STUDY ON
CHRONIC KIDNEY DISEASES

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ABSTRACT:

Chronic diseases have become a major cause of global morbidity and mortality even in developing countries. The burden of chronic kidney disease (CKD) in India cannot be assessed accurately. Chronic kidney disease (CKD) is defined by persistent urine abnormalities, structural abnormalities or impaired excretory renal function suggestive of a loss of functional nephrons. The majority of patients with CKD are at risk of accelerated cardiovascular disease and death. For those who progress to end-stage renal disease, the limited accessibility to renal replacement therapy is a problem in many parts of the world. Risk factors for the development and progression of CKD include low nephron number at birth, nephron loss due to increasing age and acute or chronic kidney injuries caused by toxic exposures or diseases (for example, obesity and type 2 diabetes mellitus). The management of patients with CKD is focused on early detection or prevention, treatment of the underlying cause (if possible) to curb progression, and attention to secondary processes that contribute to ongoing nephron loss. Blood pressure control, inhibition of the renin-angiotensin system, and disease-specific interventions are the cornerstones of therapy. CKD complications such as anemia, metabolic acidosis, and secondary hyperparathyroidism affect cardiovascular health and quality of life and require diagnosis and treatment.

BACKGROUND:

The overall magnitude and pattern of chronic kidney disease (CKD) in India has been studied sporadically [1-5]. There are no national or regional reports on the incidence or prevalence of either CKD or end-stage renal disease (ESRD). In a population-based survey of approximately 570,000 individuals in the Central The Indian city of Bhopal, the crude and age-adjusted ESRD incidence rates were determined at 151 and 232 pmp, respectively [6,7]. Studies on the prevalence of CKD suffer from the use of divergent methodologies. In a survey of about 4,000 healthy adults, the prevalence of microalbuminuria and reduced glomerular filtration rate was 10% and 13% respectively [8]. In another study [9], 2.5% of 5300 subjects had dipstick positive proteinuria and 4.8% had GFR < 60 ml/min. Agarwal et al [10] found low GFR (defined as serum creatinine > 1.8 mg/dl) in 0.8% of 4972 subjects surveyed in Delhi. These data stand in contrast to data from the developed world, where large population-based surveys such as the NHANES have shown the prevalence of CKD to be about 12-20% [11-13].

INTRODUCTION:

Chronic kidney disease (CKD) is among the top 20 causes of death worldwide and affects approximately 10% of the world's adult population.

The kidneys are two bean-shaped organs. Each kidney is about the size of a fist. Your kidneys filter extra water and wastes out of your blood and make urine. Chronic kidney disease (CKD) means your kidneys are damaged and can’t filter blood the way they should. The disease is called “chronic” because the damage to your kidneys happens slowly over a long period. This damage can cause wastes to build up in your body. The main risk factors for developing kidney disease are diabetes, high blood pressure, heart disease, and a family history of kidney failure.

CKD is defined by indicators of kidney damage—imaging or proteinuria (commonly using albumin to creatinine ratio, ACR)—and decreased renal function (below thresholds of GFR estimated from serum creatinine concentration). Current recommendations by Kidney Outcomes Quality

Initiative (KDOQI) and National Institute for Health Excellence (NICE) are to use serum creatinine concentration to estimate GFR (eGFR) and transform it using the Chronic Kidney Disease Epidemiology Collaboration (CKD-EPI) equation. CKD-EPI replaces the Modification of Diet in Renal Disease (MDRD) equation as a more accurate predictor of clinical risk and both these equations correct for selected non-renal influences (age, race, gender). CKD can be classified into five stages using KDOQI guidelines using thresholds of eGFR within the CKD range and/or evidence of structural renal changes e.g., proteinuria. NICE has suggested that stage 3 be subdivided into 3a and 3b reflecting increasing CVD risk. The largest stage of CKD, with over 90% of cases, has been estimated from a UK retrospective lab audit study to be CKD stage 3 with 84% stage 3a (GFR of 45 to 59 ml/min/173m2) and 16% stage 3b GFR of 30 to 44 ml/min/173m2.

Chronic diseases have become a major cause of global morbidity and mortality even in developing countries. The burden of chronic kidney disease (CKD) in India cannot be assessed accurately.

Your health care provider may do tests to find out why you have kidney disease. The cause of your kidney disease may affect the type of treatment you receive.

DATA SET:

https://archive.ics.uci.edu/ml/datasets/chronic_kidney_disease

This dataset can be used to predict the chronic kidney disease

METHODOLOGY:

DATA COLLECTION:

This report is written based on secondary data collected from Source:

Dr.P.Soundarapandian.M.D.,D.M

(Senior Consultant Nephrologist),

Apollo Hospitals,

Managiri,

Tamilnadu,

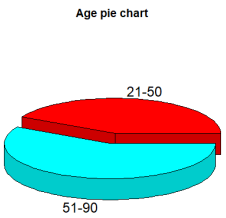
India.

