The Comorbidity Profile among Chronic Kidney Disease Patients in Clinical Practice: A Prospective Study

Olumuyiwa John Fasipe¹, Peter Ehizokhaliel Akhideno², Sampson Omagbemi Owhin³, Fidelis Azagbor Ilukho⁴, Oluwatosin Beatrice Ibiyemi-Fasipe⁵
¹Department of Clinical Pharmacology and Therapeutics, University of Medical Sciences, Ondo City, Ondo State, ²Department of Internal Medicine, Irrua Specialist Teaching Hospital, Irrua, ³Department of Clinical Pharmacology and Therapeutics, Edo University, Iyamho, Edo state, Nigeria

ORCID:
Olumuyiwa John Fasipe: https://orcid.org/0000-0001-8761-1709

Abstract

Background: The comorbidity profile among chronic kidney disease (CKD) patients can influence and predispose them to increase mortality and health-care costs. In addition, there could also be a prolongation in the length of hospital stay and recurrent frequency of hospitalization.

Aim: This study was predominantly designed to highlight and create awareness concerning the burden of comorbidity profile among CKD patients in renal practice.

Materials and Methods: This was a descriptive prospective study of 18-month duration that was carried out to review the medical case records of consented adult CKD patients attending a Nigerian Tertiary Kidney Care Hospital from January 2015 to June 2016.

Results: This study involved 123 consented adult CKD patients comprising 82 (66.67%) males and 41 (33.33%) females, with a mean age of 53.81 ± 16.03 years. A majority of the respondents 45 (36.59%) were having 2 comorbidities with hypertension in 103 (83.70%), diabetes mellitus in 39 (31.70%), obesity in 24 (19.51%), heart failure in 11 (8.90%), obstructive uropathy in 8 (6.50%), human immunodeficiency virus infection in 7 (5.70%), peptic ulcer disease/gastroesophageal reflux disease in 7 (5.70%), gastroenteritis/gastrointestinal tract sepsis in 6 (4.90%), stroke in 5 (4.10%), adult polycystic kidney disease in 5 (4.10%), and hepatitis B virus infection in 5 (4.10%), being the most frequent. Eighty-six (69.9%) patients were in CKD Stage 5, 15 (12.2%) were in CKD Stage 4, 19 (15.5%) were in CKD Stage 3, 2 (1.6%) in CKD Stage 2, and the remaining one (0.8%) in CKD Stage 1. Regarding the form of nephrological interventions offered, majority of the respondents 66 (53.66%) were on maintenance dialysis, followed by 53 (43.09%) on conservative care, while 4 (3.25%) were on renal graft transplant.

Conclusion: The prevalence rates for comorbidities such as hypertension, diabetes mellitus, and obesity were significantly high among these CKD patients; this agreed with the previous studies conducted in other regions of the world. In this study, the comorbidity profile among CKD patients may significantly increase the risk of mortality, recurrent frequency of hospitalization, length of hospital admission, and health-care costs.

Keywords: Chronic kidney disease, comorbidity profile, diabetes mellitus, hypertension, obesity

INTRODUCTION

The most common diseases leading to end-stage renal disease (ESRD) globally include malignant/accelerated hypertension,[¹] severe septicemia,[²] poorly controlled chronic diabetes mellitus,[³] human immunodeficiency virus (HIV)-associated nephropathy,[⁴] and focal segmental glomerulosclerosis.[⁵] Genetic causes of ESRD include polycystic kidney disease,[⁶] a number of inborn errors of metabolism,[⁷] and autoimmune conditions such as systemic lupus erythematosus.[⁸] Diabetes is the most common known cause of kidney transplantation, accounting for approximately 25% of those in the United States.[⁹]

Chronic kidney disease (CKD) is associated with increasing incidence,[¹⁰] and prevalence,[¹¹] high cost of treatment,[¹²] and poor outcomes.[¹³] There is evidence to suggest that, early in the course of CKD, appropriate interventions may slow down its progression or completely halt the progression of the disease.[¹⁴] Despite

