Chronic kidney disease in Nigeria: an evaluation of the spatial accessibility to healthcare for diagnosed cases in Edo State

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Abstract

Chronic kidney disease (CKD) is a growing problem in Nigeria, presenting challenges to the nation's health and economy. This study evaluates the accessibility to healthcare in Edo State of CKD patients diagnosed between 2006 and 2009. Using cost analysis techniques within a geographical information system, an estimated travel time to the hospital was used to examine the spatial accessibility of diagnosed patients to available CKD healthcare in the state. The results from the study indicated that although there was an annual rise in the number of diagnosed cases, there were no significant changes in the proportion of patients that were diagnosed at the last stage of CKD. However, there were indications that the travel time to the hospital for CKD treatment might be a contributing factor to the number of diagnosed CKD cases. This implies that the current structure for CKD management within the state might not be adequate.

Introduction

Chronic Kidney Disease (CKD) is recognised as a major contributor to the global burden of disease in both rich and poor countries.[1] If detected at an early stage, treatment is relatively inexpensive and the condition often progresses no further. However, this requires a good level of awareness, and prompt referral to a specialist service. In turn this requires access to good quality primary healthcare. Should a CKD diagnosis not be made until the condition is advanced, the treatment can be prohibitively expensive and detrimental to the patient's quality of life, and the outcome is inevitably very poor.

Access to healthcare can be defined as *the ability to secure a specified range of services at a specified level of quality, subject to a specified maximum level of personal inconvenience and costs, whilst in the possession of a specified level of information*.[2] Accordingly, access to healthcare is not limited to physical accessibility but is also influenced by both affordability and the level of awareness of the existing healthcare services. It has been argued that the limited access to, and affordability of, healthcare by people in low socio-economic status areas demonstrates the inverse care law,[3-5] which suggests that healthcare services are distributed inversely to population health needs.[6]

Whilst ability to pay is paramount, accessibility to healthcare also involves proximity to suitable service providers, transportation networks, socioeconomic and cultural characteristics and decision-making strategies of the individuals.[7] A service has to be accessible before it can be utilised. Studies have suggested that distance to healthcare services influences their accessibility and utilisation especially in developing countries.[8] A meaningful evaluation of geographical access remains elusive in many developing country contexts, partly because public transport is unregulated and its temporal and spatial coverage irregular, nevertheless, it may still play an important role for a significant proportion of the population.[9]

Studies have demonstrated unequal access to healthcare especially for the treatment of chronic diseases, which suggests that distance to healthcare and the total cost of seeking healthcare need to be reduced.[10-12] In Nigeria, the provision of healthcare is currently managed by the three tiers of Government.[13,14] The federal government's role coordinates the university teaching hospitals, providing tertiary or specialised healthcare, whilst the state government manages the general hospitals (secondary healthcare) and local government focuses on primary healthcare. Nigeria does not offer free healthcare to patients apart from a national health insurance scheme (NHIS),[15] which covers 90 percent of the cost of some basic health services. However the people that can access this scheme comprise less than 5 percent of the nation's population.[16,17] It can thus be assumed that the majority of patients within the country are expected to pay for any healthcare service that they receive. Therefore, within the current system, the financial burden for a chronic disease such as CKD is the sole responsibility of the patient. Hence accessibility both in terms of cost and physical access can have a significant impact on the effectiveness of CKD management within the country. It can be argued that within Nigeria, population access to tertiary care, including specialised healthcare for chronic diseases, is limited as these services are located in large urban areas. Most of the rural population are too poor to pay for the service and even if they could afford the treatment, there is the absence of an efficient transportation system to enable access.[18] Evidence from past censuses indicates that over 70 percent of rural dwellers are within the low socioeconomic groups.[19]

Although CKD is a growing problem in Nigeria, due to the lack of a national CKD register, the national prevalence rate is not known. Hospital-based data estimated that CKD patients accounted for 2% to 4% of hospital admissions,[20] yet in 2007 estimates of between 10% and 12% were reported.[21] CKD is categorised into five stages at diagnosis, with Stage 5 also known as end stage renal disease (ESRD) indicating a total or near-total loss of

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kidney function, needing renal replacement therapy such as dialysis or a kidney transplant. The early detection of CKD is one of the best ways of treating and managing the disease.

