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PREVALENCE AND FACTORS ASSOCIATED WITH CHRONIC KIDNEY DISEASE IN SELECTED HOSPITALS IN KIGALI, RWANDA

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Abstract*— *chronic kidney disease (CKD) is a recognized global public health problem whose effects are felt across different socioeconomic. It directly resulted in an estimated 1.23 million deaths in 2017. This study aimed to determine the prevalence and associated factors with chronic kidney disease. The study was conducted under a cross-sectional study design. A pre-tested structured questionnaire was applied to collect data. This study included 87 study respondents using Yamane formula. Simple random sampling technique was used to select the study respondents. The study data collected considered the timeframe from January to March 2023. Data were entered into SPSS, coded, recorded, and analysed in SPSS version 29 was used. Bivariate and multivariate analysis were conducted to analyse the sociodemographic characteristics, and factors associated with CKD. The significance level was set to 95% CI and a P value less than 0.05. A total of 87 inpatients in the medical ward were included in this study, the prevalence of CKD in Kigali City selected hospitals was 20%. Diabetes mellitus, hypertension and malaria antecedent were significantly associated with CKD with AoR:11.264 (2.642-18.546); 6.215(3.112-22.543); 4.112(1.724-14.254) and p<0.001. Acute kidney disease, over-the-counter medication, and longer sickness period) were also significant with p<0.05. This study concluded that hypertension and diabetes are the key factors that are associated with chronic kidney disease. Therefore, this study suggests the Ministry of Health in Rwanda and international partners to increase health education/health promotion intervention by health workers for kidney protection and decrease the risk of developing serious CKD. The interventions should be oriented to non-communicable diseases prevention within a prepared periodic campaign through media, seminars, and workshops by the healthcare providers and patients who are involved.
***Keywords*— *chronic kidney diseases, cardiovascular diseases, comorbidities*.**

I. INTRODUCTION

Globally, the prevalence of CKD according to a study that examined the prevalence and burden of CKD in 2010, the age-standardized global prevalence of CKD stages 1–5 in people aged 20 years and older was 10.4% for men and 11.8% for women. [1] This study pooled the findings of 33 population-based representative studies from around the world. The study found significant disparities by income level and area, with a CKD age-standardized prevalence of 8.6% and 9.6% in men and women, respectively in high-income nations, and 10.6% and 12.5% for men and women in low- and middle-income nations, respectively. [2]

CKD is prevalent in all stages at a rate of 13%. Global estimates of the prevalence of adults with CKD stage G3-G5 range from 1.7% in China to 3.1% in Canada, to 5.8% in Australia, and to 6.7% in the United States. [3] The incidence varies across Europe, from 91 2.3 % in Germany, 2.4 % in Finland, 4.0 % in Spain, to 5.2 % in England. Further research is needed to determine the causes of the variation in these numbers, which could be due to a variety of factors (for example, some studies may only use time one-time point, which does not meet the definition of CKD);

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as a result, it is difficult to determine whether prevalence has been overestimated or underestimated.[3] Due to the absence of community-based research, unreliable measurements of kidney function, and non-standardized or non-calibrated methods, the epidemiology of CKD in low- and middle-income countries (LMICs) is poorly understood. However, when analysed, the prevalence of CKD appears to be commensurate with the estimates of 10–16 percent in sub-Saharan Africa, Southeast Asia, and several Latin American 98 nations (such as Mexico). [3]

Africa is the second-largest continent in the world, with a population of over 1 billion; 961.5 million people live in sub-Saharan Africa and 195million in Northern Africa. [4] Africa now faces the dual challenge of infectious illnesses and chronic diseases. Africa and sub-Sahara Africa (SSA) with a prevalence of 15.8% and 17.7%, respectively in the general population. The high-risk populations such as patients who suffer from diabetes mellitus, high blood pressure, and HIV were highly vulnerable with a prevalence of 32.3% in the CKD. (Abd ElHafeez et al., 2018)

