

# Gender Based Prevalence and Associated Factors of Chronic Kidney Disease Patients Attending Hemodialysis Maintenance at Mnazi Mmoja Hospital in Zanzibar

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## Abstract

**Background:** Chronic Kidney Disease (CKD) is an abnormality of kidney structure or function that is present for more than 3 months, resulting in a progressive loss of renal function that can occur over a year. It is a global public health concern affecting around 9.1% of the total global population. In Sub-Saharan Africa (SSA), more than 16% of the population is affected by CKD. Most of the published papers focused more on explaining the prevalence of Chronic Kidney Disease (CKD) regardless of sex differences. No or little study in Zanzibar has explained CKD and its associated factors based on gender. So, this study aimed to address the prevalence of CKD patients based on sex criteria and further determined the risk factors associated with the development of Gender based CKD.

**Methods:** This cross-sectional prospective study was conducted at Mnazi Mmoja Referral Hospital in Zanzibar. Consecutive sampling was used as the only technique to obtain participants. A standard questionnaire and patient files were used to capture the demographic, clinical characteristics, and risk factors data respectively. SPSS was used to analyze the data. A frequency distribution table was used to calculate the prevalence. *Chi-square* as well as relative Risk were used to determine the association between factors and gender based CKD.

**Results:** A total of 97 patients participated in the study. The prevalence of males and females CKD was 57.1% and 42.3% respectively. The mean age of all study participants was  $49 \pm 12$  years respectively, where males' and females' mean age were  $50 \pm 12$  and  $46 \pm 10$  years. The majority of the females with CKD were in between 36-45 years while males were 45-60 years. Most of the CKDs were secondary school gradulators (M: F=58.9:61). Older age >60 years for males CKD and 36-45 years for females' age was identified as a statistically significant risk factor for developing a CKD ( $p < 0.05$ ). Hypertension and diabetes were also identified as the risk factors mostly for males than females although the finding was not statistically significant ( $p > 0.05$ ).

**Conclusion:** The study observed a higher prevalence of male CKD than did females. Factors like old age, hypertension and diabetes were more associated with male's CKD than females. Young females 36-45 years old were identified as a risk factor for the progression of CKD for females.

**Keywords:** Prevalence of CKD • Risk factors • Diabetes • Hypertension • Testosterone

**Abbreviations:** CKD: Chronic Kidney Disease; ESRD: End-Stage Renal Disease; M/1/H: Mnazi Mmoja Hospital in Zanzibar

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## Introduction

Chronic Kidney Disease (CKD) is an abnormality of kidney structure or function that is present for more than 3 months, resulting in a progressive loss of renal function that can occur over a year [1-4]. The disease is progressive and develops slowly from an acute kidney injury to irreversible loss of nephron and the same time accompanied by a decrease in estimated glomerular filtration rate in a few days which may be due to ischemia or toxin [5-8]. The kidney is an important organ in the body due to its wide physiological activities [9-11].

CKD is a global public health concern affecting around 9.1% of the total global population. In Sub-Saharan Africa (SSA), more than 16% of the population is affected by CKD [12-16]. This disease is now ranked as the sixth fastest-growing cause of mortality globally, with over 2.4 million deaths per year [17].

Sex differences in CKD progression were reported to be influenced by various risk factors such as hypertension, hyperglycemia, albuminuria, dyslipidemia, body mass index, lifestyle factors, and sex hormones. But few studies have reported the scenario.

Most of the published papers focused more on explaining the prevalence of Chronic Kidney Disease (CKD) regardless of gender differences. The generalized approach to reporting disease is good but its efficiency is increased if it focuses more on a specific approach like sex. The gender-based intervention will be developed easily and will focus on physiological differences that exist between males and females. No or little study in Zanzibar has explained CKD and its associated factors based on gender. Furthermore, country-level assessment of the differential burden of CKD in females and males is needed to define locally relevant policies that address the needs of both sexes. So, this study aimed to address the prevalence of CKD patients based on sex criteria and further determined the risk factors associated with the development of gender-based CKD.

## Materials and Methods

### Study design and duration

This was a cross-sectional prospective study conducted in 2022 in a hemodialysis unit at Mnazi Mmoja Hospital in Zanzibar.

### Study area

The study was conducted in the dialysis unit of Mnazi Mmoja Referral Hospital of Zanzibar.

The hospital has more than 10 functioning hemodialysis machines which operate properly. About 20 patients attend dialysis procedures for HD services per day. The unit has about 16 health care workers including doctors and nurses. The services daily start from 7 am to 5 pm.

### Study population

The study participants were CKD patients attending hemodialysis maintenance at Mnazi Mmoja Hospital in Zanzibar. Those aged 18 years and above, with a stable health condition, and able to communicate well at the time of data collection were included in the study while those with an acute kidney injury were excluded from the study.

### Sample size and selection

The sample size of the study was 97 while 90% power was used to detect a mean difference of 1 with an effect size of 1 and an estimated standard deviation of 3, a significance level (alpha) of 0.050 using a two-sided paired t-test.