In Nigeria, studies have indicated that the majority of patients are diagnosed at the final stage of the disease when the cost of treatment is usually beyond the financial capacity of the average citizen.[22,23] It is clear that the majority are unable to either begin or continue treatment for any length of time[24-27] and so they die.[21]

Materials and Methods

The study area for this research was Edo State, located in the Niger-delta region of Nigeria, with an estimated population of 3.5 million.[28] There are eighteen local government areas (LGAs) in Edo State with an average of 10 political wards in each LGA. In total, there are 193 wards within the state (Figure 1). The wards are the smallest unit of health service delivery.

The study investigated the accessibility of people diagnosed with CKD to healthcare in Edo State. At the time of the study, only one healthcare service had a fully functioning CKD treatment centre and this was the University of Benin Teaching Hospital (UBTH), located within the state's capital. Since the renal centre at the hospital is also responsible for the treatment of CKD cases within the entire Niger-delta region, CKD patients residing just within the boundary of Edo state cannot travel to neighbouring states for treatment. CKD data were collected at UBTH. Ethical approval was granted by the UBTH Ethics Committee.

As outlined above, travel time or distance to a healthcare service may be an impeding factor to seeking treatment. A Geographical Information System (GIS) was used to estimate average travel times and hence evaluate physical access to UBTH. The aim was to examine whether the number and spatial distribution of diagnosed CKD patients were associated with their physical proximity to healthcare.

Data were collected from patient records at UBTH. Patients diagnosed for any non-chronic kidney disease, and those not residing in Edo state when initially diagnosed were excluded from the study. The latter group was not easily identifiable as some patients stated a temporary address in Edo state as their permanent address. Hence each patient's file had to be searched for any information that indicated that he/she lived outside the state before coming to the hospital (for example, a referral letter from any health institute outside Edo state). Whilst 609 patients qualified for inclusion in the research study, 167 CKD patients' files could not be found. This left 442 cases (72.6%) eligible for analysis. Two phases of data collection were used: the major retrieval during fieldwork from July to October 2009, then a second visit at the beginning of 2010 to retrieve records not available during the first visit.

None of these CKD patients were diagnosed at the first stage of the disease. Only 27 CKD patients were diagnosed at stage 4. Although stage 4 CKD is characterised by a low kidney function, it can still be adequately managed using treatments which are more affordable than those required for ESRD.[29] There was a steady increase in the number of patients with CKD stages 2 to 4 diagnosed between 2006 and October 2009. However, as Figure 2 shows, there was still a large margin between those diagnosed with earlier stages of CKD and the last stage of CKD.

The implementation of a GIS required patient data and a map base. Although maps showing states and LGAs within Nigeria are available, ward boundary maps showing detailed road networks are not. The ward boundary map was created for this study by the Regional Centre for Training in Aerospace Surveys (RECTAS) agency at Ile Ife, Nigeria. This agency also generated a road network dataset.

There were two main limitations with the road network. The first was the absence of detailed street and road networks for towns and settlements outside the state's capital. This meant that only the access roads to and from these areas could be included. The absence of a street network outside Benin city also made it impossible to generate a comprehensive pedestrian travel model using the available road network that would represent a realistic travel-time for pedestrians especially those walking from long distances (*i.e.* from outside Benin City). Therefore, the travel-time for the CKD patients was only calculated for

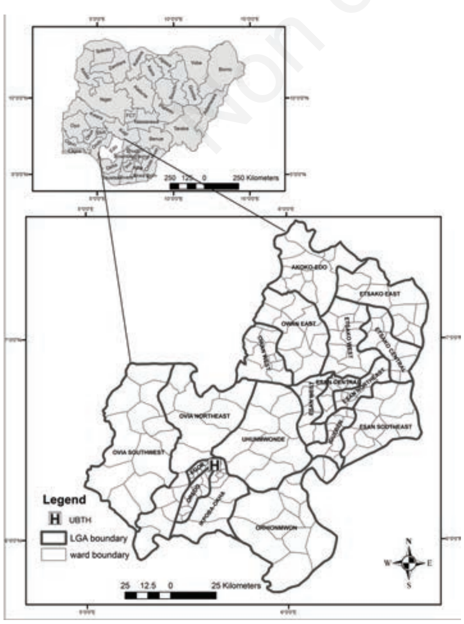

Figure 1. The study area of Edo State, Nigeria.