A study conducted in South Africa in 2015, showed that 60.42% of university students had good knowledge of CKD risk factors, and in Abia State, Nigeria, 81% of 4th-year nursing students had good knowledge of kidney function, 21% of CKD, though overall knowledge of risk factors was poor.[4] At the university community in Nigeria in 2015, the prevalence of risk factors for CKD was high wherein a sample of 259 young volunteers; obesity was found in 12.2% of participants while proteinuria and glycosuria were found in 12.4% and 2.7% of participants, respectively. This indicated that young people like university students were also at high risk of developing CKD. From our review, there has not been a study conducted on the level of knowledge and preventive practices of risk factors of CKD in Rwanda. [5]

II. METHOD

Research Study Design

A descriptive quantitative cross-sectional Research study design was to determine the prevalence of chronic kidney diseases and factors that are associated with the prevalence at the selected hospitals in Kigali, Rwanda.

Target Population

The target population of this study was 111 in patients who were available in the medical words during the period of data collection in the selected hospitals. This is monthly admission and was the base of the calculation of the sample size to ascertain the prevalence and factors associated with chronic kidney disease in selected hospitals in Kigali, Rwanda.

Sample Size

This study used the Yamane sample size formula with a 95% confidence interval and a margin of error of 5% and prevalence.

Where,

n is the size of the sample,

N is the size of the population, and

e is the precision level or standard error = 0.05

A is a 95% level of confidence, and P = 0.05 are supposed for the equation.

Thus, the sample size is 87.

To calculate the sample size of each stratum to be in each hospital

is (sample size/population size) x stratum size. The study samples from the hospitals were further selected proportionally to apportion the sample size in the selected Hospitals.

Sampling Technique

This study used proportionate stratified random sampling to select the sample for each hospital after listing down all the beds from medical wards in selected hospitals. Therefore, simple random sampling was used to select the sample from each stratum (Hospital). Simple random sampling was done by putting all numbers in the basket and selecting the sample at equal change. Further apportioning by department and profession wasn't considered in the sampling stage.

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Eligibility Criteria

Inclusion Criteria

All patients over the age of 18 who were admitted to the medical wards and granted their consent were eligible for inclusion.

Exclusion Criteria

Patients with cognitive dysfunction, Patients in critical status who cannot respond to the questionnaire have been excluded from this study.

Data Collection Methods

Data Collection Instruments

This Research used both questionnaires for consulting the patient document as a support tool for collecting the information based on the research objectives. It consisted of a close-ended question to identify the prevalence and factors associated with chronic kidney disease and each respondent was provided a chance to express his/her opinion, ideas, and view freely in a given space without any other influence of the research or his/her assistant.

Administration of The Questionnaires

The study instruments were administered and filled out after the presentation of the introduction letter obtained from the MKU MPH departments. The participants were asked for signatures on the informed consent form. Once there are sufficient questionnaires generated for distribution, the chosen and trained research assistants collect the data from the study participants' and patients' files. Interview questionnaires with appropriate questions was asked of the respondents and a checklist of their files after identifying if they have chronic kidney disease. Finally, all questionnaires were returned to the researcher to verify that all questions were well responded to.

Reliability

A pilot study formula was conducted to improve the reliability of the test instrument, the number of Reliability will be 15/20 = 0.76 which gave a Cronbach alpha test of 0.7. This was tested to maintain the reliability of the study instrument (questionnaire).

Validity

A pilot study formula used validity to test accuracy V=RQ\TQ above (0.5) is valid V= validity RQ=relevant questions TQ= total question, Therefore,19 questions were asked for the different respondents, the total question was 19 with relevant questions where 15 other irrelevant questions were also 4 data validity as follows by using sample formula tests validity instrument=RQ\TQ=19\15=0.85. This was a valid result.

