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Prediction of Ischemic Heart Diseases using Logistic Regression a Case-Control Study

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ABSTRACT: *The present study was designed to identify the level of Ischemic Heart Disease (IHD) with reference to various risk factors. This was a case-control study that was used to develop a predictive model for the risk of IHD in various conditions. Complete information of 980 males and females was taken at the Punjab Institute of Cardiology Lahore. 480 patients and 480 healthy individuals were taken as experimental and control group respectively. Data was examined through SPSS version 17. The age of the patient was shown in the manner of Mean ± Standard Error. To estimate the chances of Ischemic Heart Disease, Step-by-step Logistic Regression Framework was utilized. An average age was recorded as 49.73 ± 0.47 among all the individuals. There were 63.5 percent of males and 36.5 percent of females were included in this study. In present investigation, age, obesity, blood glucose level, way of living, perspiration, cough, dizziness and high blood pressure were found to promote the development of IHD. This study showed IHD model has more prediction power with age and lower economic condition. Certain conditions such as high blood pressure, diabetes, and chest pains greatly exacerbate the condition. Men were at greater risk of IHD as compared to women.*

Keywords: *I.H.D, Odds Ratio (OR), Risk Factors, Logistic Regression*

INTRODUCTION

Ischemic Heart Disease remains a major cause of illness and death in the elderly worldwide (McGovern et al., 1996). Arteriosclerosis is not just an issue in Western lands; rather, it is a major problem in developing countries, which are carrying a huge share of the disease (Topol et al., 2007). Now a days, in these countries 80% of the population dies from

IHD (Habib, 2012). In Pakistan, people are more prone to IHD (Jafar, 2005).

According to a study, one in fourth adults in Pakistan has Coronary Artery disease (CAD) (Butt et al., 2010). Plasma total cholesterol concentration is well established as a major risk factor for ischemic heart disease (IHD) (Verschuren et al., 1995), (Law et al., 1994). It has long been believed that cardiovascular diseases are mainly common in men. However, heart diseases are also common in women, especially in old age. Women in their late adolescence after climacteric usually experience more cardiac illness as compared to men. The increased possibility of cardiac illness and hypertension in women is due to increased levels of fats. Females have a greater threat of cardiac arrest or angina. Other than chest cramps, other signs such as breathing difficulty, nausea, or insomnia also occur (Perk and Benlian, 2012). Chest cramps, breathing difficulty, cardiac infarction, and arteriosclerosis are signs of IHD (Ferket et al., 2010). In a report based only on the Caerphilly cohort at 10 years of follow-up, serum total cholesterol, HDL cholesterol, and triglyceride concentrations were independently predictive of IHD (Egger et al., 1999).

In addition, smoking, diabetes, high blood pressure are some of the predictors of IHD. Within the past 20 years, HDL cholesterol has also been added as a major lipid risk factor independent of total cholesterol (Gordon and Rifkind, 1989), (Pocock et al., 1989). The current study aimed to identify risk factors known to people (age, gender, and economic and social status) as well as the combination and magnitude of various risk factors with ischemic heart disease. It was also used to develop a mathematical model using asset classification to predict Ischemic heart disease.

MATERIALS AND METHODS

This was a case-control investigation. A case-control sample of 480 patients, both men, and women who underwent IHD or scheduled tests were considered. The approved IHD patients came to the Punjab Institute of Cardiology Lahore and this was assumed that these patients came from all Pakistanis.

Data Collection Method

All considered patients were with IHD and the controls were healthy individuals. Equal groups of people from both genders were considered. Ischemic Heart Disease along a variety of risk factors such as gender differences, lifestyle, economic status, social index (mass and stature), family background, smoking background, high blood pressure, abnormally high blood glucose level, conjugated proteins, obesity, perspiration, vomiting, cough, lightheadedness, faintness and mood swings were considered. The subject's age was shown in the manner of a description ± S.E. Standard deviations were utilized to detect age differences.

