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PREVALENCE AND FACTORS ASSOCIATED WITH CHRONIC KIDNEY DISEASE AMONG PATIENTS WITH HYPERTENSION ATTENDING KIGEME DISTRICT HOSPITAL, RWANDA

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Abstract

Chronic kidney disease (CKD) is a prevalent global health issue that impacts around 10% of the global population with significantly higher prevalence rates observed in specific regions like Sub-Saharan Africa (13.4%), Eastern Africa (14%), and particularly in Rwanda with 20%. Little information is known about the magnitude of CKD and its associated factors in people with hypertension particularly in Rwanda. Consequently, the primary goal of this study is to ascertain the prevalence of chronic kidney disease and explore the factors associated with it in individuals with hypertension attending Kigeme District Hospital. The research adopted a cross-sectional design, recruiting 271 participants through a simple random technique. Structured open-ended questionnaires were used for interviews. The study used univariate analysis to measure the prevalence of CKD and bivariate and multivariate analysis to explore associations between dependent and independent variables using fisher exact tests. Both research and medical ethics including privacy and confidentiality of the respondents was respected. The study findings revealed that 14.4% of respondents were affected by chronic kidney disease (CKD), highlighting its prevalence within the surveyed population. In contrast, the vast majority, comprising 85.6% of respondents, were not suffering from this condition. Bivariate analysis identified three comorbidity and behavioral factors significantly associated with CKD: diabetes, hepatitis C, and HIV status, with Fisher exact test values ranging from 4.625 to 6.315 and all p-values < 0.001. Additionally, uncontrolled hypertension and BMI were found to be significant, with p-values ranging from 0.012 to 0.032. Uncontrolled hypertension emerged as a notable associated factor, with individuals being eleven times more likely to have CKD (Adjusted Odds Ratio [AOR] = 11.105, 95% Confidence Interval [CI]: 1.197-19.061, p = 0.03). Hypertension duration exceeding 5 years was also significant predictors of CKD, with adjusted odds ratios of 12.149 (95% CI: 1.975-74.653, p = 0.007) and 15.558 (95% CI: 8.090-22.273, p < 0.001), respectively. Furthermore, diabetes mellitus and family history of CKD were also significant, with p-values < 0.05. After controlling confounders in multivariate analysis, only uncontrolled hypertension and duration of hypertension exceeding 5 years were significantly associated with CKD. This study concluded that comorbidities such as hepatitis C and HIV were only linked with CKD by bivariate analysis. Moreover, hypertension duration more than five years, diabetes and uncontrolled hypertension were both associated with chronic kidney disease among patients attending Kigeme hospital and recommended policymakers and health officials create policies and preventive measures that could proactively support patient's education framework, early detection and early management of hypertension.

Key words: Kidney, Chronic Kidney Disease, Hypertension

Introduction

Chronic kidney disease (CKD) represents a worldwide health challenge, constituting a global average prevalence of 13.4% (Hill et al., 2016) ,with a current study showing that it affect 10 % of the world's general population(Kovesdy et al.,2022).There is significant diversity in the prevalence of chronic kidney disease (CKD) among the general population across continents, particularly in Asia. (7-34.5%)(Liyanage et al., 2022), Europe (3.31- 17.3%)(Kampmann et al., 2023), and Africa (4.6–10.1)(Hariparshad et al., 2023).In Africa, there is a disparity in CKD prevalence as for example Northern Africa (6.1%),Southern Africa(20.4%). In Eastern Africa, the prevalence of chronic kidney disease (14.4%) is notable, while in Middle Africa, it stands at 16%, and in Western Africa (19.8%)(Kaze et al., 2018).

A study conducted in Brazil have shown that hypertension, congestive heart failure, diabetes, older are significant contributors to chronic kidney diseases(Pinho et al., 2015). Conversely, factors such as proteinuria, dyslipidemia, comorbid diseases, serum creatinine levels exceeding 0.9 mg/dl, a hypertension duration surpassing 10 years, and diastolic blood pressure exceeding 90 mmHg have been identified as associated with chronic kidney disease (CKD) in individuals with hypertension (Hunegnaw et al., 2021).

