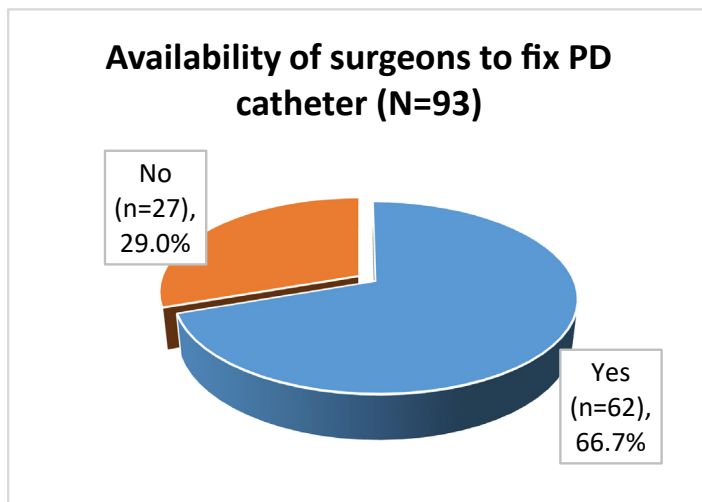


Figure 10: Availability of surgeons to insert PD catheters

#### Infrastructure

Most health service providers 61.3% (57) reported that there is no infrastructure for PD access in the selected hospitals. A minority 35.5% (33) reported that there was infrastructure to PD access as shown in (Figure 11). Therefore it is clear from this research that accessibility of PD fluids is a barrier. (Figure 12) shows that there is no access to PD catheters as indicated by a majority 50.5% (16) health service providers while 31.2% (29) said there is accessibility, 17.2% (16) did not know. The health service providers were asked whether there is production of PD fluids and the majority 68.8% (64) said no, 9.7% (9) said yes and 20.4% (19) said they did not know. This is shown in (Figure 13). There is clear evidence from this study study that there is no local production of PD fluids and this has been a barrier to PD utilization.

