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Modifiable and Unmodifiable Risk Factors of Myocardial Infraction: Systematic Review

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ABSTRACT

Myocardial infarction is a significant cause of death and disability worldwide, especially in relation to cardiovascular disease. To evaluate the contribution of modifiable and non-modifiable risk factors to the incidence of myocardial infarction in a large population, we conducted an extensive search of databases and screened articles using PRISMA guidelines. The study analyzed six articles and included 32,585 patients, of whom 79.8% were male and aged between 61 and 70 years (59.5%). The majority of the population was white (32.3%), followed by black (28.1%) and other races (36.1%), and 20.4% had a positive family history of myocardial infarction. The most common modifiable risk factors were hypertension (48.9%), smoking (42.2%), hypercholesterolemia (40.9%), and diabetes (24.4%). The average BMI was 25.0-39.9, with a mean of 19.6. Hypertension was significantly associated with gender, age, and diabetes, while hypercholesterolemia was positively associated with diabetes and hypertension. The prevalence of myocardial infarction was higher in men and patients with hypertension. The study highlights the importance of healthy lifestyle training and early control of modifiable risk factors to prevent cardiovascular diseases, which increase with age along with coronary artery occlusion.

Keywords:
Myocardial Infarction, Non-modifiable Risk Factors, Systematic review

1. INTRODUCTION

Myocardial infarction is a serious health issue with a rising frequency worldwide [1]. Cardiovascular disorders are the most common cause of death and impaired quality of life internationally. In the 20th century, the percentage of mortality attributable to coronary artery disease increased from 10% to 30%, and it is predicted that by 2030, there would be about 23.6 million cardiovascular disease-related deaths [2,3]. These diseases are disruptive for the healthcare system because they cause complications, incapacity, and decreased efficiency.

The Third Report of the World Health Organization estimates that 12 million people globally pass away from heart failure each year, and that amount will rise to 25 million by the end of 2020 [4]. Urbanization in developing nations is causing a sharp increase in factors associated with risk for cardiovascular disease, which is the major cause of death and disability in prosperous countries. This increases the risk for nations with middle and low incomes, which make up 85% of the global population [5].

According to research, 4%–15% of AMI patients are under the age of 45, making it the most prevalent cause of mortality and affecting both young men and women [6]. Acute myocardial infarction, which happens when there is inadequate circulation due to the abrupt obstruction of a coronary artery by blood clots, is one type of irreparable injury to the cardiac muscle that can be caused by cardiovascular disease. Necrosis, or the death of cardiac tissue, is

caused by myocardial infarction and can be seen on an electrocardiogram (ECG) by alterations like ST-segment rise. It can be distinguished from other ischemia illnesses using cardiac enzymatic indicators [7,8].

The prevalence of coronary artery disease has not greatly decreased despite improvements in scientific studies in identifying factors associated with risk. Risk indicators can be classified as modifiable or non-modifiable, comprising age, gender, genealogy, and ethnicity. Variable risk factors include diabetes, hypertension, smoking, elevated cholesterol levels, and a high-fat diet. According to studies, these variables as well as the passage of time affect the risk of myocardial infarction and sudden death [9]. The probability of heart attack or stroke is exacerbated by having a combination of numerous risk factors at the same time, such as smoking and high blood pressure [10].

Numerous studies have identified that individuals under 45 years old who experienced myocardial infarction had at least three risk factors associated with the condition, including smoking, diabetes, hypertension, dyslipidemia, lifestyle, obesity, and family history [11,12]. Certain racial and ethnic groups experience a higher burden of cardiovascular disease, and studies in the United States have found racial differences in treatment, potentially due to financial barriers, clinical disparities, and patient preferences. Given the significant costs of treating these diseases, understanding their epidemiology and risk factors is essential [6,10]. This study aimed to investigate the modifiable and non-modifiable risk factors for acute myocardial infarction and the relationship between these factors.

2. METHOD

2.1 Search Strategy:

In order to find relevant studies, an extensive search was conducted on databases such as PubMed, Google Scholar, Scopus, Medline, and Web of Science. The search was limited to full-text articles written in English and published from 2015 onwards, using keywords such as "myocardial infarction (MI)," "epidemiology," "prevalence," "incidence," and "risk factors." The screening process was conducted according to PRISMA standards, and Figure 1 illustrates the steps taken in the screening process, excluding the irrelevant abstracts and animal experiments and systematic reviews. The full-text articles were searched including the modifiable and unmodifiable risk factors in patients suffering from myocardial infraction.

2.2 Study Selection Criteria:

Two authors independently reviewed all potentially relevant publications based on inclusion criteria which included case and case series studies reporting demographic and modifiable/unmodifiable risk factors of individuals with individual client data required for case series. Peer-reviewed English-language papers were evaluated, with exceptions for animal experiments, medical case reports, pilot experiments, bibliographic assessments, systematic reviews, and book chapters. Selection was based on focus on MI prevalence, incidence, and risk factors in patients. Papers were evaluated using the Strengthening the Reporting of Observational Studies in Epidemiology checklist, which assesses 43 methodological aspects including sampling procedures, variable measurement, and statistical analysis.