Moreover, a systematic review carried out in Sub-Saharan Africa discovered that the general population's prevalence of chronic kidney disease (CKD) is 13.9%.(Stanifer et al., 2014). Another study done six countries(DRC, Nigeria, Ghana, Uganda, Tanzania, and South Africa) of Africa such in 2021 have shown the pooled prevalence of CKD was 17.8%(Ajayi et al., 2021) while the prevalence of chronic kidney disease based on CrockroftGauld formula stand at 25% in Rwanda(Stanifer et al., 2014) and 58% of mortality rate in Rwanda are attributed to non-communicable disease with renal disease included(Shumbusho et al., 2022).

In the context of hypertension, the pooled prevalence of CKD was 34.5% among patients with hypertension in African population (Abd ElHafeez et al., 2018).Additionally, a study carried out among adult hypertensive patients have found the prevalence of 17.6%(Hunegnaw et al., 2021).In fact, recent research by Kovesdy in 2022 predicts a 47.5% increase in CKD-related mortality by 2027, potentially making CKD the 5th leading cause of death by 2040 (Kovesdy, 2022). CKD carries a substantial economic burden where by one-year cost for its treatment is reaching $14,634, especially those with comorbidities, low estimated Glomerular Filtration Rate

(eGFR), and severe albuminuria (Manns et al., 2019). Worldwide CKD DALYS number due to hypertension increased by 125.2% whereby male and elderly people tend to have high burden of disease than the remaining population group(Chen et al., 2021).

Moreover, factors as age, uncontrolled hypertension, overweight/obesity and diabetic mellitus was strongly associated with CKD among patients with hypertension (Bahrey et al., 2019) as well as being elderly people with 65years or smoking and high cholesterol are significant factors that contributes to CKD(Aguiar et al., 2020). Based on recent studies it noted that there a need of up-to-date research on CKD prevalence in patients with hypertension particularly in Rwanda and to explore its relationship with sociodemographic, clinical and lifestyle factors variation among these population with hypertension. Although hypertension is recognized as a major risk factor for CKD (Hunegnaw et al., 2021) and known as significant contributor to the development and progression of CKD(Liu et al., 2023), there is a lack of detailed information on the prevalence and associated factors of CKD specifically among hypertensive individuals in Rwanda. This study aims to fill this gap by investigating both the prevalence and the risk factors associated with chronic kidney disease among hypertensive patients receiving care at Kigeme District Hospital.

Materials and methods

Research design.

In this study, the researcher used a cross-sectional research design and adopted a quantitative research approach.

Participants

This study involved patients with hypertension followed in non-communicable department (NCDs). Kigeme DH NCDS department receive monthly average of 350 patients under follow up of hypertension of which the majority are female 65% (HMIS, 2023). The sample was calculated using Cochcram Formula and gave 246. After adding 10 % of non-response rate the sample size was 271.

Inclusion criteria

The study involved patients with hypertension aged 18 years old and above, being followed in NCDs Department at Kigeme Hospital and Having Renal function monitored in the past three months of follow up.

Exclusion criteria

People without hypertension, Participants with incomplete patient's files and pregnant women were not included, Patients with acute kidney injury, terminal disease and pregnancy related hypertension was excluded from this study, Patients who are not followed at Kigeme Hospital and Patients under 18 years old.

Research instruments.

A standardized questionnaire was developed and adapted from previous studies related to the objectives of the study. It consists of three sections. The first section consists of sociodemographic (Age, sex, marital status, Level of education occupation, income level, Family history of Hypertension, Family history of CKD). Second section contains clinical characteristics of the study participants which are blood pressure status like controlled Versus uncontrolled Hypertension, Duration on antihypertensive medications, Comorbidities like Diabetes, HIV, Hepatitis C and B, and BMI). The third section contains information related to lifestyle variables (Smoking, Alcohol use, Exercise). The instrument validity was ensured by content validity index of 0.8 while the reliability was ensured by the Cronbach alpha test which yielded a result of 0.71.