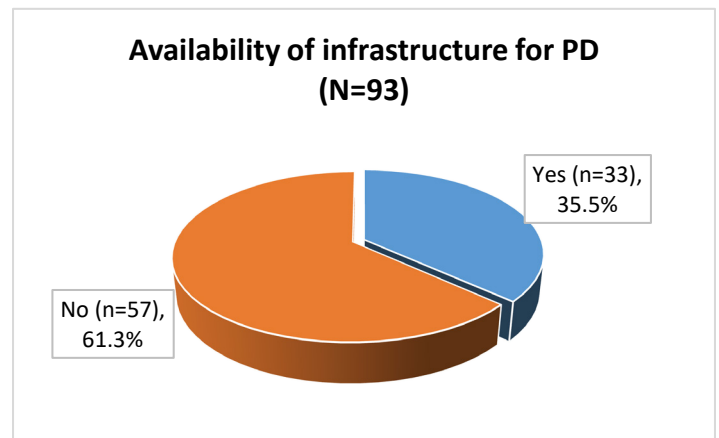


Figure 11: Availability of infrastructure for PD

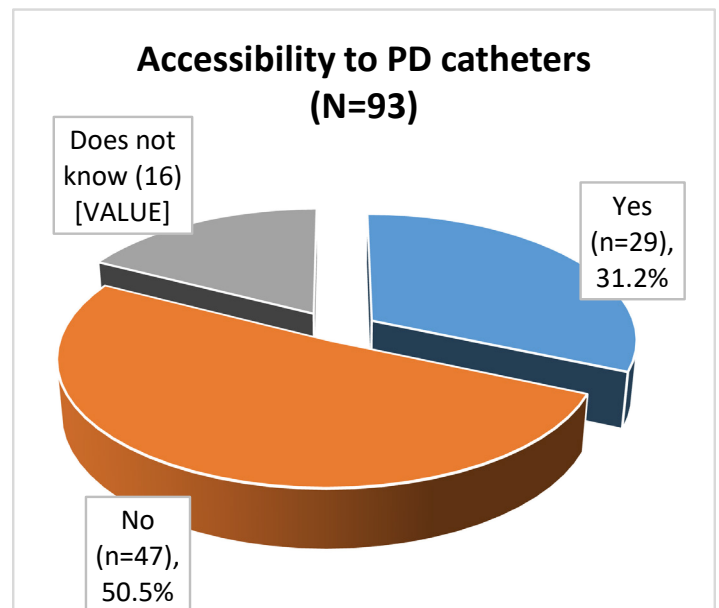


Figure 12: Accessibility of PD catheters

#### Cost as a barrier

Most of the health care providers 54.9% (79) expressed that high cost of PD was a barrier to PD utilization while 9.7% (9) did not

know, 3.2% (3) said it was a barrier as shown in (Figure 14). This shows that high cost is a barrier to PD utilization in Kenya.

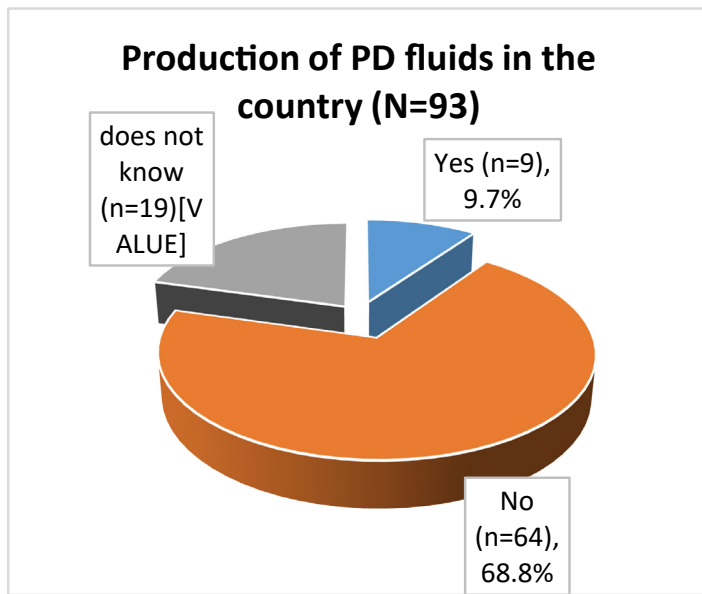


Figure 13: Production of PD fluids in the country

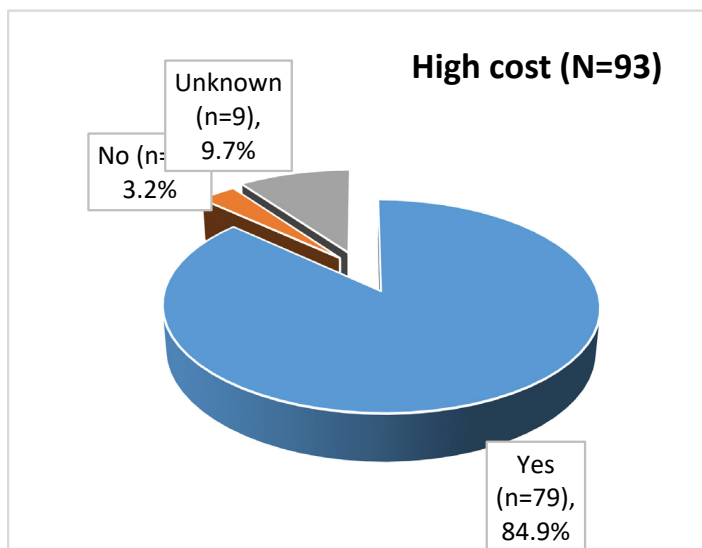


Figure 14: High cost as a barrier to PD utilization.