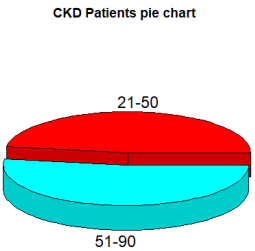
METHODS OF DATA ANALYSIS:

Statistical methodologies were used to analyze the data and inferences were drawn accordingly based on the study. The data was further analyzed by drawing simple tables, scattered plot etc., and suitable statistical tests with help of R software.

VARIABLES:

1. Age
2. coronary artery disease
3. Diabetes Mellitus
4. Anemia
5. Hypertension
6. Albumin
7. Serum Creatinine
8. Sodium
9. Potassium
10. Red Blood Cell Count
11. Blood Urea
12. Hemoglobin





HYPOTHESIS:

	NULL HYPOTHESIS
HYPOTHESIS 1	*THERE IS NO ASSOCIATION BETWEEN AGE AND CHRONIC KIDNEY DISEASE(CKD)*
HYPOTHESIS 2	*THERE IS NO ASSOCIATION BETWEEN AGE AND CORONARY ARTERY DISEASE(CAD)*
HYPOTHESIS 3	*THERE IS NO ASSOCIATION BETWEEN AGE AND HYPERTENSION(HTN)*
HYPOTHESIS 4	*THERE IS NO ASSOCIATION BETWEEN CORONARY ARTERY DISEASE (CAD) AND CKD*
HYPOTHESIS 5	*THERE IS NO ASSOCIATION BETWEEN DIABETES MELLITUS(DM) AND CKD*
HYPOTHESIS 6	*THERE IS NO ASSOCIATION BETWEEN ANEMIA(ANE) AND CKD*

ANALYSIS AND RESULT:

After weeding out duplicate and incomplete entries, data on 235 patients were analyzed.

Data consist of the population between age group 21 to 90. 47.6% of the population is between 21 to 50 years and the rest 52.4% population between 51 to 90 years. According to data, 42.1% of the patients are suffering from CKD while the remaining 57.8% are not.

For testing the significant dependence of variables and CKD the researcher used the chi-square test for independence.

HYPOTHESIS-1

Pearson's Chi-squared test with Yates' continuity correction
data: chi
X-squared = 11.255, df = 1, p-value = 0.0007941

SINCE TABULATED VALUE OF CHI SQUARE AT d.f=1 IS LESS THAN CALCULATED VALUE HENCE NULL HYPOTHESIS IS REJECTED.

The null hypothesis was rejected as the X^2 value is significant hence CKD is associated with age.

HYPOTHESIS-2

Pearson's Chi-squared test with Yates' continuity correction
data: chi
X-squared = 4.5759, df = 1, p-value = 0.03242

SINCE THE TABULATED VALUE OF CHI-SQUARE IS LESS THAN THE CALCULATED VALUE HENCE NULL HYPOTHESIS IS REJECTED.

The null hypothesis was rejected as the X^2 value is significant hence CAD is associated with age.

HYPOTHESIS-3

Pearson's Chi-squared test with Yates' continuity correction
data: chi
X-squared = 17.432, df = 1, p-value = 2.978e-05

SINCE THE TABULATED VALUE OF CHI-SQUARE IS LESS THAN THE CALCULATED VALUE HENCE NULL HYPOTHESIS IS REJECTED.

The null hypothesis was rejected as the X^2 value is significant hence HYPERTENSION is associated with age.

HYPOTHESIS-4

Pearson's Chi-squared test with Yates' continuity correction
data: chi
X-squared = 42, df.779 = 1, p-value = 6.128e-11

SINCE THE TABULATED VALUE OF CHI-SQUARE IS LESS THAN THE CALCULATED VALUE HENCE NULL HYPOTHESIS IS REJECTED.

Null hypothesis rejected as X^2 value is significant hence CORONARY ARTERY DISEASE is associated with CKD.

HYPOTHESIS-5

```
Pearson's Chi-squared test with Yates' co
ntinuity                          correction
data:                                   chi
X-squared = 105.07, df = 1, p-value < 2.2
e-16
```

SINCE THE TABULATED VALUE OF CHI-SQUARE I S LESS THAN THE CALCULATED VALUE HENCE NU LL HYPOTHESIS IS REJECTED.

The null hypothesis was rejected as the X^2 value is significant hence CKD is associated with DIABETES MELLITUS.