Access this article online

Quick Response Code: http://iahs.kaums.ac.ir
Website: 10.4103/iahs.iahs_21_18
DOI: 10.4103/iahs.iahs_21_18
Fasipe, et al.: Pattern of comorbidities among chronic kidney disease patients

International Archives of Health Sciences | Volume 6 | Issue 1 | January-March 2019

This, many patients with CKD present late to the nephrologists so that, at the time of initial patient assessment, all that can be offered is preparation for renal replacement therapy. This is particularly so in resource-poor settings where among several other factors, the lack of awareness, traditional beliefs about the cause and nature of the disease, the need to pay out of pocket for health care, and shortage of specialists combine to promote inappropriate healthcare-seeking behavior and late presentation to the nephrologist. Several studies showed that hypertension and diabetes mellitus are the most common causes of ESRD worldwide; therefore, control of high blood pressure (BP) and optimization of glucose level are essential in delaying and retarding CKD progression. These necessitate the use of several medications to improve the quality of life expectancy of these patients and slow down the progression of early CKD to full-blown ESRD.

This study was designed to unravel the comorbidity profile among CKD patients attending the nephrology clinic of a Nigerian Tertiary Kidney Care Hospital. This will create awareness on the burden of comorbidity profile among CKD patients in renal practice. In addition, it will also highlight the need to appropriately manage these associated comorbid conditions and/or complications in order to retard the disease progression to full-blown ESRD.

Materials and Methods

This was a descriptive prospective study carried out at the nephrology clinic of a Tertiary Kidney Care Hospital, University of Medical Sciences, Ondo City, Ondo State, Nigeria. It receives referral from within and outside the State. One hundred and twenty-three consented adult CKD patients who were being managed at the center over 18 months between January 2015 and June 2016 were recruited for the study. Patients below the age of 18 years, those being managed for acute kidney injury (AKI), and adult CKD patients who did not grant their informed consent were excluded from the study. The medical case records of all the adult CKD patients were retrieved after a verbal informed consent has been obtained from each of them, and the following information was extracted using a pro forma: sociodemographic data, BP, body weight, height, stage of CKD, and number and list of comorbidities including hypertension, diabetes mellitus, obesity, heart failure, HIV infection, and stroke. In this study, CKD was defined as a progressive and irreversible deterioration in the renal function of an individual over a period of at least 3 months regardless of the underlying etiology.

The serum creatinine level was used to calculate estimated glomerular filtration rate (eGFR) using the Chronic Kidney Disease Epidemiology Collaboration formula, and CKD staging was done using eGFR based on the National Kidney Foundation-Kidney Disease Outcome Quality Initiative guideline as follows: stage 1 (eGFR of ≥90 ml/min with evidence of kidney damage), Stage 2 (eGFR of 60–89 ml/min with or without evidence of kidney damage), Stage 3 (eGFR of 30–59 ml/min with or without evidence of kidney damage), Stage 4 (eGFR of 15–29 ml/min with or without evidence of kidney damage), and Stage 5 (eGFR <15 ml/min with or without evidence of kidney damage). The British Hypertensive Society-World Health Organization (BHS-WHO) guideline criteria were used for the classification category and severity grading of BP in this study. Furthermore, the prevalence rate for individual specific comorbidity among these CKD patients was obtained by dividing the total number of patients having the particular specified comorbidity by the total number of patients that participated in the study (sample size). Data collected were encoded and analyzed using the Statistical Package for the Social Sciences (SPSS) version 17 (released 2008; SPSS Inc., Chicago, Illinois, USA). Results were expressed as mean ± standard deviation or using frequency and percentage values where necessary. The t-test and Chi-square test were used to compare means and proportions, respectively.