Data analysis procedure

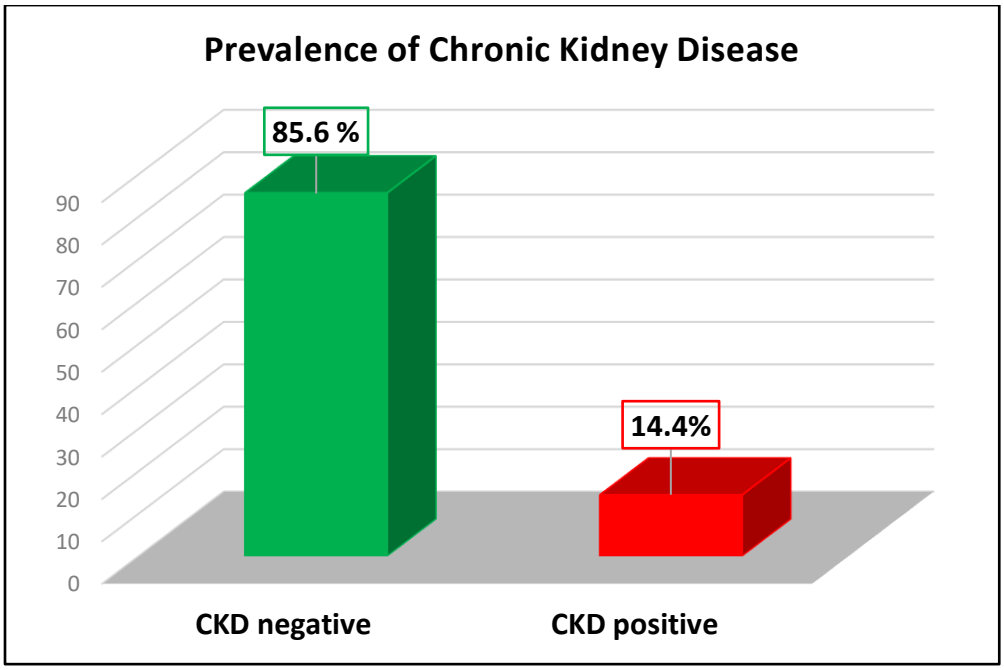
Descriptive statistics was employed to provide a summary of the data, where categorical variables were depicted as frequencies, and continuous variables was represented by mean and standard deviation. Participants was considered as having CKD if their Cockcroft-Gault calculated creatinine clearance is less than 60ml/min during the period of the study. The fisher exact test was performed to evaluate the relationship between the dependent variable and all independent variables in the study. Variables showing a p-value < 0.05 was considered for inclusion in the multivariable logistic regression model to account for potential confounding effects. The fitness of the model was assessed using the Hosmer-Lemeshow Test, and a p-value > 0.05 signified a good fit for the model. For significance testing, both the p-value and Adjusted

Odds Ratio (AOR) was used. A variable was considered statistically significant if its p-value is less than 0.05 at a 95% confidence interval.

Ethical consideration

This research received approval from the research ethics committee at Mount Kenya and it also obtained approval by the Institutional Review Boards (IRBs) of the Kigeme District Hospital. In order to protect the privacy and confidentiality of all study participants, their identities were kept anonymous. The information collected during this study was handled with strict confidentiality and solely for academic purposes related to this research. Participation in interviews was entirely voluntary, and individuals had the freedom to decide whether or not to take part. This approach was crucial to ensure the safety and well-being of respondents and to safeguard the confidentiality of both respondents and their sensitive information.

Results



Source: Researcher (2024)

Figure 1: prevalence of chronic kidney disease among diseases among patients with hypertension attending Kigeme district Hospital.

Figure 1 indicates the majority of respondents of 85.6% were not suffering from chronic kidney disease while 14.4% were found to have chronic kidney disease status.

Table 1: Bivariate analysis of sociodemographic factors associated with chronic kidney disease among patients with hypertension attending Kigeme district Hospital.