Data Analysis Procedure

Quantitative methods with coding and analysis by SPSS were done in this study. There was analysis and discussion per research objectives. around the research objective. The quantitative data was captured in SPSS version 21 the levels of significance were fixed at $p<0.05$, The CKD prevalence was calculated based on the CKD elucidated among the total study participants. Frequency and percentage were also used in the tables. Bivariate analysis with chi-square and multivariate analysis with odd ratios and Adjusted Odd Ratios were performed to assess the factors associated with CKD.

Ethical Considerations

This research study was approved by the research ethical committee of Mount Kenya and the IRB of the selected hospitals including the university teaching of the Hospital of Kigali and King Faisal, this research was mindful of ethical and data protection issues. All the participants who were part of this study have remained anonymous and Confidentiality for information collecting was used for academic purposes related to this study. The interview participants were voluntary respondents, but it is your choice whether to participate or not. This was important for the protection of the respondents from harm or harassment and the confidentiality of the respondents and their sensitive information.

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III.RESULTS & DISCUSSION

This study findings showed that the majority, 55.2% of the respondents were Male while the Female represented 44.8%. Around 19.5% were single while 69.0% were married, 9.2% were window and 2.3% were divorced (Table 1). Furthermore, table 1 revealed that the majority in the educational level, 43.7 were at the high school level while 32.2 were at the primary school level and 19.5 were at the university level. Around 3.4 were un-educational and 1.1 have not attended school. In the age group, 25.3% of the respondents were within the age group of 31-40 years, followed by 20.7% who were within the age group of 51-60 years. Around 66.7% were unemployed while 12.6% were privately employed. Of the nationality respondents, 92.0% were Rwandans while 6.9 were Burundian and 1.1 were Congolese.

Figure 1 indicates the majority of respondents of 80% were not suffering from chronic kidney disease while 20% were saying Yes have suffered from chronic kidney disease.

The bivariate analysis findings as shown in Table 2 demonstrated that all sociodemographic characteristic factors were not statistically significant toward chronic kidney disease. Table 3 presents findings that showed no significance for anemia, polycystic kidney disease, alcohol use, and liver failure. Around ten factors were statistically and significantly associated with chronic kidney disease. Diabetes, malaria antecedent, and long sickness period of more than 3 weeks were scientifically significant with X^2 =11.5, 19.5, 15.7 with $p<0.001$, respectively. Hypertension, heart diseases, acute kidney disease, and taking over-the-counter medication were also significant with a $p<0.05$.

The multivariate data analysis was processed for only the significant variables in bivariate analysis for controlling the confounders. Table 4 showed that only six variables were statistically significant among ten variables that were significant in the previous bivariate analysis. Diabetes mellitus, hypertension and malaria antecedent were significant with AoR:11.264 (2. 2.642-18.546); 6.215(3.112-22.543); 4.112(1.724-14.254) and $p<0.001$. The remaining three variables (acute kidney disease, over-the-counter medication, and longer sickness period) were also significant with $p<0.05$.

TABLE I
SOCIO-DEMOGRAPHIC CHARACTERISTICS OF THE STUDY PARTICIPANTS IN SELECTED KIGALI CITY HOSPITALS

Variable	***Category***	***Frequency***	***Percentage***
Gender	Male	48	55.2
	Female	39	44.8
Marital status	Single	17	19.5
	Married	60	69.0
	Divorced	2	2.3
	Window	8	9.2
Educational status	University	17	19.5
	Highschool(secondary)	38	43.7
	Primary school	28	32.2
	Non-educational	4	4.5
Age group	21-30yrs.	7	8.0
	31-40yrs.	22	25.3
	41-50yrs.	14	16.1
	51-60yrs.	18	20.7
	61-70yrs.	13	14.9
	71-80yrs.	11	12.6
	81-90yrs.	2	2.3
Occupation	Self-employed	9	10.3
	Governmental employed	9	10.3
	Private employed	11	12.6
	Un-employed	58	66.7