Results

There were 123 consented adult CKD patients in this study, out of which 82 (66.67%) were male and 41 (33.33%) were female. The mean age of the study patients was 53.81 ± 16.03 years. Forty-eight patients (39.0%) were aged between 18 and 49 years, 52 (42.3%) were between 50 and 69 years, and the remaining 23 (18.7%) were 70 years and above [Table 1].

In this study, the range for the number of associated comorbidities was 0–6 diseases, with a mean of 2.33 ± 1.09 diseases per patient. A majority of the respondents 45 (36.59%) had 2 comorbidities, followed by 36 (29.27%) with 3 comorbidities, 23 (18.70%) had only one comorbidity, while 11 (8.94%) had 4 comorbidities [Table 1]. The most frequent specific comorbidities were hypertension in 103 (83.70%), diabetes mellitus in 39 (31.70%), obesity in 24 (19.51%), heart failure in 11 (8.90%), obstructive uropathy in 8 (6.50%), HIV infection in 7 (5.70%), peptic ulcer disease/gastroesophageal reflux disease (PUDx/GERD) in 7 (5.70%), gastroenteritis/gastrointestinal tract (GIT) sepsis in 6 (4.9%), stroke in 5 (4.10%), adult polycystic kidney disease in 5 (4.10%), and hepatitis B virus (HBV) infection in 5 (4.10%) [Table 1].

Their mean body mass index (BMI) was 25.71 ± 5.09 kg/m²; 55 (44.72%) had normal BMI (18.50–24.99 kg/m²), followed by 39...
Fasipe, et al.: Pattern of comorbidities among chronic kidney disease patients

International Archives of Health Sciences ¦ Volume 6 ¦ Issue 1 ¦ January-March 2019

50 (39.0)
52 (42.3)
23 (18.7)

Mean BMI (kg/m²)
Underweight
Normal
Overweight
Mild (Grade-1) obesity
Moderate (Grade-2) obesity
Morbid (Grade-3) obesity

Table 1: Characteristics of the study population

| Characteristics                      | Frequency (%)/mean±SD |
|--------------------------------------|-----------------------|
| Gender                               |                       |
| Male                                 | 83 (66.67)            |
| Female                               | 41 (33.33)            |
| Mean age (years)                     | 53.81±16.03           |
| Age group (years)                    |                       |
| 20-49                                | 48 (39.0)             |
| 50-69                                | 52 (42.3)             |
| ≥70                                  | 23 (18.7)             |
| Level of education                   |                       |
| No formal education                  | 16 (13.0)             |
| Primary                              | 18 (14.6)             |
| Secondary                            | 36 (29.3)             |
| Tertiary                             | 53 (43.1)             |
| CKD stage                            |                       |
| 1                                    | 1 (0.8)               |
| 2                                    | 2 (1.6)               |
| 3                                    | 19 (15.5)             |
| 4                                    | 15 (12.2)             |
| 5                                    | 86 (69.9)             |
| Mean comorbidities (diseases)        | 2.33±1.09             |
| Number of comorbidities (diseases)   |                       |
| 0                                    | 4 (3.52)              |
| 1                                    | 23 (18.70)            |
| 2                                    | 45 (36.59)            |
| 3                                    | 36 (29.27)            |
| 4                                    | 11 (8.94)             |
| 5                                    | 3 (2.44)              |
| 6                                    | 1 (0.8)               |
| Specific comorbidities               |                       |
| Hypertension                         | 103 (83.70)           |
| Diabetes mellitus                    | 39 (31.70)            |
| Obesity                              | 24 (19.51)            |
| Heart failure                        | 11 (8.90)             |
| Obstructive uropathy                 | 8 (6.50)              |
| HIV infection                        | 7 (5.70)              |
| PUDx/GERD                            | 7 (5.70)              |
| Gastroenteritis/GIT sepsis           | 6 (4.9)               |
| Stroke                               | 5 (4.10)              |
| Adult polycystic kidney disease      | 5 (4.10)              |
| HBV infection                        | 5 (4.10)              |
| HCV infection                        | 4 (3.52)              |
| Cardiac arrhythmias                  | 4 (3.52)              |
| Ankylosing spondylitis               | 4 (3.52)              |
| UTI/pyelonephritis                   | 4 (3.52)              |
| Dyslipidemia                         | 3 (2.44)              |
| SLE                                  | 2 (1.63)              |
| NSAID nephropathy                    | 2 (1.63)              |
| Glaucoma                             | 2 (1.63)              |
| Osteoarthritis                       | 2 (1.63)              |
| Renal osteodystrophy/osteoporosis    | 2 (1.63)              |
| Bilateral duplex ureter              | 1 (0.81)              |
| Multiple myeloma                     | 1 (0.81)              |
| Dementia                             | 1 (0.81)              |

