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Non Clinical Risk Factors of Myocardial Infarction: A Meta-Analysis Approach

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Abstract

Background: Myocardial Infarction (MI) is a coronary heart disease that is one of the main causes of the mortality over the globe. There are various clinical and non-clinical risk factors that can be further classified as modifiable and non-modifiable. This study has explored the role of the some Non Clinical factors like; Gender, Education and Family History with MI using Meta-analysis approach.

Methods: The published literature from 1990 to 2015 on MI was collected by using several databases and search engines. A review of the collected literature (28 studies) showed that the studies under analysis were of different origins and had different objectives. For each study, Odds Ratio and 95% confidence intervals was extracted and pooled with a random effect model, weighting for the inverse of the variance. Meta-analysis software version 2.0 was used to analyze heterogeneity analysis and estimate pooled estimates through random effect model.

Results: The study has showed that gender (OR=1.391 and 95% C.I.: 1.140, 1.697), family history of heart diseases (OR=3.206 95% C.I.:2.064, 4.981) and low education level or illiteracy (OR=1.552 and 95%C.I.: 1.132, 2.128) are the significant risk factors in developing Myocardial Infarction.

Conclusion: This study has concluded that included factors in this study are significantly related to the Myocardial Infarction. Gender difference, family history of heart disease and low education are the important risk factors in causing this fatal disease.

Keywords: Myocardial infarction; Gender; Education; Family history; Risk factors; Meta-analysis

Introduction

Cardiovascular disease is a commonly used term that refers to the diseases that affect the heart and other parts of the cardiac system of the body. The cardiovascular diseases that affect the coronary arteries of the heart are called Coronary Heart Diseases (CHD) [1]. Myocardial Infarction (MI) is one of the diseases in this group. A large number of people die every year due to this fatal disease. In 2013, the number of people who died from cardiovascular disease (CVD) was more than 17.3 million (95% uncertainty interval, 16.5 to 18.1), representing an increase from 1990 of 40.8% [2]. The burden of Coronary Heart Disease is increasing at a greater rate in South Asian countries than the other countries of the world. It has been estimated that the risk of MI would be doubled in the next 20 years [3]. According to American Heart Association, approximately one of every six deaths in United States is caused by MI [4,5]. Another study showed that the high prevalence of MI in Pakistan with more than 30% of the population over 45 years of age is affected by this disease [3]. This statistics has revealed that this disease is growing at alarming rate in the world. A mammoth literature is available on this disease. As a result many medical, social, economic, demographic risk factors were explored in the literature.

In this literature medical factors got significant attention by medical professionals and practitioners. The least attention has been paid to non-clinical factors (demographic and socioeconomic factors) which can play significant role in causing MI [6-8]. Age, gender and family history of MI are demographic factors and education is a socioeconomic factor. Age and gender has been found as powerful risk factors of MI [9]. It has also been observed that chances of getting MI increases as the age of the patients increases. Another study shows that MI in patients less than the age of 40 is 10% of all the cases [10]. A study conducted in Bangladesh shows that the incidence of AMI was more frequent among the patients of age group 50-59 years [11]. Recently a health survey conducted in England suggests that 4% of men and 0.5% of women have had an MI [12]; however, after the age of 70 both genders have equal chance of getting this disease. It has been observed that women have experienced their first MI on the average 9 years later than men [13].

Family history of heart diseases has also emerged as an important predictor of MI in many studies. A family history of MI increases the risk of CHD especially for MI. The National Cholesterol Education Program highlights that an individual may have a positive history of MI if his close blood relative male (father or brother) has MI younger than 55 years or female (his mother or sister) has MI younger than 65 years [14].

Socioeconomic Status (SES) refers to the combination of social and economic indicators like; education, income, occupation etc. A study

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shows that Low level of education, low income and unhealthy life style also increase the risk of MI particularly in women [15]. The current study has focused on the low education level as one of the indicators of socioeconomic status because it is very difficult to find out the income and life style subjects of the most of our collected 28 published researches. Education is generally regarded as an indicator of an individual's general knowledge and problem solving skills. Low level of education is the most consistent risk factor for MI globally [16]. It has been observed that a person who does not get education is at a greater risk of developing MI than that that gets any type of education [17,18]. Furthermore, education also has an inverse relation with the mortality after getting attacks of MI. It might be assumed that self-management can differ in educated person. It has been found that education level is independently and strongly associated with MI particularly among younger men [19]. In this study, there is an attempt to pool the results of different studies regarding associations of these non-clinical risk factors with MI through a Meta-Analysis Approach.