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Religion	Islamic	1	1.1
	Protestant	57	65.5
	Roman catholic	27	31.0
	Others	2	2.3
Nationality	Rwandan	80	92.0
	Burundian	6	6.9
	Congolese	1	1.1

Source: Researcher (2023)

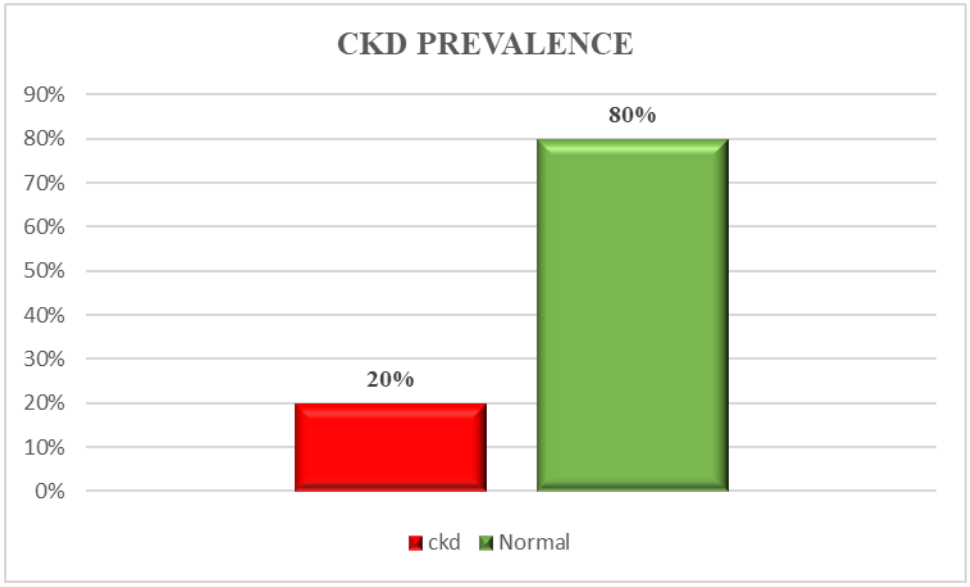

Fig. 1 prevalence of chronic kidney disease among inpatient in selected Kigali city hospitals in 2023.

TABLE II
BIVARIATE ANALYSIS OF SOCIODEMOGRAPHIC FACTORS ASSOCIATED WITH CHRONIC KIDNEY DISEASE AMONG INPATIENT IN KIGALI CITY SELECTED HOSPITALS.

Variables	***Chronic Kidney Disease***			***Chi-square***	***P-value***
	No n (%)	**Yes n (%)**	**Total (%)**		
Age Group				0.7	0.7
21-40yrs.	22(25.3)	7(8.0)	29(33.3)		
41-60yrs.	27(31.0)	5(5.7)	32(36.8)		
61yrs and +	21(24.1)	5(5.7)	26(29.9)		
Gender				0.1	0.7
Male	38(43.7)	10(11.5)	48(55.2)		
Female	32(36.8)	7(8.0)	39(44.8)		
Marital status				0.8	0.8
Single	13(14.9)	4(4.6)	17(19.5)		
Married	49(56.3)	11(12.6)	60(69.0)		
Divorced	8(9.2)	2(2.3)	10(11.5)		
Education level				2.0	0.7
Non-education	4(4.5)	0(0.0)	4(4.5)		
Primary	24(27.6)	4(4.6)	28(32.2)		
High school	29(33.3)	9(10.3)	38(43.7)		
University	13(14.9)	4(4.6)	17(19.5)		

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Occupation				6.2	0.09
Self-employed	7(8.0)	2(2.3)	9(10.3)		
Governmental employed	5(5.7)	4(4.6)	9(10.3)		
Private employed	11(12.6)	0(0.0)	11(12.6)		
Unemployed	47(54.0)	11(12.6)	58(66.7)		
Religion				1.4	0.6
Muslim	1(1.1)	0(0.0)	1(1.1)		
Protestant	44(50.6)	13(14.9	57(65.5)		
Roman Catholic	23(26.4)	4(4.6)	27(31.0)		
Others	2(2.3)	0(0.0)	2(2.3)		
Nationality				1.8	0.3
Rwandans	63(72.4)	17(19.5)	80(92.0)		
Burundians	6(6.9)	0(0.0)	6(6.9)		
Congolese	1(1.1)	0(0.0)	1(1.1)		

