

# BIOSTATISTICAL ANALYSIS OF MODIFIABLE RISK FACTORS OF MYOCARDIAL INFARCTION

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## ABSTRACT

**Objective:** To examine the degree of dependency of myocardial infarction (MI) on its modifiable risk factors and development of a statistical model for prediction of the probability of MI in the presence of other diseases.

**Material and Methods:** This was an analytic study which was conducted on a sample of 2000 subjects including 1000 cases and 1000 controls. Data was collected from various cardiac centers and hospitals from all the four provinces of Pakistan from February 2013 to March 2014. Data includes both the genders. Logistic regression analysis is performed to measure the risk of myocardial infarction (MI). Odds ratios are calculated to see the sensitivity of all the modifiable risk factors to MI. Statistical data analysis softwares SPSS and Eviews are used for running analysis.

**Results:** The gender wise percentages of subjects are 55.8% females and 44.2% males in this study. All the modifiable risk factors are playing positive role in terms of association with the dependent variable MI. Hypertension is found to be the most significant risk of MI with Odds Ratio (OR) of 10.20 followed by diabetes mellitus with OR of 8.37 and obesity with OR of 7.72.

**Conclusion:** In this study the modifiable risk factors obesity, diabetes mellitus, hypertension, easily angered, cholesterol level, alcohol, eating habit, income class and smoking are proved statistically significant in the development of disease MI.

**Key Words:** Logistic Regression, Case-Control, Risk Factors, Myocardial Infarction, SPSS.

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## INTRODUCTION

The study is conducted to analyze the sensitivity of the modifiable risk factors of myocardial infarction (MI) and to explore significant variables which can push subjects towards the risk of facing an MI. The variables that are included to this study are modifiable risk factors. These variables can be brought under control and its risk can be reduced by adopting certain medication, eating, physical activity plan. The variables included in the study as independent variables are obesity (BMI), diabetes mellitus (DM),

hypertension (HBP), easily angered (AR), cholesterol (HDL), eating habit (EH), fried food (FF), income class (IC) and smoking (TOB). Pakistan is a developing country and the contribution of developing countries to the global burden of heart disease is 82 percent<sup>1</sup>. World health organization (WHO) pointed cardiovascular diseases (CVD) as the number one cause of deaths around the world<sup>1</sup>. The major reason of these mortalities is linked to the event of myocardial infarction<sup>2</sup>. Till date many researches are conducted to study the occurrence of MI and its risk factors (like ethnic, socioeconomic, medical, modifiable, non-modifiable) in several parts of the world<sup>3-8</sup>. Heart diseases are the top most cause of mortalities for both the genders in America and developing countries<sup>9-13</sup>. Various studies have concluded the modifiable risk factors as the more important in the increment of risk of MI<sup>3-13</sup>.

This study is planned to estimate the strength of relationship of the modifiable risk factors with the response variable MI and fitting of suitable logistic regression model.

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**MATERIAL & METHODS**

Sampled populations of this study are the four provincial capitals (Peshawar, Lahore, Karachi and Quetta) along with Islamabad and Rawalpindi. The data was collected from all the four provinces to make it more representative for the target population. The survey is carried on 2000 subjects including 1000 cases and 1000 controls. The subjects includes 1116 (55.8%) females and 884 (44.2%) males. Province wise distribution of subjects is 50% for Punjab, 22.8% for KPK, 16.6% from Sindh and 10.6% from Balochistan.

All the data is collected by the same investigator to avoid any sort of bias. Data for obesity (BMI), hypertension (HBP), diabetes mellitus (DM) & cholesterol level (HDL) is recorded on the following scales; BMI is normal if  $(18.5 < \text{BMI} < 25) \text{ Kg/m}^2$  and a person is overweight/obese if  $\text{BMI} > 25 \text{ Kg/m}^2$ . A subject is considered as hypertensive patient if the systolic Blood Pressure (SBP)  $> 140\text{mmHg}$  or Diastolic Blood Pressure (DBP) is  $> 90\text{mmHg}$ . Blood sugar is normal if Fasting Blood Glucose (FBG) is  $< 120 \text{ mg/dL}$  and if  $\text{FBG} > 120 \text{ mg/dL}$  then the subject is counted as diabetic patient. HDL is considered abnormal if it is less than  $40 \text{ mg/dl}$  and LDL is abnormal if it is higher than  $160 \text{ mg/dl}$ . Data for all the other variables of this study are recoded through oral questioning from the subjects.

The study involves myocardial infarction (MI) as a binary response variable and BMI, HBP, DM, AR, HDL, TOB, FF, EH and IC as modifiable explanatory variables. Binary logistic regression procedures are used using SPSS and Eviews to assess the probability of MI. Odds Ratio is estimated to see the risk of explanatory variables on MI. Stepwise procedures are sequential in the sense that they assume a current model and look to add to, or delete terms one at a time from that model. Binary logistic regression analysis is very applied in the field of medical and disease because the response variable is often dichotomous.

**FITTED LOGISTIC REGRESSION MODEL**

Putting all the values of significant risk factors in the theoretical binary regression model we get our final binary logistic regression model as,  $f(\text{MI}) = 1/(1 + e^{-w})$

Where  $W = -6.78 + 1.3(\text{AR}) + 2.1(\text{DM}) + 2.2(\text{HBP}) + 0.5(\text{EH}) + 0.2(\text{TOB}) + 1.08(\text{HDL}) + 2.01(\text{BMI}) + 0.30(\text{IC})$ .