HYPOTHESIS-6

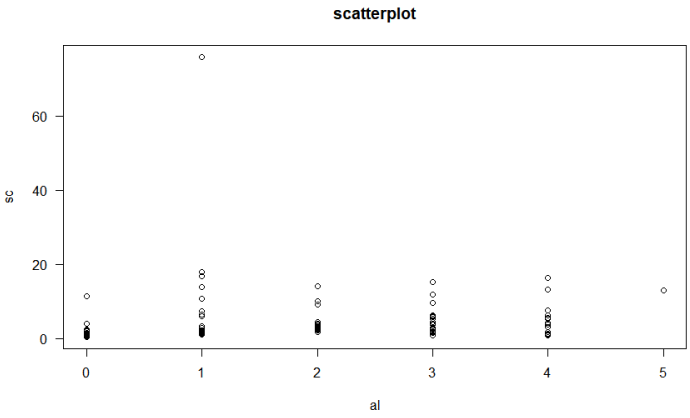
```
Pearson's Chi-squared test with Yates' co
ntinuity                          correction
data:                                   chi
X-squared = 42.779, df = 1, p-value = 6.1
28e-11
```

SINCE THE TABULATED VALUE OF CHI-SQUARE I S LESS THAN THE CALCULATED VALUE HENCE NU LL HYPOTHESIS IS REJECTED.

The null hypothesis was rejected as the X^2 value is significant hence CKD is associated with ANEMIA.

CORRELATION & LINE OF REGRESSION:

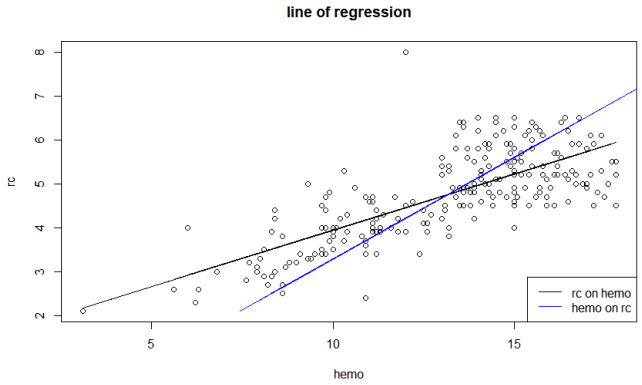
(I) ALBUMIN & SERUM CREATININE




```
data:  al and sc
t = 4.9189, df = 233, p-value = 1.644e-06
alternative hypothesis: true correlation is not equal to 0
95 percent confidence interval:
 0.1860488 0.4182730
sample estimates:
      cor
0.3067185
```

From the above data, it is visible that **correlation value = +0.30**. Hence, we can say that albumin & serum creatinine have **a weak downhill (positive) linear relationship.**

(II)RED BLOOD COUNT CELL & HEMOGLOBIN

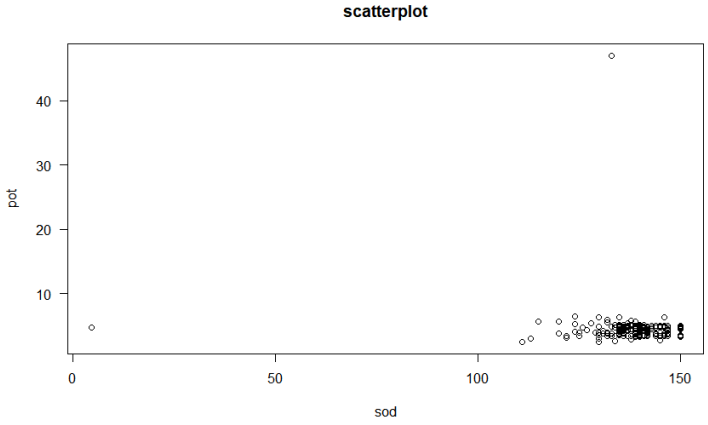



```
data:  rc and hemo
t = 16.979, df = 233, p-value < 2.2e-16
alternative hypothesis: true correlation is not equal to 0
95 percent confidence interval:
 0.6804492 0.7958928
sample estimates:
      cor
0.7436643
```

Regression Line Rc on Hemo Is Better Fitted Than Model Hemo on Rc As The Regression Line For Rc On Hemo Is More Closer To The Data Points, Thus Error Is Less In Rc On Hemo Than Rc On Hemo Hence A Better R^2 Value.