Material and Methods

The researchers have searched online databases like Medline, Pub med, Embase, Mesh etc., googled the medical subjects heading "Myocardial Infarction" and key words "Socio-economic," "Demographic", "gender as risk factor of MI", "education as a risk factor of MI", "Family History as a risk factor of MI" and "risks factor of Myocardial Infarction" to collect a corpus of 28 studies on MI.

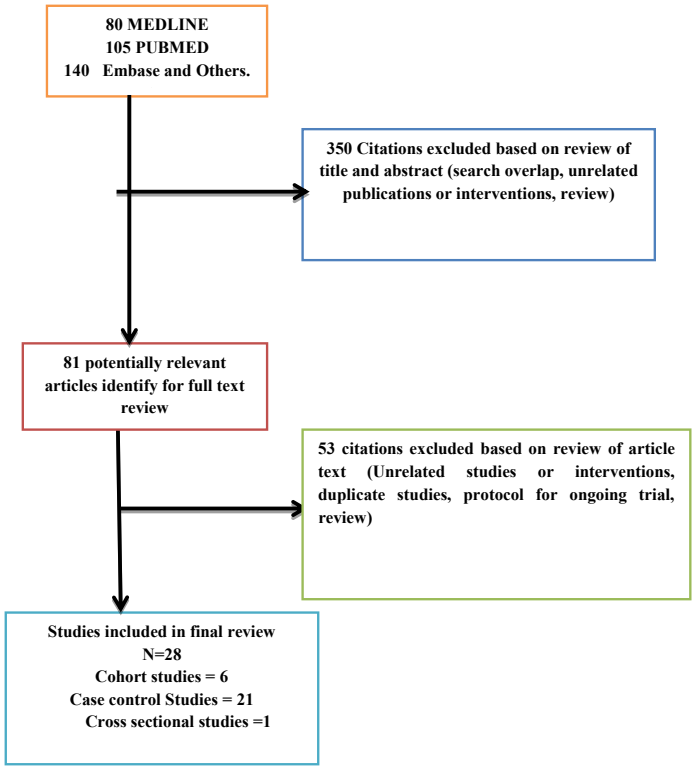
All 28 studies were analyzed by conducting Meta-Analysis technique which matches with the inclusion criterion. It was ensured that only case control, cohort and cross sectional studies published from 1990 to 2015 on the subject MI have been taken for analysis. One of the delimitations of the study was the language of the selected research studies; as only those research studies were collected which used English as a language of their publication.

From the identified studies and respective populations characteristics of the studies were recorded which were as follows: author's name, years of publication, study design (case control study, cohort and cross sectional studies), sample size, Country of Origin, RR and OR of MI associated with socio-economic and demographic factors with their standard error.

In this study, separate Meta-analysis was performed on each risk factor of MI. All statistical analyses were performed with comprehensive Meta-analysis software version 2.0. Odds Ratio (OR) was used as effect size that reflected the magnitude of the association between different factors and the risk of MI in each study. Odds ratios with their corresponding 95% confidence intervals (CI's) were calculated from the summary data provided. In the selected articles, researchers calculated a weighted average of odds ratio with weights being the inverse of variance of odds ratio. In the presence of heterogeneity, random effects models were used (rather than fixed effects models) to obtain pooled effect estimates across studies. Heterogeneity among the studies was studied by the inspection of Q statistic and I^2 statistic.

Results

Initially 325 studies which followed the primary inclusion criteria were identified through different sources. Then these studies were further the scrutinized at different stages and the major portion of identified studies was excluded on the basis of; irrelevant material, inconsistency with the objectives of Meta-analysis, poor reporting, quality of work and lack of statistical data (detail is given in Flow Chart 1). Twenty eight (28) different studies were identified as potentially relevant for analysis, in the selected data of research studies 6 were



Flowchart 1: Objectives of Meta-analysis, poor reporting, quality of work and lack of statistical data.

cohort, 1 was cross sectional and 21 were case control studies. Nineteen (19) studies had discussed the association between gender and MI. Eight (8) studies had described the association between levels of education and risk of MI. Eight (8) studies had illustrated the association between family history of heart diseases and risk of MI. The characteristics of the study subjects and the designs of the studies have been presented in Tables 1-3.