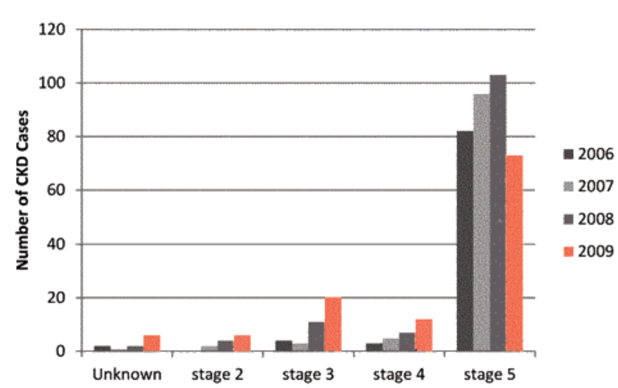

Figure 2. Chronic kidney disease stages at diagnosis, 2006-2009.

the vehicular travel-time to the hospital. This is an unavoidable limitation, but given that the majority of the patients were at the last stage of CKD, it is unlikely they would have been able to routinely walk very long distances to and from the hospital. It does indicate that some further research exploring modes of transportation could be undertaken. The second limitation was the absence of any road network data for the southwestern area of the state, limiting network analysis. Attempts at using paper maps and using Google Earth were equally unsuccessful as the satellite image was not clear enough to trace the road networks that might be present. Ultimately no CKD patients resided in this area, so the absence of road network data in this area did not restrict the results generated. Hence this limitation did not influence the outcome of the study.

Different driving speeds were allocated to the differing road types within the road network, ranging from 20-50 mph. For the accessibility analysis, the patients' residential addresses needed to be geocoded so they could be mapped, and the distance from each to the healthcare service could be calculated. The address geocoding was not a straight-forward process as the information needed within a GIS platform was not available. The initial georeferencing technique attempted was to geocode the patients' addresses using the roads as a reference dataset and to create address locators in order to identify the associated geographic coordinates for each patient. However, the road data did not have the necessary features required for the creation of an address locator. The next method was to use Google Earth as a platform. Investigations had shown that Google Earth could be used for geospatial work as the range of error for georeferencing using satellite images on Google Earth was within 15 metres.[30] The majority of the patients had enough address details to locate their homes or streets on Google Earth. The remaining 5% of cases were assigned manually.

GIS service area analysis techniques were used to examine the CKD patients' accessibility to CKD healthcare facilities within the state (using ArcGIS10 software). There was the need to evaluate the impact of distance to the hospital and the spatial distribution of diagnosed CKD cases. The analysis could help to identify deficiencies in CKD management and potentially recognise sub-populations who were at risk but had limited access to CKD healthcare. Travel time was used as the impedance instead of distance. This has been regarded as an appropriate indicator for geographical access.[31] The network analysis functionality within the GIS was used to calculate the travel time to the hospital (Figure 3). The impedance was set to the travel time with four bands selected to indicate the various travel time towards the hospital. These were 10 minutes, 30 minutes, 90 minutes, and 150 minutes. The resultant travel time bands are shown in Figure 3.

As outlined earlier, the travel estimation was based on the use of a vehicle as the mode of transport and this did not take into consideration the waiting times at a public station and the interval stops in order to drop or pick up passengers for those that use public transport. Also excluded from this analysis was the estimation of pedestrian travel time. This was because the road data available was not sufficiently detailed to give a realistic result. In addition, as most cases were ESRD, these patients would be unlikely to be able to walk long distances.