Data Analysis Techniques:

The Step-by-step Forward Logistic Regression was utilized to evaluate the accurate systematic

framework and the likelihood of Ischemic Heart Disease (IHD). The Wald Chi-Squared test was utilized for the estimation of the significance of the coefficient of regression. Odds Ratio was utilized to calculate the extent of the uncertainties of independent factors in the IHD. We have identified risk factors in both subjects (patients and healthy individuals) and have identified the combination of a variety of threatening parameters utilizing the Chi-square and Fisher Exact tests. A Z-rating test was used to determine the value of independent factors e.g. Age, BMI, DB years, HP years, annual smoking package, and smoking years (Start). The Logistic Regression formula states:

$$f(y) = \frac{e^y}{(1+e^y)} \quad \ldots\ldots\ldots (1)$$

$$\text{Here } y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \ \ldots\ldots + \beta_m X_m \quad (2)$$

Also, $\beta's$ are coefficients and m indicate the no. of independent factors.

RESULTS

The combination of all hazardous substances was tested in patients and controls using the chi-square and Fisher Exact test. P values were calculated randomly to evaluate the significance of the threatening parameters, which are important for determining the combination of these risk factors in patients and controls. We have all 610 males, 370 cases, and 240 controls and 350 women, 110 cases, and 240 controls. The most notable were p-values (0.000), threatening parameters were age, chest cramp, abnormally high blood glucose level, high blood pressure, obesity, way of living, faintness, insanity, family background, economic condition, perspiration, breathing difficulty, and fats where risk factors such as age code, chest cramp, abnormally high blood glucose level, smoking, high blood pressure, fats, obesity, way of living, faintness, breathing difficulty, lightheadedness, family background, economic condition, perspiration and rate social and economic are important for men only. In addition, risk factors such as age, chest cramp, abnormally high blood glucose level, high blood pressure, fats, obesity, way of living, faintness, breathing difficulty, disequilibrium, family background, economic condition, perspiration, hormonal status, and social status economies are found to be important for women. Peripheral Vascular Diseases are not randomly associated with IHD. It has been identified that age, chest cramps, high blood pressure, way of living, economic condition, abnormally high blood glucose level, perspiration, obesity, and faintness are closely related factors. And gender, family background, and coughing are nearly uniformly connected with all the patients and healthy individuals.

Omnibus Test:

Out of 36.5% of women, the mean age of the patients was 49.73 years ± 0.47 with SD = 14.63 years. In obedience to the Omnibus test with a p-value = 0.000, indicating that the Logistic Regression framework is correct. The

threatening parameters involved in the framework were age, abnormally high blood glucose level, obesity, smoking, perspiration, vomiting, way of living, family background, cough, disequilibrium, and faintness caused as important threatening parameters, shown in Table 1. The majority of the relapse coefficients of independent factors were positive denoting a positive relation between threatening parameters and IHD.

Table 1: Step-by-step Logistic Regression Framework

Parameter	$\hat{\beta}$	S.E($\hat{\beta}$)	Wald	d.f	p-vlaue	Odds Ratio	95% C.I for Exp(β)	
Age	-0.84	0.33	6.59	1	0.01	0.43	0.23	0.82
Marital Status	-3.57	1.17	9.25	1	0.002	0.02	0.003	0.28
Blood glucose level	2.03	0.44	20.77	1	0.000	7.59	3.17	18.17
High blood pressure	1.75	0.39	19.25	1	0.000	5.75	2.63	12.57
Smoking	1.38	0.34	16.32	1	0.000	3.98	2.037	7.789
Faintness	2.37	0.44	29.34	1	0.000	10.74	4.55	25.34
Disequilibrium	-0.94	0.41	5.36	1	0.02	0.39	0.17	0.86
Obesity	1.47	0.33	19.82	1	0.000	4.37	2.28	8.37
Sweating	1.49	0.32	21.32	1	0.000	4.47	2.37	8.44
Way of living	4.69	0.41	130.53	1	0.000	109.84	49.05	245.96
Family Background	-0.86	0.34	6.24	1	0.01	0.42	0.21	0.83
Cough	0.88	0.42	4.40	1	0.04	2.41	1.06	5.49
Constant	-15.82	3.09	26.09	1	.000	.000		

The prevalence of obesity was 4.37, which showed fat persons have 4.37 folds increased chances to develop a notable IHD than thin patients. While maintaining all other variables considered in the model constant. The blood glucose level was 7.59, which showed that a diabetic has 7 folds increased chances to develop significant IHD in comparison to normal people. The same was true for smoking, or 3.98, which indicates increased chances to develop significant IHD in comparison with non-smokers. The reference group for high perspiration was classified as hypertension. The average perspiration rate was 3.87, showed that this particular victim has 3.87 folds increased chance to develop a notable IHD in comparison with healthy people. Similarly, the average dizziness was 4.47, such a patient has 4.47 folds increased chances to develop a notable

IHD in comparison with healthy people. The Odds Ratio confidence period showed that diabetes, smoking, obesity, dizziness, vomiting, lifestyle, and sweating were important risk factors. They all showed a significant relationships with IHD.

