

Evaluation of the Risk Factors of Chronic Kidney Failure (CKF) in Gujrat, Pakistan: Evidence from a Case Control Study

¹Mirza Rizwan Sajid, ¹Tuba Zia, ²Asif Hanif and ³Asim Butt

¹Department of Statistics, University of Gujrat, Gujrat, Pakistan

²Department of Bio-Statistics, Gulab Devi, Post Graduate Medical Institute, Lahore, Pakistan

³Statistical Analyst, Office for National statistics, United Kingdoms

Abstract: Chronic Kidney/ Renal Failure (CKF) is a disease in which kidney fails to remove the waste products from the blood which make the human life very difficult, ultimately reduces the life expectancy of patients. This condition usually leads to renal replacement therapy. The primary objective of current study is the evaluation of the risk factors of disease (CKF). And formulate a predictive model for CKF, which helps in determining the likelihood of having this disease for a normal person in the presence of different risk factors. A Case Control study design has been used to collect the data. The sample of 180 (90 cases and 90 controls) were selected from four different hospitals (Aziz Bhatti Shaheed Hospital, Chenab Hospital, Jinnah Hospital and Khawajgan Trust) of Gujrat, Pakistan. Odds Ratio, Chi-Square test of association and conditional Logistic Regression analysis has been used as data analysis techniques. Study results have shown that, Blood pressure, Diabetes Mellitus, Blood transfusion, Family History, Analgesic, Back Injury, Urinary Tract Infection and Anemia were found to be the significant risk factors of Chronic Kidney Failure (CKF) in this study. But conditional logistic regression model shows that only three risk factors have been used for the prediction of disease. This study concludes that these risk factors are linked with the disease outcome and can be dealt as predictive factors of CKF.

Key words: Chronic Kidney Failure (CKF) • Odds Ratios (OR) • Conditional Logistic Regression • Risk factors

INTRODUCTION

The prevalence and incidence of Chronic Kidney Failure (CKF) is increasing rapidly that reduces quality of life and causes great expense to the health system of countries. According to a study conducted in Pakistan, “One in three adults in Pakistan above the age 40 has to face the problem of kidney disease, which is mainly caused by diabetes and high blood pressure [1]. Approximately 140,000 people are suffering from kidney diseases annually in Pakistan. From these 40,000 get dialysis treatment and only 800 patients can avail transplant facility [2].

There are many illustrious risk factors for this disease as stated in literature. Some of them have been discussed in this study. In medical studies muscular impact of demographic and socio-economic variables cannot be

denied. Low socioeconomic status is associated with elevated risk of having CKF [3]. On the other hand some other factors have been identified and provided the evidence that Anemia increased the risk of chronic kidney disease [4]. Another study concluded that Anemia, Congestive Heart Failure (CHF) and Chronic Kidney Insufficiency (CKI) are capable of causing or worsening each other [5]. Urinary Tract Infection (UTI) may increase the rate of the deterioration of renal function and cause the chronic kidney failure [6].

An important study in 1994 reported that analgesic consumption increased the risk of end stage kidney disease [7]. Similarly some studies highlighted that there was strong association between Family history and CKF [8]. In addition to that some studies showed that diabetic status has strong influence on having CKF [7, 9]. There are many physiological changes which affect functions of

other body parts. Like; hypertension has also been shown a positive association with CKF in studies [9-11]. Some studies have also explored that behavioral risk factors like alcohol consumption was also the risk factor of CKF [12, 13]. Like alcohol usage, Smoking has also been shown a strong link with CKF in the literature [9, 12, 14, 15].

There are many risk factors of this disease which can be studied in the literature. But this study will provide a statistical model which can be used in the prediction of this disease outcome on the basis of risk factors.

Objectives of Study:

- To see the main signs and symptoms of CKF in patients
- To evaluate the risk factors of disease (Chronic Kidney Failure).
- To formulate a predictive model for chronic kidney failure which helps in determining the likelihood of having this disease for a person?

MATERIALS AND METHODS

A case control retrospective study was designed to evaluate and estimate the effect of risk factors. This study was completed at Department of Statistics, University of Gujrat, by taking data from District Head Quarter (Aziz Bhatti Shaheed Hospital) and some main private hospitals like: Chenab Hospital, Jinnah Hospital and Khawajgan Trust Hospital. 180 patients were included in the study after taking their informed consent. In these selected patients 90 were cases and remaining was dealt as controls.

Sample Selection Criteria

Inclusion Criteria:

- The sampled population of this study consisted of those people who were visited to District Head Quarter (Aziz Bhatti Shaheed Hospital), Chenab hospital, Jinnah hospital and Khawajgan Trust Hospital Gujrat.
- The patients who were visiting dialysis centre of selected hospitals of Gujrat, with the disease of Chronic Kidney Failure and were diagnosed by the doctor were chosen as the cases for this study and the patients who did not have the disease of Chronic Kidney Failure were selected as the control group for this study.