Results

Earlier stages of CKD were defined as those diagnosed with stage 2 to stage 4 while ESRD was classified as the late stage. ESRD patients require some form of renal replacement therapy (RRT) such as dialysis and will ideally have to travel to hospital at least 3 times a week.[32] Of the 442 cases, 354 patients were diagnosed with ESRD;42.3% of these patients did not take part in any dialysis sessions even though their health files indicated this was required. Only 5 patients had more than 30 dialysis sessions. Clearly very few patients were undertaking the optimal number of dialysis sessions required to maintain their kidney functions. All the patients cited in their health files that lack of funds was their primary reason for either not commencing, or discontinuing dialysis. As shown in Figure 4, the results indicated that almost 70% of the CKD patients resided within a 10-minute travel distance from the hospital, while 1.8% of the CKD patients had to travel for over 90 minutes.Within Benin City 304 out of 345 CKD patients lived within 10 minutes from the hospital while the remaining 36 CKD patients were approximately 30 minutes away from the hospital.

Table 1 shows distance to the hospital by stage of CKD at diagnosis. Those diagnosed at the earlier stages had an average travel time of 28 minutes and 69.3% resided within a 10 minute travel time. More patients resided

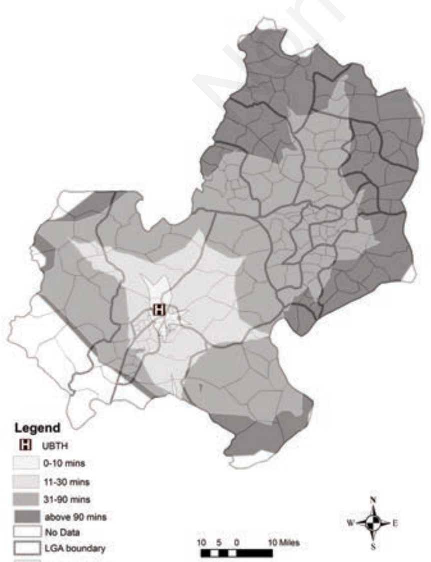

Figure 3. Travel time bands of accessibility to the hospital.

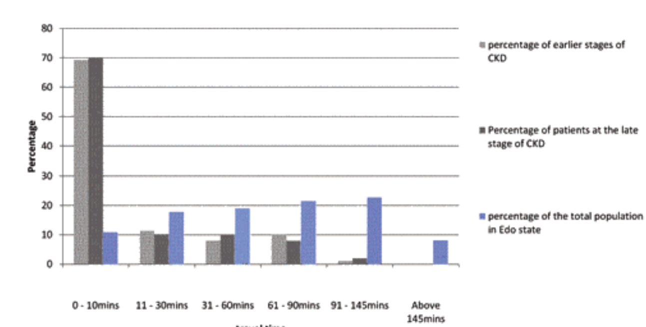

Figure 4. Chronic kidney disease stage and travel time to healthcare at the University of Benin Teaching Hospital (Nigeria).

between 31 minutes to 90 minutes than those within 11 to 30 minutes. This could be attributed to the presence of a major urban centre (Ekpoma town) within that band as opposed to the rural settlements within the previous band, as well as a network of secondary roads within that town that connects it to Benin City. Based on the argument about the impact of geographical accessibility to UBTH, it is plausible to assume that cases residing in urban areas that are further away from the hospital are more likely to be diagnosed than those residing in rural areas that are closer to UBTH, due to available road networks. As mentioned earlier, approximately 70% of those diagnosed at the late stage of CKD cases resided within a 10 minute journey to the hospital. However, there was a sharp decline in the number of diagnosed cases that resided within the next travel time band of 11 to 30 minutes and the number of diagnosed cases dropped as the time interval increased. Although most CKD patients at the last stage of CKD are unable to afford regular dialysis, their health status is regularly monitored by the nephrologists at the hospital. There is therefore the possibility that most of these patients might have moved closer to the hospital to reduce their travel time. Doctors had commented on their frustration at the helpless situations of the patients because the patients usually arrived at the point when very little could be done for them patients given their inability to afford the dialysis sessions (Renal Consultant UBTH, 2010, personal communication). However, this did not dissuade the patients from regularly coming to the hospital for check-ups. This might explain the large proportion of ESRD patients residing within a 10-minute distance from UBTH.