#### Peritonitis as a barrier to PD utilization

The health service providers 79.6 % (74) felt that infections and peritonitis is a barrier to PD utilization while 11.8 % (11) did not know and 9.7% (n=9) felt it was not. Peritonitis and recurrent infections are seen to be a barrier to PD utilization as shown in (Figure 15).

#### Knowledge barriers among health service providers

Most health service providers in the selected hospitals did not have knowledge on the various dialysis fluids that are used in PD as only 32.3% (30) had the knowledge of PD fluids who said all the listed fluids were useful in PD, 24.7% (23) Said only weak solutions

((1.36% or 1.5% glucose solutions) were useful, 16.1% (15) said only medium solution ((2.27% or 2.25% glucose solutions) were useful, 8.6 % (8) said only the strong solutions (3.86% or 4.25% glucose solutions) were useful and 7.5% (7) felt that none of the fluids were useful in PD. This shows that most health care workers had no or little knowledge on fluids used in PD. 32.3% (30) had knowledge on the special fluids used in PD while 21.5% (20) knew only Icodextrin as the only fluid used out of the several choices made, 11.8 % (11) knew nutrineal as the only solution, 1% (1) thought it was only special calcium solution. The rest 6.5% (6) had no knowledge as to whether the choices provided were useful for PD as shown in (Figure 16).

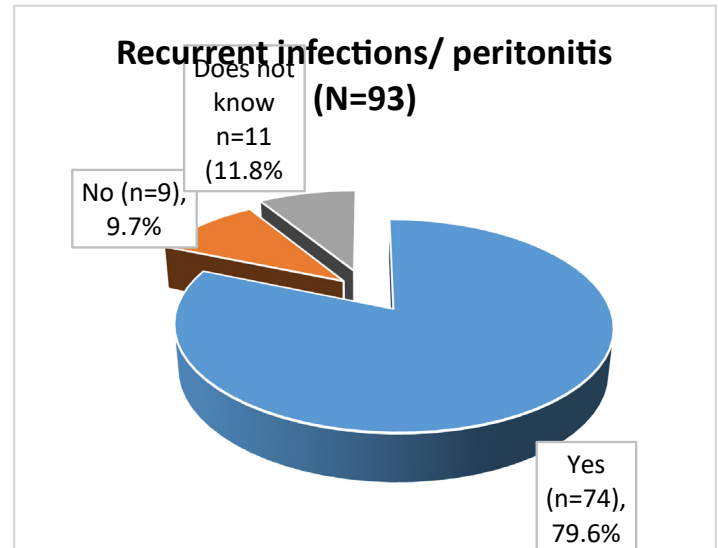


Figure 15: Recurrent infections/Peritonitis as a barrier.

#### Family support

Majority of the health service providers 44.% (41) strongly felt that family support is needed for patients to go on PD. 25.8% (24) agreed, 9.7% (9) were not sure, 6.5% (6) disagreed and 9.7% (strongly) disagreed. This is illustrated in (Figure 17).

#### Qualitative findings

The qualitative findings from the service health providers on suggestions to improve PD utilization in Kenya were Government should support PD through N.H.I.F, need for health education and counselling to the patients and community, More trainings on PD are needed for the nephrology nurses and doctors, need train more nurses and doctors in the universities and colleges on PD, need to produce PD supplies within Kenya and these should be made affordable, need for change of attitudes by health care workers towards PD and PD administration to be made a policy, and not a choice. The qualitative findings from the policy makers offered ways that they thought PD utilization can be improved in Kenya as follows: Capacity building for staff in renal units, Patient training on self-care/ responsibility, NHIF to support, Reduction of the cost of requirements, Increasing the number of qualified staff in the area, Producing data that shows better outcomes, lower costs and Provide PD as an option.