Data Collection Tool: A well structured questionnaire was used for the data collection. It was consisted of five sections: Demographic information, Family history, Potential risk factors, Sign and symptoms and Lab investigation.

Matching Strategy: In this study one to one matching strategy was used to control the effect of potential confounding variables identified in the previous researches such as age, area and gender.

Statistical Analysis: Using SPSS version 16.0 data was analyzed. Mean \pm S.D was used for quantitative data while f (%) was used for qualitative data. We used Chi-square test of association, calculate odds ratio and made a predictive model through Logistic Regression. Logistic Regression is a type of predictive model that can be used when the target variable is a categorical variable with two or more categories – for example has disease/doesn't have disease. A special form of logistic regression is used in this study which is

$$\pi_i = \frac{1}{1 + e^{-z}}$$

In the logistic regression model, the relationship between Z and the probability of the event of interest is described by this link function.

where,

π_i Is the probability the i^{th} case experiences the event of interest(to get disease)

Z_i Is the value of the unobserved continuous variable for the i^{th} case

The model also assumes that Z is linearly related to the predictors.

$$z_i = b_0 + b_1x_{i1} + b_2x_{i2} + \dots + b_px_{ip}$$

This model also help in calculating the OR which is e^b = Odds Ratio. Otherwise (OR=ad/bc) can be used to calculate the OR.

RESULTS

The average age of the respondents was 45.73 ± 1.0204 years. The basic characteristics of the selected patients are shown in Table 1. It shows the demographic information of the participants of study. It depicts that 60% of the respondents were female and 40% were male

Table 1: Demographic Characteristics of Subjects

Risk Factors	Cases (%)		Control (%)	
	Yes	No	Yes	No
Diabetic	63.3	36.7	13.3	86.7
Blood pressure	86.7	13.3	30	70
Anemia	27.8	72.2	11.1	88.9
Heart attack	16.7	83.3	10	90
Back injury	15.6	84.4	5.6	94.4
Urinary tract infection	15.7	84.3	7.8	92.2
Drug	3.3	96.7	2.2	97.8
Analgesic	42.2	57.8	17.8	82.2
Smoking	20	80	17.8	82.2
Alcohol	3.3	96.7	2.2	97.8
Liver Problem	13.3	86.7	0	100
Family history	18.9	80	4.4	95.6
Signs and Symptoms				
Itching	83.3	6.7		
Decrease urinary flow	85.6	14.4		
Shortage of breath	68.9	31.1		
Chest infection	56.7	43.3		
Vomiting	70	30		
Oedema	18.9	81.1		
Fatigue	97.8	2.2		

in the sample. It means there were a high percentage of female respondents. 50% respondents belong to the rural and equal % from urban area. The percentage of married and unmarried respondent was same in this study.

In Table 2 it is observed that Blood Pressure was a major prevailing characteristic in Chronic Kidney Failure patients and it was comparatively very high as in the control group where it was just 30%. It can also be seen that diabetes, anemia, back injury, urinary tract infection, usage of analgesic, liver problem and family history were looking the considerable factors due to their widespread in the cases as compared to controls where their prevalence was low. Itching, decrease urinary flow, shortage of breath, chest infection, vomiting and fatigue were the major symptoms or problems in the CKF patients. Only 19% respondents felt the problem of oedema. Table 3 shows that Alcohol, Smoking, Drug usage and heart disease had no statistically significant effect on Chronic Kidney Failure. Chi- square test was also used to see the association among exposures of the risk factors and disease status. Fisher exact test was also used in that situation where expected count in the cells of cross tables was less than five. Results of the test also confirmed the Odds ratio results.

$$Z = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3$$

$$Z = -2.818 + 2.648 X_1 + 2.715 X_2 + 1.120 X_3$$

$$\pi = \frac{1}{1 + e^{-z}}$$

Logistic regression model was fitted by using conditional logistic regression due to matching strategy for confounders. This model in Table 4 showed that only three major risk factors were in the model for the prediction of probability of having this disease. All the regression coefficients showed positive impact on the likelihood of having this disease. This model predicts that a person having exposure of diabetes mellitus, blood pressure and anemia has 97% chances to get this disease. This model can be used for the prediction of probability of having a disease in a person who might have different combinations of exposures appeared in this logistic regression model.

DISCUSSIONS

Diabetes was the major cause of the progression of disease CKF in this study and the odds ratio of that risk factor was 11.227 with 95% confidence interval 5.337 to 23.620. So, a person who has the exposure of diabetes 11.227 times more chances to get this disease (Chronic Kidney Failure) as compared to those persons who have not the exposure of diabetes. Many studies were showed similar results [8, 9, 16].