From the above data, it is visible that **correlation value = +0.70**. Hence, we can say that red blood count cell & hemoglobin have **a strong uphill (positive) linear relationship.**

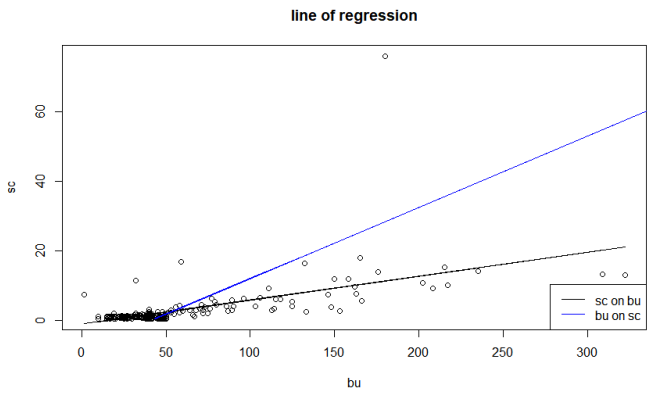
(III) SODIUM & POTASSIUM




```
data:  sod and pot
t = -0.46591, df = 233, p-value = 0.6417
alternative hypothesis: true correlation is not equal to 0
95 percent confidence interval:
 -0.15786455  0.09784592
sample estimates:
        cor
-0.03050849
```

From the above data, it is visible that **correlation value = -0.30**. Hence, we can say that sodium & potassium have **a weak downhill (negative) linear relationship.**

(IV) BLOOD UREA & SERUM CREATININE




```
data:  bu and sc
t = 10.833, df = 233, p-value < 2.2e-16
alternative hypothesis: true correlation is not equal to 0
95 percent confidence interval:
 0.4868441 0.6579962
sample estimates:
      cor
0.5787583
```

Regression Line sc on bu Is Better Fitted Than Model bu on sc As The Regression Line For sc On bu Is More Closer To The Data Points, Thus Error Is Less In sc On bu Than sc On bu Hence A Better R^2 Value.

From the above data, it is visible that **correlation value = +0.50**. Hence, we can say that blood urea & serum creatinine have **a moderate uphill (positive) relationship.**

CONCLUSION:

- Age is **a significant risk factor for chronic kidney disease** (CKD). The high prevalence of CKD is the result of a combination of age and cardiovascular risk factors that accrue with age.
- Age is **the strongest factor related to the development of coronary heart disease.**
- Hypertension and diabetes mellitus are associated with CKD and across the full adult age range. Importantly, this association was statistically significantly stronger at younger age groupings.
- The presence of chronic kidney disease (CKD) is a major risk factor for developing coronary artery disease (CAD). This implies that CKD and CAD are associated.
- CKD is associated with pedal edema and the symptoms of CKD can include: **swelling around your eyes**, called periorbital edema. swelling of your legs, called pedal edema.
- Anemia is common in CKD, especially in the latter stages of the disease. You're more likely to develop anemia if you also have diabetes. Anemia is also correlated to CKD.
- In CKD patients, the correlation is not strong in patients with low urinary creatinine concentration. Albumin is increased excretion of urinary albumin and a marker of kidney damage.
- The group with both high potassium and high sodium intake had the greatest reduction in risk of CKD.
- Sugar is not a problem for the kidneys unless the blood sugar level gets too high.

SUGGESTIONS:

We can protect our kidneys by preventing or managing health conditions that cause kidney damage. The steps illustrated below may help keep our whole body healthy, including our kidneys.

1. Make healthy food choices-Choose foods that are healthy for your heart and your entire body: fresh fruits, fresh or frozen vegetables, whole grains, and low-fat or fat-free dairy products. For instance:

(I)Try to choose foods with little or no added sugar.

(II)Cook with a mix of spices instead of salt.

(III)Eat foods made from whole grains

(IV)Slow down at snack time.

2. Make physical activity part of your routine - Be active for 30 minutes or more on most days. Aiming to walk 10,000 is a great way to motivate yourself to move more and to interrupt the time you spend sitting. Regular physical activity can improve your muscle strength and boost your endurance.

3. Aim for a healthy weight-Reaching and maintaining a healthy weight is important for overall health and can help you prevent and control many diseases and conditions

4. Get enough sleep- Aim for 7 to 8 hours of sleep each night. Sleep plays a vital role in good health and well-being throughout your life. Getting enough quality sleep at the right times can help protect your

mental health, physical health, quality of life, and safety.

5. Stop Smoking-Quitting smoking is one of the most important actions people who smoke can take to reduce their risk for cardiovascular disease.

6 . Limit alcohol intake,ke-Health problems such as liver disease, brain injury, cancer, and heart problems are strongly linked to drinking alcohol, and the more you drink the greater the risk. People with pre-existing mental and physical health vulnerabilities are more at risk.

7. Explore stress-reducing activities-

It can increase self-confidence, improve your mood, help you relax, and lower symptoms of mild depression and anxiety. Activities like meditation help us to reduce stress

8. Manage diabetes, high blood pressure, and heart disease

If you have diabetes, high blood pressure, or heart disease, the best way to protect your kidneys from damage is to Keep blood glucose numbers and blood pressure close to your goal. Take all your medicines as prescribed.

To help prevent heart attacks and stroke, keep your cholesterol levels in the target range.

ACKNOWLEDGEMENT:

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