Discussion

To some extent, the location of CKD patients will be a function of the wider population geography of Edo state: even if there were no inverse care issues, places with concentrations of population would be more likely, in absolute terms, to have more CKD patients than more sparsely-populated areas. However, this did not account for the geography of diagnosed CKD patients' locations. This is confirmed by comparing the proportion of CKD patients in each band of travel time from UBTH with the proportion of the overall state population (based on the ward populations of the 2006 census) in the same band (Table 1).

The two geographies are quite different. The relative differences in travel times to the hospital for patients and for the public at large are substantial, as illustrated by the last row in Table 1, which expresses the percentage of all CKD patients living in each travel time band as a ratio of the equivalent percentage of the total population. The percentage of CKD patients living within 10 minutes of UBTH was approximately 6 times higher than the percentage of the population not doing so. But in all other travel time bands, the relative share of the state population living there exceeds the relative share of patients, and the under-representation of patients relative to the population as a whole worsens dramatically at increasing distance. These results suggest that distance may be an important impeding factor to the diagnosis of CKD within the state. There might be more CKD cases not coming to the hospital for treatment because of the long distance: clinics and hospitals outside the city may be referring patients to UBTH but these patients cannot make the journey. The travel time evidence demonstrates a steep distance decay effect in the access to the renal department. CKD patients are over-represented relative to the general population in the travel time band nearest the hospital, but are noticeably lower in all the other bands. One possible explanation could be that there is a strong inverse care process where only those living very close to the hospital have a realistic chance of being diagnosed. Another possible explanation is that individuals diagnosed with CKD from elsewhere in the state move into Benin City and live with friends/relatives or rent/buy accommodation when they realise they need treatment at UBTH. Unfortunately there is little reliable internal migration data. Geographical accessibility and affordability of CKD treatment are likely to be key factors affecting the spatial distribution of diagnosed cases within the state. Possibly people who live nearer the hospital might be better informed about CKD, which could have led to more cases being diagnosed close to the hospital.

The low number of diagnosed CKD cases within the rural areas might be due to the problem of accessible road networks. A study on rural roads within Nigeria reported that more than 70% are in a deplorable conditions and their accessibility can be classified as seasonal due to the obstruction of these roads during the rainy season.[18] Since these are feeder roads that connect to the rest of the road network, they compound the problem of inaccessibility. This might also explain why there appears to be more diagnosed CKD cases from urban areas that are further away from Benin City than the rural areas closer to the city.

This study has highlighted the possibility that geographical access to CKD healthcare contributes to the spatial pattern of diagnosed CKD cases within the state. It can be argued that given the large proportion of rural dwellers, the likelihood that many will have family or friends within Benin City to help bear the cost of treatment and accommodation is quite small. The absence of reliable data on socio-economic status and migration makes it difficult to determine the reasons for and/or number of those who have actually migrated as a result of their illness. Knowing which of these assumptions is the most likely will have significant policy implications. Although some studies have looked at the prevalence rate of CKD within certain states within the country,[26,27,33-35] due to the non-availability of data on the national prevalence rate of CKD, it is not possible to evaluate how these assumptions might be influencing access to healthcare by CKD patients across the country.

There is a strong argument for locating more renal centres in the state. One such centre has been established at Irrua Specialist Hospital, but does not offer the full range of treatment. Limited accessibility from rural areas to UBTH might account for the current spatial pattern of diagnosed CKD within the state. The limitations associated with the data mean that these results can only serve as a baseline for further investigations on optimal locations for CKD healthcare services. The outcomes from the modelling approach could help health planners to evaluate the organization of the available CKD services both from the managers of the healthcare service and patients'

Table 1. Estimated travel distance in minutes within Edo State, Nigeria to the hospital for chronic kidney disease treatment.