Blood pressure was also a very important contributor for raising the disease of Chronic Kidney Failure in this study and the odds ratio of that risk factor was 15.167 with 95% confidence interval (7.116 to 32.324). So, a person who has the exposure of blood pressure 15.167 times is more likely to get the disease of CKF as compared to those persons who do not have the problem of blood pressure and this finding of study was also supported by many studies [8-11]. So the results of these studies provide the evidence that high blood pressure as a modifiable risk factor for CKF.

Anemia is the risk factor of the disease of Chronic Kidney Failure and the odds ratio of that risk factor was 3.077 with 95% confidence interval 1.378 to 6.869. This finding has been supported by many studies [4, 5] results of these studies provide the evidence that anemia was the risk factor for CKF.

Urinary tract infection (UTI) also a cause of Chronic kidney Failure and the odds ratio of this risk factor was 2.213 with 95% confidence interval 0.848 to 5.778 95% confidence intervals for the factor shows that it has value lower than 1 So, it was not a confirmed risk factor. A research results has also provided the evidence that urinary tract infection (UTI) might be not linked with the risk of CKF [9].

Table 2: Descriptive statistics for Risk factors and sign and symptoms of disease

Variables	Category	Frequency (%age)	Category	Frequency (%age)
Gender	Male	108 (60%)	Female	72 (40%)
Area	Rural	90(50%)	Urban	90(50%)
Marital status	Unmarried	90(50%)	Married	90 (50%)

Table 3: Evaluation of Risk Factors

Sr#	Factor	Exposure	Crosstable		Odds Ratio	95% CI	Chi-Square	P-value
1	Diabetes	Exposure	Disease status		11.227	5.337-23.620	47.591	.000
			Control	Cases				
			No	78				
		Yes	12	57				
2	Blood pressure	Exposure	Disease status		15.167	7.116-32.324	59.451	.000
			Control	Cases				
			No	63				
		Yes	27	78				
3	Anemia	Exposure	Disease status		3.077	1.378-6.869	7.980	.005
			Control	Cases				
			No	80				
		Yes	10	25				
4	Heart disease	Exposure	Disease status		2.588	0.489-13.704		0.444
			Control	Cases				
			No	88				
		Yes	2	5				(Fisher exact test)
5	Blood transfusion	Exposure	Disease status		5.355	2.196-13.055	15.641	.000
			Control	Cases				
			No	83				
		Yes	7	28				
6	Back injury	Exposure	Disease Status		3.132	1.077-9.102	4.766	.029
			Control	Cases				
			No	85				
		Yes	5	14				
7	Drug usage	Exposure	Disease status		1.517	0.247-9.304		1.000
			Control	Cases				
			No	88				
		Yes	2	5				(Fisher exact test)
8	Usage of analgesic	Exposure	Disease status		3.380	1.707-6.694	12.80	.000
			Control	Cases				
			No	74				
		Yes	16	38				
9	Smoking	Exposure	Disease status		1.156	0.548-2.442	0.145	.703
			Control	Cases				
			No	74				
		Yes	16	18				
10	Alcohol usage	Exposure	Disease status		1.517	0.247-9.304		0.50
			Control	Cases				
			No	88				
		Yes	2	3				(Fisher Exact Test)
11	Family history	Exposure	Disease status		5.076	1.634-15.67	9.283	.002
			Control	Cases				
			No	86				
		Yes	4	17				

Table 4: Logistic Model for Prediction

Variable	B	S.E.	Wald	Df	Sig.	Exp(B)	95.0%C.I.for EXP (B)
Diabetic	2.648	.492	29.004	1	.000	14.123	5.338-37.019
B P	2.715	.472	33.083	1	.000	15.102	5.988-38.090
Anemia	1.120	.599	4.013	1	.045	3.063	1.025-9.160
Constant	-2.218	.459	37.727	1	.000	.060	

Use of analgesic (like sleeping pills) is another risk factor of studied disease. Finding of this study was also supported by studies [7, 17, 18]. Smoking is another contributing factor which can cause dangerous effect in the life. The odds ratio of that risk factor was 1.156 with 95% confidence interval 0.548 to 2.442. So, 95% confidence intervals for the factor shows that it had value lower than 1 so it was not a confirmed risk because most of respondent were female. And there is very low trend of smoking among females in Pakistan. Studies [9, 12, 14, 15] provide the indication that Smoking increases the risk of this disease.

Family history is a risk for emergent the disease and in this study it had been proven as a risk factor and supported by many studies in the literature [8, 19]. Studies provided the evidence that family history was associated with an increased risk of kidney failure.

CONCLUSION

The study was conducted on the evaluation of the Risk Factors of Chronic Kidney Failure. It would provide the awareness about risk factors of this disease to those people who are at risk. This study concludes that Blood pressure, Diabetes, Blood transfusion, Family History, Analgesic, Back Injury, Urinary Tract Infection and Anemia are found to be the significant risk factors of CKF. But only three risk factors have been used for the prediction of disease.

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