Asset Model Relocation:

In accordance with (1), P (I.H.D) = 1 / (1 + e ^ (- y))

When Y = β_0 + β_1 X_1 + β_2 X_2 + β_3 X_3 + β_4 X_ (4) + β_5 X_5 + β_6 X_6 + β_7 X_7 + β_8 X_8 + β_9 X_9 + β_10 X_10 + β_11 X_11

By setting all the β and Xi values we find

Y = -15.82 - .84 (Age) -3.57 (Marital Status) + 2.03 (Blood glucose level) + 1.75(High blood pressure) + 1.38 (Smoking) + 2.37 (Faintness) -0.94 (Disequilibrium) + 1.47 (Obesity) + 1.49 (Perspiration) + 4.69(Way of living) -0.86 (Family Background) + 0.88 (Cough)

By placing all the β and X values, It was noticed IHD in 50-year-old male has high-risk factors provided by P (IHD) = 0.941. It means 94.1% chances of getting IHD were high in males with the enlisted threatening parameters. In the same way, we can find opportunities in a particular scenario by alternating the figures of a variety of independent items in the model stated above.

DISCUSSION

The results of our study provide information on threatening parameters for IHD in Pakistan. With age, the threat of IHD enhanced and also reported by Allender et al. (2007). In this study, it was found that the highly important threatening parameters for IHD were chest cramp, abnormally high blood glucose level, obesity, perspiration, fats, smoking, way of living, and faintness. Mentioned factors were common to both sexes, though a dissimilarity lies in their strengths. Additional possible parameters like breathing difficulty and progressive vascular illness promote the sickness but are not essentially responsible for IHD. Because in Pakistan, cardiovascular disease is rare. In addition, age, diabetes, high blood pressure, sweating, dizziness, and obesity have been found to be important for both sexes but due to smoking, the risk was higher in men. Among women, endocrinological status, chest cramp, fats, obesity were identified as the most prominent threatening parameters for IHD. Endocrinological status in women was strongly related to age. Postmenopausal females were at greater threat to sickness.

The average age of the cases was 56.08 for the males and 43.56 for the females and P-value = 0.000 indicated that age was significantly related to IHD. Significant p-values (0.000) of BMI indicated that the risk connected to IHD development in a diabetic group was greater than the risk of developing IHD in a non-diabetic individual. Similarly, p-value (0.000) showed IHD has a significant association with smoking and the number of smoking years. The risk was higher with CAD 345 (71.9%) as compared to healthy individuals (without CAD) 135 (28.1 %). The incident was high in patients of peripheral vascular

illness and recorded as 4 (0.8% in patients) and 476 (99.2 in healthy). Economic status plays an important role and 254 (52.9 %), 203 (33.9 %), and 23 (4.8%) were recorded from upper, intermediate, and low-income groups. Out of healthy individuals, 32 people (6.7%) fell into the highest-earning group and 395 (82.3%) were of the intermediate group and 76 (7.9%) were from the low-income group. High blood pressure was recorded (23%) for both genders, high cholesterol levels were (17%) common in males and females, and obesity in males was 33% and 47% for females. The widespread presence of obesity, high blood pressure, and high cholesterol levels was high among the Karachi people of low urban populations (Aziz et al., 2005). The outcomes of our investigation were consistent with that research project.

Ezzati et al. (2005) stated that abnormally high blood glucose level was not a notable threatening parameter. The investigation of this research estimates that IHD enhances in victims with diabetes. According to study of Memon and Samad (1999) females had increased threatening parameters than males. Hanif et al. (2010) showed in their research study that men were at higher risk than Pakistani women and according to our results, men were have greater risk than women.

CONCLUSION

It was concluded with the age, the threat of IHD was enhanced while various important threatening parameters were common for both genders. However, reduced chances of developing illness were recorded in women than men. It was identified sedentary lifestyle as an important factor that greatly affects human health and highly associated with IHD.

Conflict of interest

Authors declare there is no conflict of interest.

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