Variables n=271	Chronic Kidney Disease			Fisher exact test	P-value
	No n (%)	Yes n (%)	Total (%)		
Age Group					**0.02**
<=50 years	47(17.3)	2(0.7)	49(18.1)		
>50 years	185(68.3)	37(13.7)	222(81.9)		
Gender					0.114
Male	66(24.4)	16(5.9)	82(30.3)		
Female	166(61.3)	23(8.5)	189(69.7)		
Marital status					0.361
Single	6(2.2)	0(0.0)	6(2.2)		
Married	202(74.5)	36(13.3)	238(87.8)		
Divorced	11(4.1)	0(0.0))	11(4.1)		
Widowed	13(4.8)	3(1.1)	16(5.9)		
Education level					0.607
Informal education	47(17.3)	10(3.7)	57(21.0)		
Primary education	142(52.4)	20(7.4)	162(59.8)		
Secondary education	33(12.2)	6(2.2)	39(14.4)		
University	10(3.7)	3(1.1)	13(100.0)		
Occupation					**0.001**
Farmers	180(66.4)	30(11.1)	210(77.5)		
Health professionals	2(0.7)	3(1.1)	5(1.8)		
Teachers	12(4.4)	5(1.8)	17(6.3)		
Others	38(14.0)	1(0.4)	39(14.4)		
Social category					0.987
Social category 1	19(7.0)	3(1.1)	22(8.1)		
Social category 2	97(35.8)	16(5.9)	113(41.7)		
Social category 3	116(42.8)	20(7.4)	136(50.2)		
Total	232(85.6)	39(14.4)	271(100.0)		
Family history of hypertension					0.275
Yes	47(17.3)	5(1.8)	52(19.2)		
No	185(68.3)	34(12.5)	219(80.8)		
Family history of CKD					**0.004**
Yes	15(5.5)	8(3.0)	23(8.5)		
No	217(80.1)	31(11.4)	248(91.5)		

Source: Researcher (2024)

The bivariate analysis findings as shown in Table 1 demonstrated that three sociodemographic characteristic factors were statistically significant toward the chronic kidney disease. Those factors are age group above 50 years, occupation and family history of CKD which were

scientifically significant with fisher exact test p-value of 0.02, 0.01, 0.004 respectively. Other factors were not significantly associated with CKD.

Table. 2: Bivariate analysis of Clinical factors associated with chronic kidney disease among patients with hypertension attending Kigeme district Hospital.

Variables n=271	**Chronic Kidney Disease**			**Fisher exact test**	**P-value**
	No n (%)	**Yes n (%)**	**Total (%)**		
Uncontrolled hypertension					**0.001**
No	122(45.0)	9(3.3)	131(48.3)		
Yes	110(40.6)	30(11.1)	140(51.7)		
Duration of hypertension					**<0.001**
<5years	140(51.7)	2(0.7)	142(52.4)		
>= 5 years	92(33.9)	37(13.7)	129(47.6)		
BMI					**0.001**
Normal	163(60.8)	39(14.6)	202(75.4)		
Overweight	48(17.9)	0(0.0)	48(17.9)		
Obesity	18(6.7)	0(0.0)	18(6.7)		
Total	232(85.6)	39(14.4)	271(100.0)		

Source: Researcher (2024)

The bivariate analysis findings as shown in Table 2 demonstrated that seven clinical factors were statistically significant toward the chronic kidney disease. Duration of hypertension, uncontrolled hypertension and BMI were statistically significant with P-value<0.001.

Table 3: Bivariate analysis of comorbidity and behavioral factors associated with chronic kidney disease among patients with hypertension attending Kigeme district Hospital.