Source: Researcher (2023)

TABLE III
BIVARIATE ANALYSIS OF COMORBID AND BEHAVIORAL FACTORS ASSOCIATED WITH CHRONIC KIDNEY DISEASE AMONG INPATIENT IN KIGALI CITY SELECTED HOSPITALS.

Variables	***Chronic Kidney Disease***			***Chi-square***	P-value
	No n (%)	***Yes n (%)***	***Total (%)***		
Hypertension				4.9	**0.02**
Yes	37(42.5)	14(16.1)	51(58.6)		
No	33(37.9)	3(3.4)	36(41.4)		
Diabetes mellitus				11.5	**<0.001**
Yes	22(25.3)	13(14.9)	35(40.2)		
No	48(55.2)	4(4.6)	52(59.8)		
Anemia				0.4	0.4
Yes	27(31.0)	5(5.7)	32(36.8)		
No	43(49.4)	12(13.8)	55(63.2)		
Acute Kidney failure				10.3	**0.006**
Yes	17(19.5)	11(12.6)	2(32.2)		
No	52(59.8)	6(6.9)	58(66.7)		
Heart disease				8.2	**0.004**
Yes	4(4.6)	5(5.7)	9(10.3)		
No	66(75.9)	12(13.8)	78(89.7)		
Liver failure				1.2	0.2
Yes	1(1.1)	1(1.1)	2(2.3)		
No	69(79.3)	16(18.4)	85(97.7)		
Malaria antecedent				19.5	**<0.001**
Yes	12(13.8)	12(13.8)	24(27.6)		
No	58(66.7)	5(5.7)	63(72.4)		
Over the counter medication				5.4	**0.02**
Yes	11(12.6)	7(8.0)	18(20.7)		
No	59(67.8)	10(11.5)	69(79.3)		
Metabolic disease				5.5	**0.01**
Yes	2(2.3)	3(3.4)	5(5.7)		
No	68(78.2)	14(16.1)	82(94.3)		
Alcohol use				0.3	0.5
Yes	26(29.9)	5(5.7)	31(35.6)		
No	44(50.6)	12(13.8)	56(64.4)		
Polycystic Kidney disease				0.3	0.5
Yes	2(2.3)	1(1.1)	3(3.4)		
No	68(78.2)	16(18.4)	84(96.6)		
Traditional medicine use				3.4	**0.06**
Yes	24(27.6)	10(11.5)	34(39.1)		
No	46(52.9)	7(8.0)	53(60.9)		
Sickness period				15.7	**<0.001**

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Short period under 7 days	6(6.9)	0(0.0)	6(6.9)		
Period between one to 2Ws	43(49.4)	3(3.4)	46(52.9)		
More than 3weeks	21(24.1)	14(16.1)	35(40.2)		
Hypokalemia				4.3	**0.03**
Yes	1(1.1)	2(2.3)	3(3.4)		
No	69(79.3)	15(17.2)	84(96.6)		

Source: Researcher (2023)

TABLE IV
MULTIVARIATE ANALYSIS OF FACTORS ASSOCIATED WITH CHRONIC KIDNEY DISEASE AMONG INPATIENT IN KIGALI CITY SELECTED HOSPITALS.