In Table 4, for all the factors, Q values are significant which indicate that heterogeneity is present and values of I^2 are 94.399 for gender, 92.389 for family history and 83.656 for level of education indicate that variation between studies due the real difference in the effect size. In this case random effects model has been used to pool the studies of each factor.

The pooled estimate for gender is 1.391 with 95% confidence interval of 1.140 to 1.697. It depicts a significant association between gender and MI. It means males have 1.391 times more risk of developing MI as compared to females. The pooled estimate for family history of MI is 3.206 with 95 % confidence interval of 2.064 to 4.981. The pooled estimate (OR=3.206) indicates a highly significant connection between family history of MI and risk of MI. It portrays that the persons who have a positive family history of MI have 3.206 times more risk of MI as compared to those who do not have family history of MI. The pooled

Study Number	Years of publication	Type of study	Country	No. of cases/ Exposed	No. of control/Not exposed	OR (95% C.I)
21	1992	Case control	Italy	801=A 115=B	976=A 130=B	0.928
30	1994	Case control	Italy	542=A 72=B	705=A 87=B	0.928
31	1994	Case control	Italy	801=A 115=B	976=A 130=B	0.929
32	1998	Case control	Argentine	156=A 180=B	228=A 218=B	0.829
33	1999	Case control	Seattle and Washington,	494=A 224=B	1546=A 590=B	0.842
29	2000	Case control	Czech Republic	279=A 79=B	938=A 1048=B	3.946
34	2001	Case control	New Jersey	440=A 210=B	1269=A 1721=B	
35	2001	Case control	Argentine	734=A 205=B	727=A 222=B	
36	2005	Cohort	Pakistan	88=A 212=B	95=A 111=B	
37	2005	Case control	Spain	50=A 22=B	39=A 38=B	2.21 (1.13-4.33)
38	2006	Case control	Japan	1353=A 572=B	1595=A 684=B	
39	2007	Cohort	Pakistan	56=A 144=B	132=A 368=B	
40	2007	Case control	Canada	10528=A 8825=B	85034=A 107787=B	
41	2007	Case control	Iran	120=A 80=B	123=A 77=B	
42	2007	Cohort	Germany	Total 159, 120 males and 39 females	10342 males and 16453 females	
43	2007	Case control	Costa Rica	786=A 103=B	965=A 202=B	
44	2008	Cross sectional	Jordan	128=A 55=B	1465=A 1435=B	
45	2009	Cohort	Sweden	34=A 19=B	780=A 880=B	
46	2009	Cohort	Mexico			1.64 (0.93-2.92)

Table 1: Characteristics of the studies of which discussed gender as a Risk factor of MI. Event A: male; Event B: female.

Study Number	Years of publication	Type of study	country	<10 years and MI	<10 years and NMI	≥10 years and MI	≥10 years and NMI
47	1996	Case control	India	135	116	65	84
48	1999	Case control	Sweden	607	546	68	130
49	2000	Cohort	Sweden	85	7443	3	1409
50	2002	Case control	Lithuania	149	218	54	69
17	2004	Case control	Pakistan	157	198	41	26
19	2009	Case control	Portuguese Caucasian	506	479	132	372
51	2009	Case control	South Asia	12	12	153	153
28	2010	Case control	Spain	1224	1078	145	291

Table 2: Characteristics of the studies which described education level as a risk of Myocardial Infarction. Event A: less than 10 years education and risk of myocardial infarction. Event B: greater than 10 years' education and risk of myocardial infarction.

Study Number	Years of publication	Type of study	Country	No. of cases/Exposed	No. of control/Not exposed	OR (95% C.I)
31	1994	Case control	Italy	211=A 705=B	111=A 995=B	
32	1998	Case control	Argentine	115=A 221=B	72=A 374=B	
35	2001	Case control	Argentine	308=A 631=B	143=A 806=B	
36	2005	Cohort	Pakistan	119=A 181=B	19=A 187=B	
12	2005	Case control	Spain	33=A 39=B	34=A 43=B	1.07 (0.56-2.04)
38	2006	Case control	Japan	241=A 1684=B	152=A 2127=B	
30	2007	Cohort	Pakistan	174=A 26=B	136=A 164=B	
52	2010	Case control	Denmark	Total 236	Total 463	2.03 (0.89-4.63)

Table 3: Characteristics of the studies which discussed family history as a risk factor of MI. Event A: have family history of MI Event B: don't have family history of MI.