Variables	Chronic Kidney Disease			Fisher Exact test	P-value
	No n (%)	**Yes n (%)**	**Total (%)**		
Diabetes status					**0.017**
No	213(78.6)	31(11.4)	244(90.0)		
Yes	19(7.0)	8(3.0)	27(10.0)		
Total	232(85.6)	39(14.4)	271(100.0)		
HCV status					**0.032**
No	222(81.9)	34(12.5)	256(94.5)		
Yes	10(3.7)	5(1.8)	15(5.5)		
Total	232(85.6)	39(14.4)	271(100.0)		
HBV status					0.347
No	230(84.9)	38(14.0)	268(98.9)		
Yes	2(0.7)	1(0.4)	3(1.1)		

Total	232(85.6)	39(14.4)	271(100.0)	
HIV status				**0.012**
No	229(84.5)	36(13.3)	265(97.8)	
Yes	3(1.1)	3(1.1)	6(2.2)	
Total	232(85.6)	39(14.4)	271(100.0)	
Smoking				0.416
No	211(77.9)	37(13.7)	248(91.5)	
Yes	21(7.7)	2(0.7)	23(8.5)	
Total	232(85.6)	39(14.4)	271(100.0)	
Physical exercise at least weekly				0.483
No	173(63.8)	27(10.0)	200(73.8)	
Yes	59(21.8)	12(4.4)	71(26.2)	
Total	232(85.6)	39(14.4)	271(100.0)	
Asthmatic				0.355
No	227(83.8)	39(14)	266(98.2)	
Yes	5(1.8)	0(0.0)	5(1.8)	
Total	232(85.6)	39(14.4)	271(100.0)	

Source: Researcher (2024)

The bivariate analysis findings as shown in Table 3 demonstrated that three comorbidity and behavioral factors were statistically significant toward the chronic kidney disease. Diabetes, hepatitis C and HIV status were scientifically significant with fisher exact test values =5.652, 4.625, 6.315 with p<0.001, respectively.

Table 4: Multivariate analysis of factors associated with chronic kidney disease among patients with hypertension attending Kigeme district Hospital.

Variables	Chronic kidney disease		P-value
	AoR	**95% CI**	
Diabetes Mellitus			
No	Ref		
Yes	1.065	0.004-2.036	**0.04**
Uncontrolled Hypertension			
No	Ref		
Yes	11.105	1.197-19.061	**0.03**

CKD family history			
No	Ref		
Yes	1.222	0.034-2.451	**0.045**
Hypertension duration			
<5years	Ref		
>= 5 years	12.149	1.975-74.653	**0.007**
Hepatitis C			
No	Ref		
Yes	2.648	0.314-12.329	0.3

Source: Researcher (2024)

Table 4 showed that only four variables were statistically significant among thirteen variables which were significant in previous bivariate analysis. Uncontrolled hypertension was eleven times more likely to be associated with CKD with AoR= 11.105, CI: (1.197-19.061), p=0.03while the duration of hypertension above 5 years was significant with AoR=12.149, CI:1.975-74.653, p=0.007; AoR:15.558 CI:(8.090-22.273), p<0.001.

Discussion

Socio-demographic results were dominated by females, who comprised the majority at 69.7%, while males accounted for 30.3% of the study respondents. This result is somewhat elevated compared to the study conducted in Ethiopia, where males were also in the majority at 55.1%. The majority of study respondents (52.8%) were between 61 and 80 years old, which is slightly lower compared to the 67.8% reported in a study from Amhara Referral Hospitals (Hunegnaw et al., 2022).

In this study the prevalence of chronic kidney disease among patients with hypertension attending Kigeme district Hospital was 14.4%. This prevalence result is in a range of a previous proteinuria study that showed a result range between 4% to 24% (Ngendahayo et al., 2019). However, this study finding is slightly low in comparison of the study done in Kigali city

selected hospitals which revealed a prevalence of 20% with 58.6% of hypertensive patients (Said et al., 2023). The twoinstitutional andTigray Teaching Hospitalbased Ethiopian cross-sectionalstudies showed a slightly elevated prevalence of CKD with a range from 17.6% to 22.1% compared to this study result of 14.4% (Bahrey et al., 2019; Hunegnaw et al., 2021).

Conversely, the Cameroonian and Ghanian studies for 400 and 712 of hypertensive patients showed high CKD prevalence of 32.3% in Cameroon and 46.9% Ghana (Osafo et al., 2011; Hamadou et al., 2017). Furthermore, a multicenter cross-sectional study in Ghana with 2781hypertensive participants result was two times higher with CKD prevalence of 26.5% than this study findings (Tannor et al., 2019).