Variables	***Chronic kidney disease***		***P-value***
	AoR	***95% CI***	
Diabetes Mellitus			
No	Ref		
Yes	11.264	2.642-18.546	**<0.001**
Hypertension			
No	Ref		
Yes	6.215	3.112-22.543	**<0.001**
Acute kidney disease			
No	Ref		
Yes	7.028	2.313-24.424	**0.03**
Malaria antecedent			
No	Ref		
Yes	4.112	1.724-14.254	**<0.001**
Metabolic disease			
No	Ref		
Yes	1.179	0.009-2.951	0.9
Heart disease			
No	Ref		
Yes	5.666	2.544-9.753	0.08
Over the counter medication			
No	Ref		
Yes	5.377	1.920-10.454	**0.04**
Longer period (>=3 weeks)			
No	Ref		
Yes	8.156	3.530-14.739	**0.03**
Traditional medicine use			
No	Ref		
Yes	2.258	0.139-3.625	0.5
Hypokalemia			
No	Ref		
Yes	1.235	0.134-2.75	0.6

Source: Researcher (2023)

In this study prevalence of chronic kidney disease for inpatients in selected Kigali city hospitals was 20%. In a similar study that was conducted in Rwanda, the prevalence of CKD ranged from 4% to 24%, mostly using proteinuria as a marker [5]. However, the prevalence of CKD in this study was pooled and ranged from inpatients [6]. The prevalence of 9% which has been done in Malaysia was less than this study's prevalence comparatively the one was found to be [7]. according to this researcher, the study conducted in Ethiopia found the prevalence of CKD was 17.3%. However, this prevalence found to be much than this in Ethiopia. the Brazil study prevalence results were 12.7% in Brazil which is less than this prevalence was found to be in Rwanda [8].

This study's findings regarding the co-morbidities of chronic kidney disease were conducted and hypertension and diabetes mellitus were among the majority of the respondents with 58.6% and 40.4%, respectively. A similar study was conducted in Ethiopia for diabetes mellitus. More than 422 million persons worldwide have diabetes

mellitus, and 40% developed CKD, less than the percentage found to be [9]. Hypertension as a co-morbidity to CKD was found to be 47 % and 23.3% in the United States of America, which is a high result compared to this study's findings[10]; [11];.

This study's results showed that old age was not associated with chronic kidney disease while the study done by Poudyal in Nepal showed that older age was associated with chronic kidney disease with AOR: 2.6, 95% CI (1.9 to 3.6). Around 36.8% of the study participants had anemia as a comorbidity with CKD. This result was slightly below the results of the study carried out in the US which showed that around 50% had anemia[12]. It was also mentioned that 47% had anemia in a South African study [13] .

The findings of this study showed that diabetes was 11 times and hypertension was 6 times significantly associated with chronic kidney disease which was also supported by other studies but with low Adjusted Odd ratios. This showed that hypertension and diabetes AORs were 2.4, 95% CI 2.0 to 3.0), diabetes mellitus (AOR 3.2, 95% CI 2.5 to 4.1), $p<0.05$, [14]. The astonishing results and the difference in this study's high AOR levels may be justified by the study settings of both studies where the Nepal study was carried out on a nationally representative sample while this study was limited to inpatients.

Malaria antecedent, over-the-counter medication, and acute kidney disease were associated with CKD, similar to other studies' findings [15].

This study's implication will be based on raising awareness and advocacy for chronic disease prevention. Improving the knowledge of people to be aware that the associated factors such as diabetes, hypertension, the counter medication could be the cause of chronic kidney disease which may jeopardize the health of people [5]. This study's findings could inspire the management of people with chronic kidney support through their education and explaining the cause of their health status. It would also be the foundation of predicting the future kidney status based on the associated factors.

IV. CONCLUSION

This study concluded that hypertension and diabetes are the key factors that are associated with chronic kidney disease. Over the counter medication and malaria antecedent were also found to be the second level factors to be associated with CKD. Therefore, this study suggests the Ministry of Health in Rwanda and international partners to increase health education/health promotion interventions by health workers for kidney protection and decrease the risk of developing serious CKD. The interventions should be oriented to non-communicable diseases prevention within a prepared periodic campaign through media, seminars, and workshops by the healthcare providers and patients who are involved.

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