Risk factors	Number of studies	Pooled estimate and 95% C.I and its p-value (Random Effect Model)	Q – statistic with p-value	I^2
Gender	19	1.391 (1.140-1.697), (0.001)	321.976, (0.000)	94.399
Family history	8	3.206 (2.064-4.981), (0.000)	91.975, (0.000)	92.389
Education	8	1.552 (1.132-2.128), (0.006)	42.829, (0.000)	83.656

Table 4: Pooled estimates for gender, education and family history.

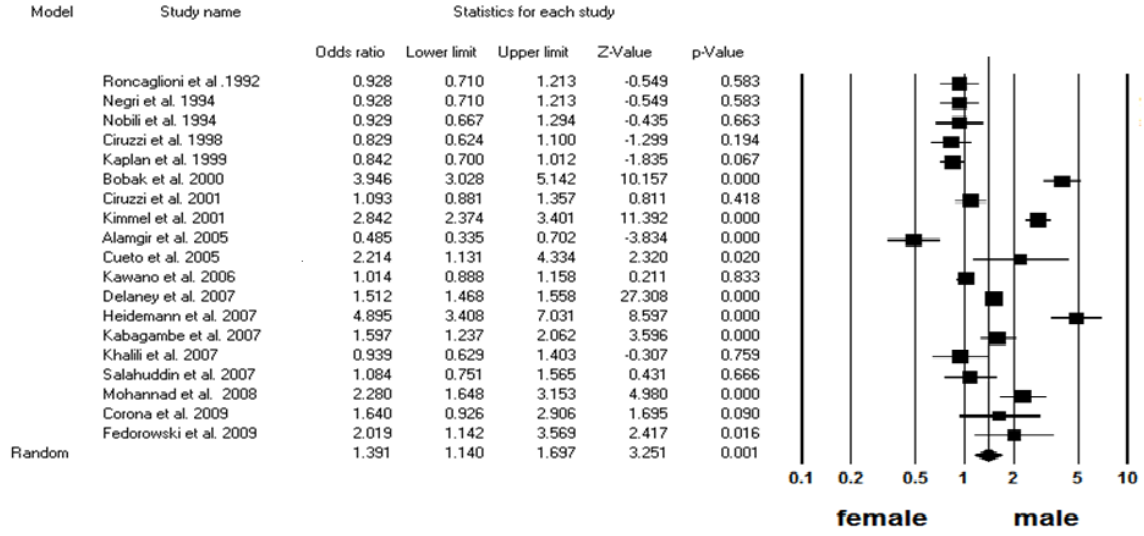


Figure 1: Summary statistic and forest plot of the studies on gender associated with risk of MI.

estimate for levels of education is 1.552 with 95% confidence interval of 1.132 to 2.128. The pooled estimate (OR=1.522) shows a significant relationship between levels of education and risk of MI. It also indicates that less educated persons have 1.522 times more risk of developing MI as compared to the highly educated persons. Table 4 also shows that gender, family history of MI and levels of education are the significant risk factors for causing MI. Figures 1-3 show the odds ratios and 95% confidence intervals of MI associated with gender, family history of MI and levels of education in each study and overall respectively.

Figure 1 shows that the odds ratios of 12 studies are greater than 1 but only Nine of them are significant, and studies which overlap with the vertical line (in the center of diamond) have same effect like the overall estimate but the studies which are not overlapping with line have different effect. In this figure two studies [12,13] have same effect like the overall estimate and remaining 17 studies have different effect.

Figure 2 shows that the odds ratios of all the eighth studies are greater than 1 but six studies are significant and also shows that three studies [14-16] have the same effect like the overall estimate and remaining 5 studies have different effect.

Figure 3 shows that the odds ratios of the seven studies are greater than 1 but four studies are significant and also shows that two studies [17,18] have same effect like the overall estimate and other 5 other studies have different effect.

Discussion

The results of present Meta-analysis indicate that socioeconomic (Education) and demographic (Gender and Family History) factors play a significant role in the developing of MI. This study estimate (OR=1.391) shows that men have greater chance of developing MI as compared with women.