(31.71%) with overweight BMI (25.00–29.99 kg/m²), 18 (14.63%) had mild/Grade-1 obesity (30.00–34.99 kg/m²), 5 (4.1%) each were having moderate/Grade-2 obesity (35.00–39.99 kg/m²), and underweight (≤18.49 kg/m²), respectively, while only one (0.8%) had morbid/Grade-3 obesity (≥40.00 kg/m²) [Table 1].

Fifty-three (43.09%) study participants had tertiary education, 36 (29.3%) had secondary education, 18 (14.6%) had primary education, while 16 (13.0%) had no formal education. Eighty-six (69.9%) study participants were in CKD Stage 5, 15 (12.2%) were in CKD Stage 4, 19 (15.5%) were in CKD Stage 3, 2 (1.6%) in CKD Stage 2, and the remaining one (0.8%) in CKD Stage 1 [Table 1].

Regarding the form of nephrological interventions offered, majority of the respondents 66 (53.66%) were on maintenance dialysis, followed by 53 (43.09%) on conservative care, while 4 (3.25%) were on renal graft transplant [Table 1].

Among these CKD patients, the prevalence rates for the most frequent specific comorbidities such as hypertension, diabetes mellitus, obesity, heart failure, obstructive uropathy, HIV infection, PUDx/GERD, gastroenteritis/GIT sepsis, stroke, adult polycystic kidney disease, and HBV infection were...
combined systolic–diastolic hypertension, followed by 18 (14.63%) with isolated systolic hypertension, while 2 (1.6%) had isolated diastolic hypertension [Table 4].

In addition, among these CKD patients recruited for this study, there was also a statistically significant association between those with diabetes mellitus and obesity with \( P < 0.0001 \) [Table 5].

**Discussion**

This study unravels the comorbidity profile among CKD patients attending the nephrology clinic of a Nigerian Tertiary Kidney Care Hospital. It also highlights the need to appropriately manage these associated comorbid conditions and/or complications in order to retard the disease progression to full-blown ESRD. The most common comorbidities in this study were hypertension and diabetes, which agreed with the previous studies conducted by Sgnaolin et al.\(^{[16]}\) and Marquito et al.\(^{[20]}\). This can be attributed to the fact that both conditions are the leading etiologies of CKD in Nigeria, sub-Saharan West African region, and worldwide. Therefore, adequate control of high BP with antihypertensives and regular optimization of blood glucose level with antidiabetics are essential in delaying and retarding CKD progression to full-blown ESRD and to reduce associated complications,\(^{[26,27]}\) mortality,\(^{[17,28]}\) health-care costs,\(^{[24,29]}\) duration of hospital admission,\(^{[25,30]}\) and recurrent frequency of hospitalizations.\(^{[31,32]}\)

Concerning BMI status, the study conducted by Marquito et al.\(^{[20]}\) in which majority of the respondents 372 (66.7%) were either overweight or obese, also agreed with our study in which 68 (55.28%) were either overweight or obese. This increased BMI (overweight or obesity) had a positive correlation with the increasing prevalence of acquired CKD in this study as a risk factor.