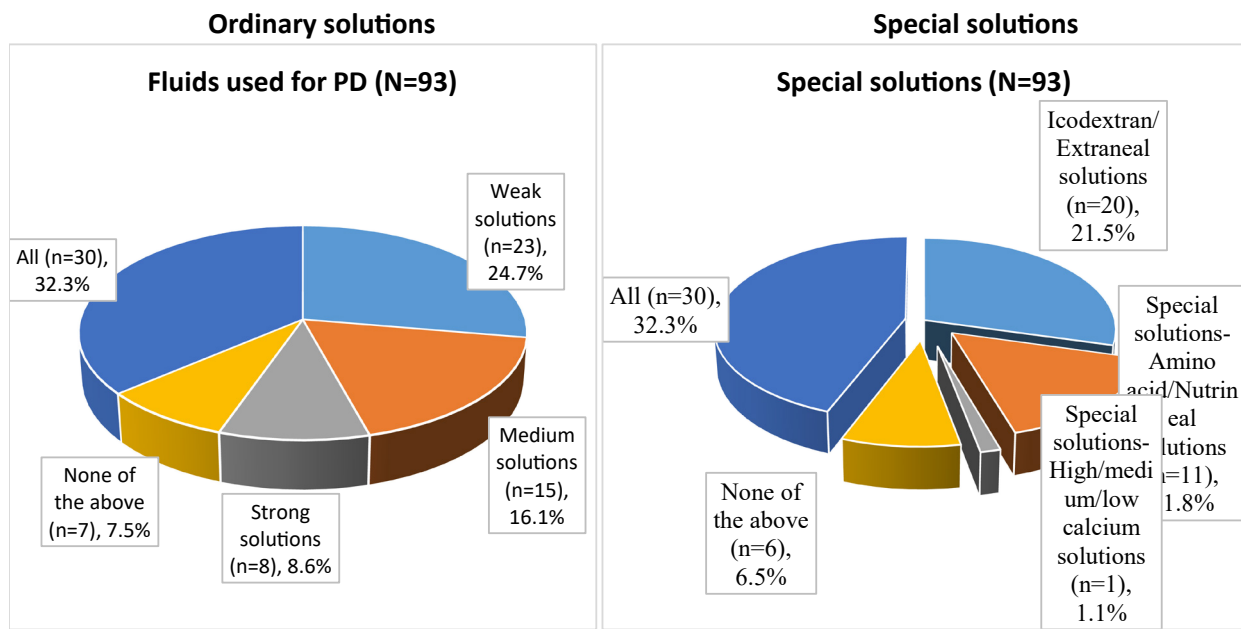


Figure 16: Knowledge of fluids used in PD among service health providers.