**RESULTS**

Before running the logistic regression analysis correlation matrix for all the variables is made and all the bivariate correlations are found less than 0.40. Omnibus is used to test the appropriateness of the

logistic regression model. Table-1 shows the Omnibus results for the fitted model which certifies that the model is appropriate as the p-values are significant (all less than 0.05). *Nagelkerke* R-square is the same as R-square in the multiple regressions. Table-1 shows the *Nagelkerke* R-squares for the fitted binary logistic regression model that the explanatory variables (risk factors) are explaining the response variable (MI) very well (i.e. 74%). For a good logistic model fit *Hosmer & Lemeshow* test must be insignificant (p-value  $> 0.05$ ). In Table-1 the p-value is greater than 0.05 and *Hosmer & Lemeshow* test confirms that there are no significant misspecifications in predictive capacity of the binary logistic regression model. Table 2 is showing results for all the risk factors on individual basis (one explanatory variable as a risk at one time). All the modifiable risk factors are found statistically significant on individual basis as all the p-values are zero.

**Table: 1**

<b>Omnibus Tests of Model Coefficients</b>			
Step 9	Chi-square	df	Sig.
Step	7.644	1	0.006
Block	1446.96	8	0
Model	1446.96	7	0
<b>Model Summary</b>			
Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
9	1325.629a	0.515	0.737
<b>Hosmer and Lemeshow Test</b>			
Step	Chi-square	df	Sig.
9	66.57	8	0.27

**Table-2: Variables not in the Equation**

			Score	df	Sig.
Step 0	Vari-ables	IC	11.127	1	.001
BMI			405.247	1	.000
HDL			296.914	1	.000
TOB			93.645	1	.000
EH			18.022	1	.000
HBP			613.920	1	.000
DM			661.213	1	.000
FF			35.884	1	.000
AR			151.025	1	.000
Overall Statistics			1.123E3	9	.000

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**Table-3: Variables in the Equation**

		<b>B</b>	<b>S.E.</b>	<b>Wald</b>	<b>df</b>	<b>Sig.</b>	<b>Exp(B)</b>
Step 9 <sup>a</sup>	IC	.302	.110	7.567	1	.006	1.353
BMI		2.010	.180	124.765	1	.000	7.722
HDL		1.081	.146	54.522	1	.000	2.947
TOB		.262	.086	9.296	1	.002	1.299
EH		.531	.087	36.928	1	.000	1.588
HBP		2.216	.147	227.245	1	.000	10.169
DM		2.114	.148	204.751	1	.000	8.370
AR		1.274	.147	74.707	1	.000	3.575
Constant		-6.781	.532	162.518	1	.000	.001

All the modifiable risk factors in the model are significant as all p-values are less than 0.05 except fried food (p=0.241 & OR 1.1). It shows that all the risk factors present in the model are playing significant role in development of the disease MI. All the coefficients of the risk factors are positively associated to the response variable MI. These positive signs indicate that the patients with these risk factors are at higher risk of MI than their respective controls. For BMI the odds ratio (OR) tells that by keeping all the other risk factors constant an obese person is 7.72 times at higher risk than a non-obese person. Similarly the patients of IC, HDL, TOB, EH, HBP, DM & AR are respectively 1.35 times, 3 times, 1.3 times, 1.5 times, 8.37 times, 10 times and 3.6 times at higher risk of MI than their respective controls. HBP looks very prominent and most significant risk factor/symptom in this study followed by DM and BMI.

### DISCUSSION

The people with obesity must try hard to reduce their weights to reduce the risk of facing an MI as they are almost 8 times at a higher risk. A person who cannot keep his cool and easily angered is at 3.6 times higher risk of facing an MI so it is very important for them to bring this variable under control. Such person can consult psychologist as well to keep their anger under control. Diabetic patients are also required to be very cautious specially in choosing their meals. Medication must be on time and sweets should not be taken at all. Hypertension is the most injurious variable (OR=10) to heart so people with this disease are to take proper medication and regular checkup from their physicians / cardiologist. They must try to avoid people, gatherings, situations etc which may cause their BP to shoot. Patients with high cholesterol levels need to switch to cholesterol free meals in order to bring the high cholesterol level under control as such persons are at 3 times higher risk than their respective controls. Income class, smoking and eating habit are significantly related

to the disease MI and persons with these risks are to consider each of these. Smokers must get rid of this habit to reduce the risk. Those who eat more than their requirement must change this habit because with more eating the risk level will also increase.

### CONCLUSION

The risk of MI increases in the presence of modifiable risk factors like, obesity (BMI), diabetes mellitus (DM), hypertension (HBP), easily angered (AR), cholesterol (HDL), alcohol (AL), eating habit (EH), fried food (FF), physical activity (PA), income class (IC) and smoking.

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### **AUTHOR'S CONTRIBUTION**

Following authors have made substantial contributions to the manuscript as under:

- Khan MZ:** Data collection, analysis.  
**Pervaiz MK:** Study design, data feeding.  
**Iqbal M:** Discussion of results.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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