Concerning the CKD staging and eGFR, this study in which majority of the participants 86 (69.92%) belonged to CKD Stage 5 agreed with the finding of Rama et al.’s study\(^{[17]}\) where 113 (68.48%) belonged to CKD Stage 5, but disagreed with the finding of Marquito et al.’s study\(^{[20]}\) in which most respondents 265 (47.5%) belonged to CKD Stage 3. This disparity can be attributed to the different variations in the serum creatinine levels of the respondents which were used to calculate their eGFRs.

Furthermore, on the form of nephrological interventions offered in this study, majority of the respondents were on maintenance dialysis 66 (53.66%) in contrast to the finding of Marquito et al.’s study\(^{[20]}\) in which most respondents 265 (47.5%) belonged to CKD Stage 3. This disparity can be attributed to the fact that most respondents in this study were of ESRD/CKD Stage 5 as opposed to pre-ESRD CKD stages 1, 2, 3, and 4 in the Marquito et al.’s study.\(^{[20]}\)

Regarding sex distribution, our study was similar to the study conducted by that of Marquito et al., 2014,\(^{[20]}\) on CKD patients at the NIEPEN Federal University of Juiz de Fora,

| Parameters                                   | Prevalence (%) |
|----------------------------------------------|----------------|
| Hypertension                                 | 83.70          |
| Diabetes mellitus                            | 31.70          |
| Obesity                                      | 19.51          |
| Heart failure                                | 8.90           |
| Obstructive uropathy                         | 6.50           |
| HIV infection                                | 5.70           |
| PUDx/GERD                                    | 5.70           |
| Gastroenteritis/GIT sepsis                   | 4.9            |
| Stroke                                       | 4.10           |
| Adult polycystic kidney disease              | 4.10           |
| HBV infection                                | 4.10           |
| HCV infection                                | 3.52           |
| Cardiac arrhythmias                          | 3.52           |
| Ankylosing spondylitis                       | 3.52           |
| UTI/pyelonephritis                           | 3.52           |
| Dyslipidemia                                 | 2.44           |
| SLE                                          | 1.63           |
| NSAID nephropathy                            | 1.63           |
| Glaucoma                                     | 1.63           |
| Osteoarthritis                               | 1.63           |
| Renal osteodystrophy/osteoporosis            | 1.63           |
| Bilateral duplex ureter                      | 0.81           |
| Multiple myeloma                             | 0.81           |
| Dementia                                     | 0.81           |
| Sickle cell disease/sickle cell nephropathy   | 0.81           |
| Seizure disorders                            | 0.81           |
| Bronchial asthma                             | 0.81           |
| Rheumatoid arthritis                         | 0.81           |
| Breast cancer                                | 0.81           |
| Hydronephrosis                               | 0.81           |
| CMV infection                                | 0.81           |
| Acute renal graft rejection                  | 0.81           |
| Gouty arthritis                              | 0.81           |
| Inguinal hernia                              | 0.81           |
| Erectile dysfunction                         | 0.81           |
| Mastoiditis                                  | 0.81           |
| Genu valgum                                  | 0.81           |
Brazil, where majority of the respondents 305 (54.7%) were males. This showed that CKD was more predominant among males which can be attributed to their rugged lifestyles such as indulgence in chronic smoking, chronic alcohol consumption, poor nutritional feeding habit, inadequate exercise, multiple sexual partners, and poor healthcare-seeking behavior. On the other hand, our study disagreed with the one conducted by Sgnalin et al., 2014,[16] in a hospital’s hemodialysis unit in Brazil where 65 patients were included in the study, with a mean age of 59.1 ± 14.7 years and 33 (50.8%) were women.

Furthermore, among these CKD patients recruited for this study, there was also a statistically significant association between those with diabetes mellitus and obesity, as this implies that those patients with obesity are highly predisposed and at risk of developing diabetes mellitus.