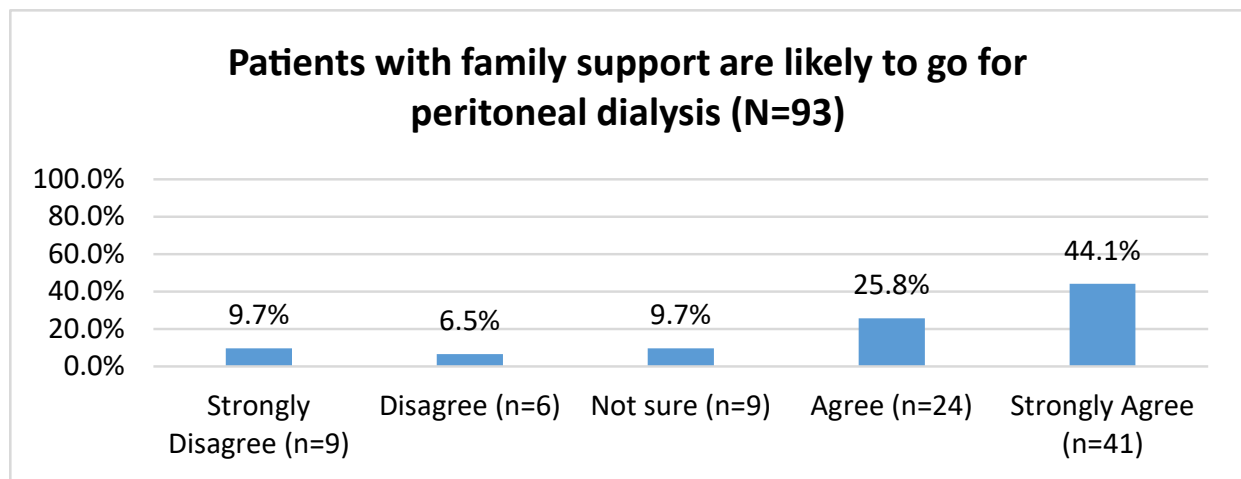


Figure 17: Family support as a barrier to PD utilization.

## Discussion

**PD prevalence:** There is clear evidence that PD has been underutilized in Kenya. This is in consistency with some other parts of the world such as the United States where PD is used for just about 10% of the more than 500,000 dialysis patients on DKRT. In the United Kingdom, PD is used by 13% of the more than 26,000 dialysis patients [6]. Research done in Indonesia revealed a prevalence of 2 % PD use. However, the utilization of PD in Kenya is very low compared to Hong Kong where 73% of patients on maintenance dialysis in Hong Kong are on PD, making it the world's largest relative PD use [7]. Hong Kong has the highest PD use rate in the world [8]. According to Sachdeva et al., PD accounts for less than 7% of the dialysis population in the United States compared to Canada where more than 50% of the dialysis population are on PD. The use of PD in Mexico is quite high where 18% is automated PD, CAPD at 56%. A study done in South Africa,

revealed that the private sector had 7081 patients on dialysis out of which 426 (6.0%) were on PD [5]. Therefore, the prevalence of PD utilization is low even in the leading country in PD utilization in Africa with even a local manufacturing plant of PD fluids. Wearne et al. (2019) noted that some provinces in South Africa practice PD first programs due to increased rationing of dialysis services that has led to increased demand of HD. The government is the primary source of PD services in South Africa. This clearly shows that the epidemiology of PD is quite low in Africa considering that South Africa has the highest PD prevalence yet the proportions are very low. Public-sector units often use a “PD-first” strategy in South Africa. In the public sector, PD was stated to be used as the first KRT modality in 57% of cases. The contribution of PD to dialysis in North African countries, which represent 93 percent of the African dialysis population, is just 0-3 percent [9]. In contrast to HD, the growth of PD usage in Sub-Saharan African countries has been sluggish. The prevalence of utilization



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of PD in Egypt was 0.29/million population in 2017. In Egypt, like most other developing countries, there is a lack of factories manufacturing PD fluids leading to importing these fluids which have made PD very expensive in relation to HD [10]. In Rwanda, PD is conducted in one health center mainly in pediatric set up.

### **Awareness of PD among ESKD patients**

From this research, it is seen that there is a huge awareness gap in PD amongst ESKD patients which is a barrier to PD utilization. This is in consistence with research done by Elzorkany [10] which showed that there is a decreased awareness in the community about PD as the first option of KRT. A Study done by Li et al., [7] showed that information provided on in-centre HD was 90% and on transplantation was 87% than with the information provided on PD 79% or home HD 61%. Limited research has been done on the awareness of PD among ESKD globally thus there exists a huge knowledge gap amongst ESKD patients.

Despite interaction with a health care worker prior to the onset of ESKD, 74.4 percent of patients were started on HD as an emergency (p value 0.001), and 29.3 percent were aware that HD was the only KRT modality (p value 0.001) [11]. Research findings revealed that patients who had been educated on PD were more likely to utilize the PD modality of dialysis. This means that creation of awareness and educating the patients before administration of dialysis can increase the patient's chances of choosing the PD modality of DKRT. The research findings showed that patients who had knowledge about the equipment required for PD were more likely to utilize the PD modality of dialysis. This implies that educating the patients about the equipment used for PD can positively influence their decision to choose the method. The multivariate logistic regression results revealed that patients who had been educated on PD were more likely to choose the PD method. This further justifies that creation of awareness or education about PD is an important factor to the patient's choice of PD modality.