### Sampling technique

A consecutive sampling technique was used to select the participants where everyone who met the inclusion criteria was selected to participate in the study

### Enrolment of study participants

Patients who met the inclusion criteria were identified via the patient's file in the dialysis unit. The objective of the study was explained to those selected patients, then consent forms of participation were provided and asked to participate in the study.

**Dependent variable:** Prevalence of male and female's CKD.

**Independent variables:** Age, blood pressure, diabetes mellitus, address, marital status, level of education, occupation, type of beverage consumed frequently before being a CKD.

### Data collection methods

A well-structured questionnaire was used to capture the demographic factors, clinical characteristics and those factors associated with chronic kidney disease.

### Data analysis

Statistical Package for Social Sciences (SPSS) was used to analyze the data. The normality of the data was investigated using Kolmogorov-Smirnov method. Means and standard deviations were used to present normally distributed data while the median was for non-normally distributed data. A *Chi-square* and risk analysis were used to find the association between genders-based CKD and its factors. P values <0.05 were considered statistically significant.

## Results

Gender prevalence, demographic and clinical characteristics of the study participants the study participants were 97, CKD male prevalence was 56 (57.7%) while female was 41 (42.3%) (Table 1).

| Gender based CKD | Frequency (n) | Prevalence |
|------------------|---------------|------------|
| Males            | 56            | 57.7       |
| Females          | 41            | 42.3       |
| Total            | 97            |            |

**Table 1.** Gender based prevalence of chronic kidney diseases.

The mean age of all study participants was  $49 \pm 12$  years respectively, where males' and females' mean age were  $50 \pm 12$  and  $46 \pm 10$  years (Tables 2 and 3).

| Variables                            | Category       | Frequency (n) |        | Percent (%) |        |
|--------------------------------------|----------------|---------------|--------|-------------|--------|
|                                      |                | Male          | Female | Male        | Female |
| Age group ( years)                   | 18-35          | 11            | 4      | 19.6        | 9.8    |
|                                      | 36-45          | 11            | 20     | 19.6        | 48.8   |
|                                      | 46-60          | 21            | 14     | 37.5        | 34.1   |
|                                      | >60            | 13            | 3      | 23.2        | 7.3    |
| Mean age ( years)                    |                | $50 \pm 12$   |        | $46 \pm 10$ |        |
| Duration of hemodialysis Maintenance | Less than year | 15            | 12     | 26.8        | 29.3   |
|                                      | 1-2 years      | 17            | 12     | 30.4        | 29.3   |
|                                      | 2-3 years      | 10            | 7      | 17.9        | 17.1   |
|                                      | 3-5 years      | 10            | 8      | 17.9        | 19.5   |
|                                      | >5 years       | 4             | 2      | 7.1         | 4.9    |
| Knowledge                            | Primary        | 11            | 9      | 19.6        | 22     |
|                                      | Secondary      | 33            | 25     | 58.9        | 61     |
|                                      | High school    | 10            | 4      | 17.9        | 9.8    |
|                                      | Nothing        | 2             | 3      | 3.6         | 7.3    |
| Hypertension before CKD              | Yes            | 38            | 25     | 67.9        | 61     |
|                                      | No             | 18            | 16     | 32.1        | 39     |
| Diabetes before CKD                  | Yes            | 25            | 14     | 44.6        | 34.1   |
|                                      | No             | 31            | 27     | 55.4        | 65.9   |

**Table 2.** Gender demographic and clinical characteristics of the study participants.

| Variables                                                                                                                                                                                      | Gender CKD status |           |           | Total | X <sup>2</sup> Value | Risk Ratio (RR) | P-value |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|-----------|-----------|-------|----------------------|-----------------|---------|
| Variables                                                                                                                                                                                      | Categories        | Male      | Female    |       |                      |                 |         |
| Age                                                                                                                                                                                            | 18-35             | 11 (73.3) | 4 (26.7)  | 15    | 11.485               | N/A             | 0.009   |
|                                                                                                                                                                                                | 36-45             | 11 (35.5) | 20 (64.5) | 3     |                      |                 |         |
|                                                                                                                                                                                                | 46-60             | 21 (60)   | 14 (40)   | 35    |                      |                 |         |
|                                                                                                                                                                                                | >60               | 13 (56)   | 3 (41)    | 16    |                      |                 |         |
| Upon a post hoc analysis, the red font colors in the above <i>Chi-square</i> "A" indicate the significant effect (Z-value>1.96) of the particular age category toward the gender CKD. (P<0.05) |                   |           |           |       |                      |                 |         |
| Knowledge                                                                                                                                                                                      | Primary           | 11 (55)   | 9 (45)    | 20    | 1.789                | N/A             | 0.615   |