Distance in minutes to Hospital	0-10 min	11-30 min	31-90 min	91-145 min	>145 min
Total number of CKD cases (%)	309 (69.9)	46 (10.4)	79 (17.9)	8 (1.8)	0
Number of CKD cases at the earlier stages (%)	61 (69.3)	10 (11.4)	16 (18.2)	1 (1.1)	0
Number of CKD cases at the late stage (%)	248 (70.1)	36 (10.2)	63 (17.8)	7 (2)	0
Total population within Edo State* (%)	367,833 (11.4)	596,874 (18.4)	1,283,490 (39.7)	817,205 (25.2)	171,334 (5.3)
Ratio of all diagnosed CKD cases and the total population	07:1	0.6:1	0.4:1	0.07:1	0.000:1

CKD, chronic kidney disease. *2006 census statistics.

viewpoints. This study is the first in Nigeria to examine the spatial distribution of diagnosed CKD patients as well as their accessibility to available CKD healthcare services. The findings suggest that the current CKD treatment provision within Edo state is still far from adequate. This is especially evident for ESRD patients who despite their inability to afford the dialysis treatment that many of them would need,[26,27] would still have to travel long distances to the hospital for their medical treatments. The study has demonstrated the applicability of the inverse care law by showing that accessibility between the rural and urban areas has been found to be unequal. Spatial inequalities in access to CKD healthcare are critical issues that need to be addressed. It is possible that this situation within Edo state is similar to other states where more needs to be done within the rural areas as many cases are left undetected until it is too late. Early preventive measures, including the location of accessible CKD screening centres, could contribute to improving the health status of the population, particular important as the numbers of cases are rapidly increasing. Such diseases affect the economically productive age-groups, and their prevention/early detection makes sound economic sense.

Conclusions

This study has demonstrated the advantages and the challenges in the application of spatial analysis in the health sector within a Nigerian context. It has shown that it is possible to utilise GIS within the health sector of a developing country where data are limited because spatial processes, previously overlooked, can now be examined in better detail. This approach can support the development of insightful health policy decisions that could lead to the improved management of healthcare. The outcome of this study can pave the way for more extensive investigations on the spatial patterns of CKD within Nigeria.