### **Knowledge barriers, medical barriers, physiological barriers and social cultural barriers**

In this study, knowledge barriers, medical barriers, physiological barriers and social cultural barriers were not associated with PD utilization. One of the industry factors (availability of enough supply of fluids) was associated with PD utilization. This means that ensuring a sufficient supply of PD fluids can directly or indirectly influence the patient's choice of PD as a method of DKRT. However, there was significant association between knowledge of a local manufacturing industry and PD utilization. These findings are consistent with Mathew et al. [12] who did a research in Canada where they identified lack of money and anxiety as barriers to PD utilization. Financial restrictions (51.7 percent), insufficient fluid supply (50 percent), recurrent catheter blockage (22.4 percent), and frequent infections are the most common problems faced with PD usage in Nigeria. Lack of PD fluids (50.8 percent) led to closure of PD centers in Nigeria [13]. Money related issues are the most significant obstacle to PD programs as most developing nations have no medical coverage

Model. Most of patients are financing their very own treatment and there is lack of experienced physicians [10]. Most patients have no knowledge of PD being done at home and this becomes a barrier to PD uptake [14].

### **Health system barriers**

None of the health system factors (knowledge of availability of PD insurance cover and knowledge of availability of PD favoured first policy or PD first policy) was associated with PD utilization. Insurance cover for PD or even PD favoured first policy cannot change the perspective or view of ESKD patients towards the choice of PD. The research findings showed that the Chi-square test revealed that availability of enough supply of PD fluids was associated with PD utilization ( $p < 0.001$ ). This was not significant in the multivariate analyses.

### **PD catheter insertions**

The research findings showed that PD catheters in Kenya are mainly fixed by surgeons which can be a barrier when surgeons are occupied leading to a compromise on PD uptake. Fruitful usage of urgent start PD is important in increasing PD uptake and it requires the capacity to teach late coming patients without prior warning treatment alternatives, place PD catheters in an auspicious way; and offer PD in an emergency clinic or dialysis office until the patient can be prepared to perform the treatment securely at home [14]. Pajek (2015) noticed that a committed catheter insertion group accessible day in and day out is the fundamental condition for intense spontaneous beginning of PD. An accomplished and devoted nephrologist performing catheter insertions accessible at the dialysis unit and availability of procedural rooms are crucial in the success of a PD program. The set-up of interventional nephrology catheter insertion administration was accounted for to empower development of PD programs. The consideration of interventional nephrologist catheter insertions has brought about a generally enormous PD entrance of 44.8% in one of the reports. Another investigation announced an expansion in the pervasiveness of PD from 16–18% to 22–32%. There is need to advocate for preparing of specialists and medical caretakers to insert PD catheters at the bedside. A timely and successful catheter placement is key in improving uptake. PD catheter insertion by a dedicated nephrology team within 24 hours is necessary for an acute unplanned PD. The setup for interventional nephrology avoiding delays in the operation rooms improved PD uptake. The inclusion of interventional nephrologist's catheter placement led to PD penetration by 44.8%. Several health-care sector reforms, such as targeted support, PD First programs, or physician-inserted PD catheters, have been shown to improve PD use [15]. Unavailability of PD catheters (22.8 percent), and lack of specialist staff to train (15.8%) were all cited as reasons for the PD centers' closure [13].

### **Family support**

Majority of the health service providers strongly felt that family support is needed for patients to go on PD. This is in consistent with a study done in Canada that showed that assisted PD and family support increased PD use from 23 to 39 percent for patients with PD. Therefore, family support is very important in PD utilization.

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## Health system barriers

From this research, it is clear that there were no government policies in PD in Kenya. In 2008, Thailand's government introduced a "PD-First" policy as part of its universal health care program. In Hong Kong, the policy indicates that dialysis facilities would only be paid for if the patient is provided with PD, which is less expensive. China has a policy that promotes PD treatment. In each of these three nations, the use of PD has grown at an exponential rate [14]. Therefore, lack of policies that govern PD in Kenya is a barrier to PD utilization.