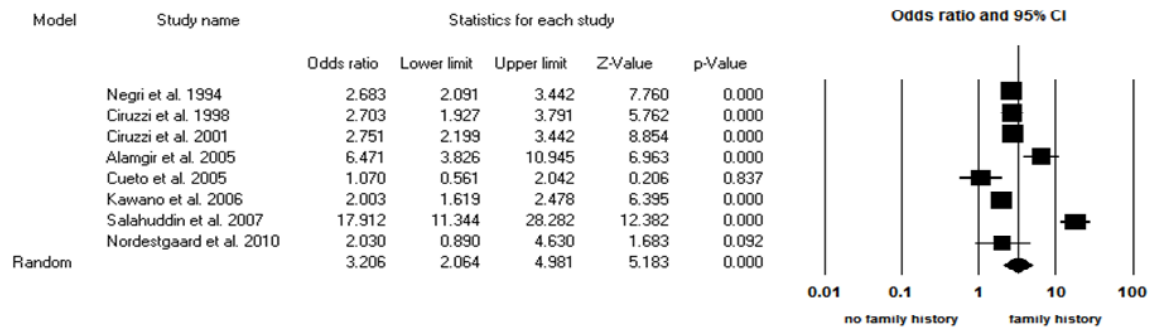


Figure 2: Summary statistic and forest plot of the studies on family history of MI associated with risk of MI.

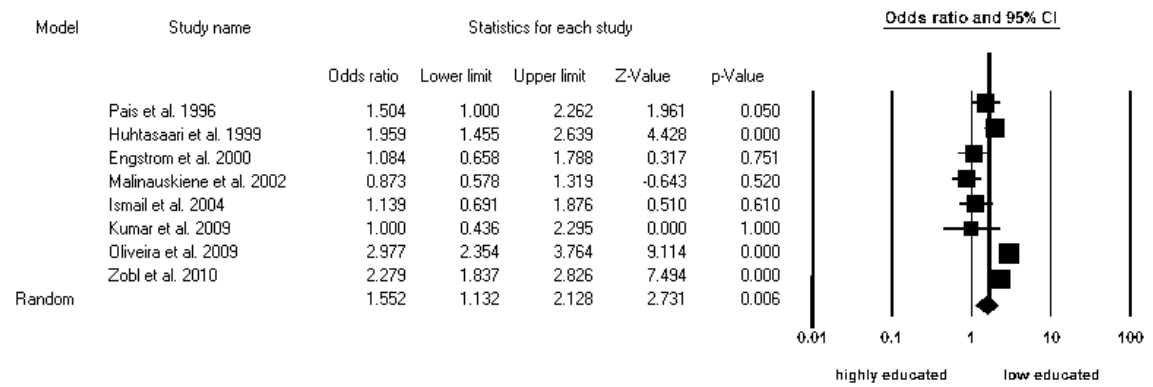


Figure 3: Summary statistic and forest plot of the studies on levels of education associated with risk of MI.

This relationship is consistent with the studies previously conducted in Asian countries as well as in the developed countries [8-10]. A study conducted in India [20] showed the risk of developing MI three times more among males as compared with the females. An Interheart case control study conducted in the 52 countries of the world has also shown that the women had experienced their first MI on the average nine years later than the men in all the different regions of the world [16].

The point estimate (OR=3.206) for Family History indicates that the person who have a strong family history of MI have greater chance of developing MI as compared with those persons who don't have a family history of MI. A study [21], on the behalf of GISSI-EFRIM, investigates the association between family history of MI and risk of AMI [22-25]. These mentioned studies have reported that Family history of heart disease was a significant and independent risk factor of MI.

In the present study the point estimate (OR=1.552) for education indicates that less educated persons have greater risk of developing MI as compared with the highly educated persons. This relationship is consistent with studies previously conducted in different regions of the world [13,16,18,26]. A study [27] describes a Meta-analysis study on the socioeconomic position and incident of AMI. It also shows that education level was strongly associated with the risk of developing MI. The risk of developing MI was greatest in individuals with only an elementary school education as compared to higher level education [28]. Personal education and parental education were also strongly associated with the risk of developing MI [29-40].

Conclusion

This study has mainly focused on the relationship of gender, education and family history with risk of MI. The study has used past researches which contain relevant data on these three selected factors [41-52]. On the basis of Meta-analysis, this study has concluded that the male are at a more risk in having MI as compared with the females. Similarly low income or low socioeconomic status also have associations with the status of MI. Family history of the heart disease is also an important risk factor in causing this fatal diseases.

Acknowledgment

The authors declare that there is no conflict of interest in doing this study.

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