This study has revealed the comorbidity profile among CKD patients in clinical practice. The strength and limitation of this study was that it considered only consented adult medical patients with CKD who were above the age of 17 years. There was exclusion of pediatric renal diseases’ patients, adult CKD patients who did not grant their informed consent, and those patients with AKI from the study. The number of adult CKD patients who did not grant their informed consent and therefore declined from participating in the study was very small and statistically insignificant (about three patients).

### Conclusion

The prevalence rates for hypertension, diabetes mellitus, and obesity were significantly high among these CKD patients. In this study, the comorbidity profile among these CKD patients may significantly increase the risk of mortality, health-care costs, length of hospital admission, and recurrent frequency of hospitalization. Regular organization of health education awareness programs on the prevention of CKD and its associated comorbidities or complications among the general public should be done by health-care professionals coupled with adequate support from both governmental agencies and nongovernmental organizations.

### Acknowledgments

The authors of this article wish to specially acknowledge and thank the Almighty God for granting them wisdom and understanding to prepare this research work for publication.

### Financial support and sponsorship

Nil.

### Conflicts of interest

There are no conflicts of interest.

### References

1. Hill NR, Fatoba ST, Oke JL, Hirst JA, O’Callaghan CA, Lasserson DS, et al. Global prevalence of chronic kidney disease – A systematic review and meta-analysis. PLoS One 2016;11:e0158765.
2. Odubanjo MO, Oluwasola AO, Kadiri S. The epidemiology of end-stage renal disease in Nigeria: The way forward. Int Urol Nephrol 2011;43:785-92.
3. Victoria M, Matteo C, Marco T, Erica G, Roberta C, Speranza R. Polypharmacy in kidney disease patients. Curr Kidney Dis 2014;11:212-9.
4. Akinsola W, Odesanmi WO, Ogumiiyi JO, Ladipo GO. Diseases causing chronic renal failure in Nigerians – A prospective study of 100 cases. Afr J Med Sci 1989;18:131-7.
5. Ulasi II, Ijoma CK, Onodugo OD, Arodiwe EB, Ifebunandu NA, Okoye JU. Towards prevention of chronic kidney disease in Nigeria: A community-based study in Southeast Nigeria. Kidney Int Suppl 2013;3:195-201.
6. Olayomobo R, Ayodele OE, Akinwusi PO, Okunola OO, Akinsola A, Arogeunde FA, et al. A community study of the prevalence, risk factors and pattern of chronic kidney disease in Osun state, South West Nigeria. West Afr J Med 2013;32:85-92.
7. Liu M, Li XC, Lu L, Cao Y, Sun RR, Chen S, et al. Cardiovascular disease and its relationship with chronic kidney disease. Eur Rev Med Pharmacol Sci 2014;18:2918-26.
8. Levin A, Hemmelgarn B, Culleton B, Toke S, McFarlane P, Ruzicka M, et al. Guidelines for the management of chronic kidney disease. CMAJ 2008;179:1154-62.
9. Alebiosu CO, Ayodele OE. The global burden of chronic kidney disease and the way forward. Ethn Dis 2005;15:418-23.
10. Riemer E, Werling E, Kribs M, Hanman De Compte A, Dimitrov Y. Medical prescriptions in haemodialysis patients: Critical analysis.
Fasipe, et al.: Pattern of comorbidities among chronic kidney disease patients

Nephrol Ther 2005;1:234-40.

11. Babua C, Kalyesubula R, Okello E, Kakande B, Sebatta E, Mungoma M, et al. Cardiovascular risk factors among patients with chronic kidney disease attending a tertiary hospital in Uganda. Cardiovasc J Afr 2015;26:177-80.

12. Edwards IR, Aronson JK. Adverse drug reactions: Definitions, diagnosis, and management. Lancet 2000;356:1255-9.

13. Pirmohamod M, James S, Meakin S, Green C, Scott AK, Walley TJ. Drug-drug interaction as cause of admission to hospital: Prospective analysis of 18820 patients. BMJ 2004;329:15-9.