## Infrastructure

Most health service providers 61.3% (57) reported that there was no infrastructure for PD access in the selected hospitals. majority of the health service providers strongly agreed that infrastructure at the health facility will influence the use of PD. This study is similar to Sudan where fluids are shipped through Sudan port from Europe and the Middle East after which they are transported further interior around a 1000km. This process adds to the cost leading to under dialysis especially if the dialysis solutions cannot reach the patients [16].

## Cost barrier

Financial problems are the most important hurdle to PD programs as most developing countries have no health insurance system. The majority of patients are financing their own treatment. Since the fluids are not manufactured locally, the cost of importing fluids is very high since they are bulky. In South Africa, the annual PD-cost is about 50% of that of HD. This is because fluids are manufactured locally. In all other African countries, PD fluids are not manufactured locally [16]. A study done by Makhele et al. [17] revealed that HD is more expensive than PD. Chang et al. [18] did a study that revealed PD to be cheaper than HD, had cost-effective advantage and acknowledged that the costs for PD are a bit low than HD in most countries. Since HD is expensive, existing guidelines say that it should be the last priority for LMICs looking to develop kidney care. On the other hand, Cho et al. [2] conducted a global study and found that the governments of 64 countries funded the costs of PD catheter placement fully, leaving patients with no out-of-pocket expenses. In 47 nations, patients partly paid bills due to a combination of public and private financing schemes. This policy adapted in Kenya can help reduce barriers to PD utilization. PD is less commonly used than convection HD because of the prohibitively high costs of PD fluids and the perceived high rate of peritonitis [7].

## Knowledge barriers among health service providers

The health care providers in the selected hospitals did not have knowledge on the various peritoneal dialysis dialysis solutions used in PD. This is in consistency with other researches done in Latin America that revealed that there are few trained nephrologists and nurses in Latin American countries. There is no PD training curriculum in the region. Training is, thus, not offered to residency programs. A large number of trainees do not get enough PD attention. This problem is a huge stumbling block to the spread of PD in Latin America. As a result, non-nephrologists often operate

PD centers in Mexico (but not hemodialysis programs). Inadequate PD teaching for nephrology students has become a roadblock to starting and maintaining PD [19]. Preparing of staff at nursing homes for PD conveyance in the use of PD is very important [20].

## Peritonitis as a barrier to PD utilization

Peritonitis has made PD unpopular in Rwanda [21]. It is the most common cause of death and technique failure. Lack of permanent clinical coordinator PD nurse in the PD clinic and lack of home follow up is the route course of increased peritonitis [7].

## Conclusion

There is data to suggest that PD is underused in Kenya. PD has been a successful mode of DKRT with positive response from patients. However, there has been a progressive decline in patient recruitment for this self-care modality. There are some subtle and some real nonmedical reasons for PD underutilization, some of which are financially based. From the research findings, Cost of PD fluids seems to be a major constraint given that many countries in Africa do not have the capacity to manufacture PD fluids but instead rely heavily on PD fluids imported from developed countries. Low patient education and motivation was also found to be a major barrier with a huge population unaware of PD.

## Recommendation

It is important to make PD widespread and provide tools to start regional production of PD fluids to reduce the cost of PD. **Education and training are needed and these are areas where international societies can be of great help.** Africans must start to find practical solutions to their own problems rather than incessantly expect foreign aid. Although there is poverty and a massive burden of disease in Africa, many African governments must start taking responsibility for their own people by providing funds for kidney replacement programs and by initiating a dialogue with the private sector on how to sustain such programs. Africa has benefited from different schemes supported by the Commission for the Global Advancement of Nephrology (COMGAN) but more focus on sub-Saharan Africa is required to fulfil the pressing need for PD training. Patient awareness of PD should be enhanced.

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