|                                                                                                                                                                                                                                                      |             |           |           |    |       |       |       |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|-----------|-----------|----|-------|-------|-------|
|                                                                                                                                                                                                                                                      | Secondary   | 33 (56.9) | 25 (43.1) | 58 |       |       |       |
|                                                                                                                                                                                                                                                      | High School | 10 (71.4) | 4 (28.6)  | 14 |       |       |       |
|                                                                                                                                                                                                                                                      | Nothing     | 2 (40)    | 3 (60)    | 5  |       |       |       |
| The X <sup>2</sup> "B" test shows the effect of the knowledge level on the gender based CKD although was not a significant statistical significance (p>0.05)                                                                                         |             |           |           |    |       |       |       |
| Hypertension before CKD                                                                                                                                                                                                                              | Yes         | 38 (60.3) | 25 (39.7) | 63 | 0.492 | 1.351 | 0.483 |
|                                                                                                                                                                                                                                                      | No          | 18 (52.9) | 16 (47.1) | 34 |       |       |       |
| The X <sup>2</sup> "C" test shows the effect of the hypertension status on the gender based CKD although even though was not a statistical significance (p>0.05). The risk ratio for male HTN to develop CKD was higher than females (RR .M/F=1.351) |             |           |           |    |       |       |       |
| Diabetes before CKD                                                                                                                                                                                                                                  | Yes         | 25 (64.1) | 14 (35.9) | 39 | 1.085 | 1.555 | 0.298 |
|                                                                                                                                                                                                                                                      | No          | 31 (53.4) | 27 (46.6) | 58 |       |       |       |
| The X <sup>2</sup> "D" test shows the effect of diabetes on gender based CKD although was not a statistical significance (p>0.05). The risk ratio for male HTN to develop CKD was higher than for females (RR .M/F=1.555)                            |             |           |           |    |       |       |       |

**Table 3.** A Chi-square that shows the gender based association of CKD to its causative agents (Independent factors).

## Discussion

The current study was conducted specifically to explore the prevalence of chronic kidney diseases patients and its associated factors based on gender criteria in Zanzibar. The study observed that CKD in males was higher than that in females. This was similar to the study that African-American men have a higher risk of CKD progression than African-American women. Physiologically is due to the effect of testosterone explained by the National Kidney Foundation and American Society of Nephrology on causing a tubular injury that leads to CKD more in males than in females. However, the finding was in contradiction with several other research conducted in different places of the world like Asia, Sweden, Israel, and the whole globe that reported a higher prevalence of female CKD patients than males. The Kidney Disease Improving Global Outcome (KIDGO) further emphasized that the prevalence of CKD is normally higher in boys than girls, but reverses when they reach adulthood. Despite gender based differences explained previously in this paper. Moreover, the meta-analysis study found the similarity CKD prevalence for stages one to five among men and women, whereas those for stages three to five were higher among women than men.

**In terms of age category:** The 18-35 years' males were more affected than comparable females. However, the most affected females were between 36 to 45 years old and were detected statically as the leading cause of CKD in the Zanzibar females (p<0.05). Furthermore, 60-year-old males and above were observed to have a statistical effect on progressing to CKD than females. The result was similar to the finding of Chang et al. The study, but also contradicted the other findings.

**In terms of knowledge level:** The study observed majority of CKDs finished secondary school regardless of their gender differences. No level of knowledge had shown a significant effect on causing CKD in either males nor did females (p>0.05) although illiteracy was observed as a risk factor for developing CKD as encountered in most females.

**In terms of hypertension:** The current study also observed that hypertension is among the risk factors of CKD and mostly for males than females (RR=1.351, p= 1.351). The result was similar to the Duru et al. study that African men have a higher risk of CKD progression than African women because of the poorly controlled hypertension among males. Despite that hypertension was observed as a risk factor for men and also women even though were not statistically significant.

**In terms of diabetes:** Diabetes was encountered as the one risk factor of CKD among male participants than females even though there was no statistical significance (RR=1.555, p=0.298). The study further showed a unique finding that the majority of the females with CKD were not diabetic before developing into CKD.

## Conclusion

The study observed that the prevalence of male CKD was higher than that of females. Old age, hypertension, and diabetes were risk factors for the progression of CKD although were slightly higher in males than females. Age in the range of 36-45 years was also identified as a risk factor for the progression of CKD more in females than males.

### Strength of the study

The study tried hard to explore and make vivid some of the risk factors that actually lead to CKD but mostly based on gender.

### Limitations of the study

Fund as because I sponsored myself.

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## Funding

This was a nonrefundable study.

## Availability of Data and Materials

The data are available from the corresponding author (hamadsuleiman558@gmail.com) on reasonable request.

## Authors' Contributions

All authors contributed to the study conception and study design. HM wrote a whole research paper on the Supervision of FM and AT from scratch to the end of the study.

## Ethics Approval and Consent to Participate

Ethical clearance for conducting this study was obtained from the Institution Review Board of the Muhimbili University of Health and Allied Sciences (MUHAS) and ZAHREC from Zanzibar. A Swahili formal written informed consent was provided to the participants and requested to sign it. Only eligible participants were allowed to participate in the study. Confidentiality was maintained by hiding Patients' names and their particular were obtained using their checklist numbers

## Consent for Publication

NA.

## Competing Interests

The authors declare that they have no competing interests.

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