References

1. Hossain MP, Palmer D, Goyder E, El Nahas AM. Social deprivation and prevalence of chronic kidney disease in the UK: workload implications for primary care. QJM 2012;105:167-75.
2. Goddard M, Smith P. Equity of access to health care services: theory and evidence from the UK. Soc Sci Med 2001;53:1149-62.
3. Bishai D, Opuni M, Poon A. Does the level of infant mortality affect the rate of decline? Time series data from 21 countries. Econ Hum Biol 2007;5:74-81.
4. Furler JS, Harris E, Chondros P, et al. The inverse care law revisited: impact of disadvantaged location on accessing longer GP consultation times. Med J Aust 2002;177: 80-3.
5. Ross S. An illustration of the inverse care law: a commentary on giving birth in Canada: providers of maternity and infant care. J Obstet Gynaecol Can 2005;27:51-3.
6. Hart JT. The inverse care law. The Lancet 1971;297:405-12.
7. Meade MS, Earickson RJ. Medical geography. 2nd ed. New York: The Guilford Press; 2000.
8. Buor D. Analysing the primacy of distance in the utilization of health services in the Ahafo-Ano South district, Ghana. Int J Health Plann Manage 2003;18:293-311.
9. Tanser F, Gijsbertsen B, Herbst K. Modelling and understanding primary health care accessibility and utilization in rural South Africa: an exploration using a geographical information system. Soc Sci Med 2006;63:691-705.
10. Antai D, Wedren S, Bellocco R, Moradi T. Migration and child health inequities in Nigeria: a multilevel analysis of contextual- and individual-level factors. Trop Med Int Health 2010;15:1464-74.
11. Awoyemi TT, Obayelu OA, Opaluwa HI. Effect of distance on utilization of health care services in rural Kogi State, Nigeria. J Hum Ecol 2011;35:1-9.
12. Omonzejele PF. The right to healthcare in african countries: Nigeria in view-a moral appraisal. Stud Ethno Med 2010;4:37-42.
13. Akhtar R, ed. Health care patterns and planning in developing countries. New York: Greenwood Press; 1991.
14. Orabuchi A. Poor healthcare system: Nigeria's moral indifference Nigeria. 2005 Available from: http://www.kwenu.com/publications/orabuchi/poor_healthcare.htm
15. Odeyemi I, Nixon J. Assessing equity in health care through the national health insurance schemes of Nigeria and Ghana: a review-based comparative analysis. Int J Equity Health 2013;12:1-18.
16. Arin D, Hongoro C. Scaling up national health insurance in Nigeria: learning from case studies of India, Colombia, and Thailand. Futures Group, Health Policy Project, Washington, DC. 2013.
17. Onoka CA, Hanson K, Hanefeld J. Towards universal coverage: a policy analysis of the development of the National Health Insurance Scheme in Nigeria. Health Policy Plan 2015;30:1105-17.
18. Ipingbemi O. Exploring labour-based approach for rural road maintenance in Nigeria. J Soc Sci 2008;17:103-11.
19. National Population Commission. Census Awareness Attitude Survey. 2005. Available from: http://www.population.gov.ng/files/caas_executive_summary.pdf.
20. Akinsola A, Adelekun T, Arogundade F. Magnitude of the problem of CRF in Nigerians. Afr J Nephrol 2004;8:24-6.
21. Kidney Consultants International. Kidney Care: KCI Nigeria; 2007. Available from: www.kcinigeria.org.
22. Arogundade FA, Barsoum RS. CKD prevention in Sub-Saharan Africa: a call for governmental, nongovernmental, and community support. Am J Kidney Dis 2008;51:515-23.
23. Ulasi II, Ijoma CK. The enormity of chronic kidney disease in Nigeria: the situation in a teaching hospital in South-East Nigeria. J Trop Med 2010;2010:1-6.
24. Arije A, Kadiri S, Akinkugbe OO. The viability of hemodialysis as a treatment option for renal failure in a developing economy. Afr J Med Med Sci 2000;29:311-4.
25. Bamgboye EL. Hemodialysis: management problems in developing countries, with Nigeria as a surrogate. Kidney Int 2003;63:93-5.
26. Ajayi S, Raji Y, Bello T, et al. Unaffordability of renal replacement therapy in Nigeria. Hong Kong J Nephrol 2016;18:15-9.
27. Makusidi MA, Liman HM, Yakubu A, et al. Hemodialysis performance and outcomes among end stage renal disease patients from Sokoto, North-Western Nigeria. Indian J Nephrol 2014;24:82-5.
28. NPC. Population Distribution by Sex, State, LGAs and Senatorial District: 2006 Census Priority Tables. Abuja: 2006.
29. El Nahas M. The global challenge of chronic kidney disease. Kidney Int 2005;68: 2918-29.
30. Redzwan G, Ramli MF. Geo-referencing the satellite image from Google Earth by relative and absolute positioning. Malaysian J Sci 2007;26:135-41.
31. McLafferty S. Predicting the effect of hospital closure on hospital utilization patterns. Soc Sci Med 1988;27:255-62.
32. Locatelli F, Buoncristiani U, Canaud B, et al. Dialysis dose and frequency. Nephrol Dial Transplant 2005;20:285-96.
33. Arogundade F, Sanusi A, Hassan M, Akinsola A. The pattern, clinical characteristics and outcome of ESRD in Ile-Ife, Nigeria: is there a change in trend? Afr Health Sci 2011;11:594-601.
34. Okafor C, Kankam C. Future options for the management of chronic kidney disease in Nigeria. Gender Med 2012;9:S86-93.
35. Okoye OCA, Oviasu E, Ojogwu L. Prevalence of chronic kidney disease and its risk factors amongst adults in a rural population in Edo State, Nigeria. J US-China Med Sci 2011;8:471-81.