This study prevalence finding is low comparing to other global results apart from Singapore study which showed 7.6% of CKD prevalence while the findings of a study done with urban population in San Salvador CKD was 21% and 19.6% in Korea and 61% in China (Flores et al., 2017; Teo et al., 2021). Similarly, Ugandan study on 300 hypertensive patients provided the prevalence which was nearly 17.2% of CKD while the Egypt cross-sectional study among hypertensive non-diabetic patients found a prevalence of 33% (Brian, 2017; Nagib et al., 2023), while in Uganda, a survey involving 300 hypertensive participants showed a prevalence of 17.2% (Brian, 2017).

Conversely, some studies carried out in different countries showed lower results than this is study findings such as the Brazilian and Malaysian studies which showed that 12.7% and 9% of CKD prevalence (Pinho et al., 2015; Alemu et al., 2020).

This study findings showed that some of the comorbidities such as hepatitis C and HIV were associated with CKD by bivariate analysis. However, these factors were not significantly associated with CKD by multivariate analysis with logistic regression while other research's findings revealed significant association (Ali et al., 2020). Diabetes was slightly significant in this study while other studies showed strong association (Said et al., 2023).

This study results showed that uncontrolled hypertension among participants were 51.7%. and this was significantly associated with chronic kidney disease (CKD). In a similar vein, hypertension as a co-morbidity to CKD was found to be 47 % and 23.3% in the United States of

America, which is a low result comparatively to this study's findings (Tedla et al., 2011; Hamrahian& Falkner, 2016; Nordheim,2021).Another study carried out in Rwanda showed that a substantial percentage hypertensive patient of 78% with CKD progressed to end-stage kidney disease (Bonane et al., 2020).

This study findings revealed that hypertension duration >=5 years was found to be 12 times associated with CKD. This result is in line with other studies where hypertension duration was an established risk of end stage kidney disease (Garofalo, 2016; Weldegiorgis, 2020). Additionally, the study conducted in Ethiopia Amhara northwest hospitals showed that 10 years hypertension duration was 8 times associated with CKD (Hunegnaw, 2020). This study again revealed overwhelming results that hypertension was eleven times associated with CKD which is far high result in comparison with the study done in Poudyal which showed that it was merely 2.4 times to be associated with CKD (Poudyal et al., 2022). This association is also high compared to another study carried out in selected hospitals in Rwanda which showed that hypertension was six times associated CKD a results which is around the half of this study finding (Said et al., 2023).

This study's constraint lay in its cross-sectional design, which precluded establishing causation, and its limited scope, hindering the generalizability of the findings.

This study implication is relying on the monitoring of creatinine levels as a cost-effective test which could be accessible for everywhere to help people get the early recognition of their kidney status for early solution generation by the healthcare. This could be linked with universal health coverage for upcountry population. This could also help the policy makers advocate for patients through policy and protocols that favors patients to prevent the chronic kidney diseases.

This study's implication was based on hospital management through checking the creatinine level which is affordable test of hypertensive people to ensure their follow-up and control of hypertension by being aware of rampant chronic disease and prevent it. Improving the knowledge of people to be aware that the associated factors such as hypertension duration, non-controlled hypertension could be potential factors that lead to chronic kidney disease which may jeopardize the health of people (Jane, 20218). This study findings could inspire the control,

prediction and prevention of chronic kidney through serum creatinine level monitoring to ensure the early recognition and medical support.

Conclusion

This study concluded that high level serum creatinine was significantly associated with chronic kidney disease. In addition, Comorbidities such as hepatitis C and HIV were only linked with CKD by bivariate analysis. Moreover, diabetes, hypertension duration more than five years and uncontrolled hypertension were both associated with chronic kidney disease among patients attending Kigeme hospital.

Recommendations

The study recommended policymakers and health officials to create policies and preventive measures that could proactively support patient's education framework, early detection and early management of hypertension.

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