14. Manley HJ, Cannella CA, Bailie GR, St. Peter WL. Medication-related problems in ambulatory hemodialysis patients: A pooled analysis. Am J Kidney Dis 2005;46:669-80.

15. Al-Hajje AH, Atoui F, Awada S, Rachidi S, Zein S, Salameh P. Drug-related problems identified by clinical pharmacist’s students and pharmacist’s interventions. Ann Pharm Fr 2012;70:169-76.

16. Sgnaolin V, Sgnaolin V, Engroff P, De Carli A, Figueiredo AE. Assessment of used medications and drug-drug interactions among chronic renal failure patients. Sci Med 2014;24:329-35.

17. Rama M, Viswanathan G, Acharya LD, Attur RP, Reddy PN, Raghavan SV, et al. Assessment of drug-drug interactions among chronic renal failure patients of nephrology ward in a South Indian tertiary care hospital. Indian J Pharm Sci 2012;74:63-8.

18. Al-Ramahi R, Raddad AR, Rashid AO, Bsharat A, Abu-Ghazaleh D, Yasin E, et al. Evaluation of potential drug-drug interactions among Palestinian hemodialysis patients. BMC Nephrol 2016;17:96.

19. Flesch MI, Erdmann E. The problem of polypharmacy in chronic kidney disease. Curr Cadiol Rep 2006;8:217-25.

20. Marquito AB, Fernandes NM, Colugnati FA, de Paula RB. Identifying potential drug interactions in chronic kidney disease patients. J Bras Nefrol 2014;36:26-34.

21. Hedge S, Udaiyakumar P, Manjunprasad MS. Potential drug interactions in chronic kidney disease patients. A cross-sectional study. Int J Recent Trends Sci Technol 2015;16:56-60.

22. Shad MU, Marsh C, Presskon SH. The economic consequences of drug-drug interaction. J Clin Psychopharmacol 2001;21:119-20.

23. Fernández-Llimós F, Tuneu L, Baena MI, Garcia-Delgado A, Faus MJ. Morbidity and mortality associated with pharmacotherapy. Evolution and current concept of drug-related problems. Curr Pharm Des 2004;10:3947-67.

24. International Society of Nephrology. Kidney disease improving global outcome (KDIGO) 2012 clinical practice guideline for evaluation and management of CKD. Kidney Int Suppl 2013;3:1-150.

25. Mason NA, Bakus JL. Strategies for reducing polypharmacy and other medication-related problems in chronic kidney disease. Semin Dial 2010;23:55-61.

26. Cardone KE, Boccia S, Assimon MM, Pai AB, Manley HJ. Medication-related problems in CKD. Adv Chronic Kidney Dis 2010;17:404-12.

27. Grabe DW, Low CL, Bailie GR, Eisele G. Evaluation of drug-related problems in an outpatient hemodialysis unit and the impact of a clinical pharmacist. Clin Nephrol 1997;47:117-21.

28. Manley HJ, Drayer DK, Muther RS. Medication-related problem type and appearance rate in ambulatory hemodialysis patients. BMC Nephrol 2003;4:10.

29. Mason NA. Polypharmacy and medication-related complications in the chronic kidney disease patient. Curr Opin Nephrol Hypertens 2011;20:492-7.

30. Manley HJ, McClaran ML, Overbay DK, Wright MA, Reid GM, Bender WL, et al. Factors associated with medication-related problems in ambulatory hemodialysis patients. Am J Kidney Dis 2003;41:386-93.

31. Eiam-Ong S, Sitprija V. Comorbidities in patients with end-stage renal disease in developing countries. Artif Organs 2002;26:753-6.

32. Kadiri S, Arije A. Temporal variations and meteorological factors in hospital admissions of chronic renal failure in South West Nigeria. West Afr J Med 1999;18:49-51.