2.3 Data Extraction

The two researchers collected data from each study, including authors' names, publishing year, sample size, area of study, sex distribution, method of analysis and final results. Due to the diverse metrics employed in the studies, only measurements duplicated in at least three studies were considered. These included age, sex, family history, BMI, race and ethnicity, as well as modifiable factors like diabetes, hypertension, smoking, and hypercholesterolemia. Mean scores and percentages were recorded for each measurement taken.

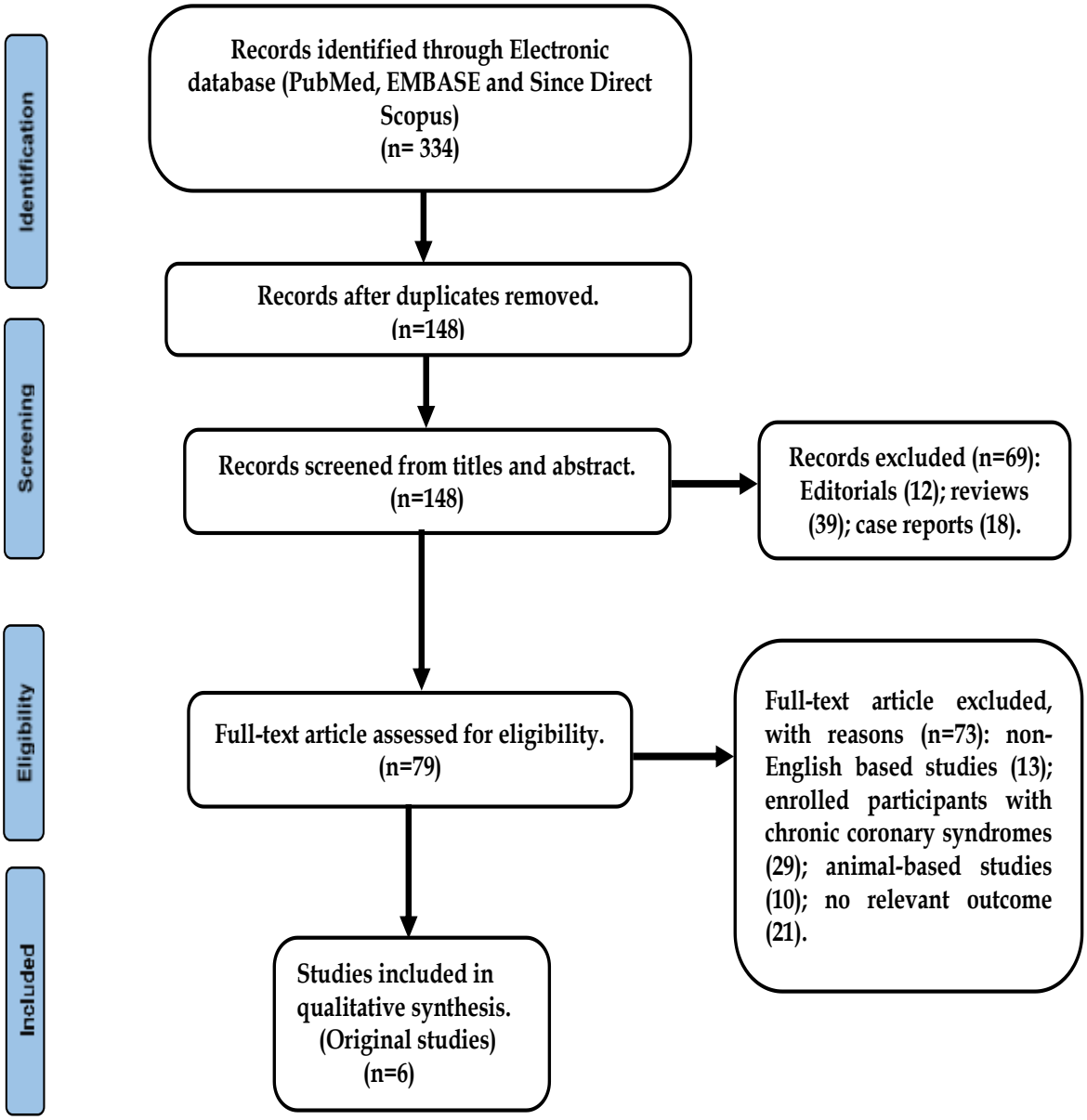

Figure 1 Flow Chart with process of article selection

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Table 1. Characteristics of the study included in the systematic review

Author and Year	Country	Research Design	Participants	Age Range	Sex (M/F)	Method of Analysis	Cardiovascular Findings
Keri N Althoff et al., (2019)	USA and Canada	Cohort study	29515 Adults with HIV who validated non-AIDS-defining cancers, myocardial infarction from Jan 1,200 to Dec 31,2014	>50 years	23773 M 5741 F	Regression analysis	Increased risk of non-AIDS-defining cancer, myocardial infarction, and end-stage liver and renal diseases in adults with HIV, with traditional and HIV-related risk factors contributing to the risk.
T Vernon et al., (2017)	Sydney, Australia	Single-Center Retrospective	536 Patients with ST elevation MI (STEMI) from Jan 2006 to Dec 2014	61-70 years	405 M 131 F	univariate logistic regression analysis	Increasing proportion of STEMI patients with significant atherosclerosis
Etienne Puymirat, MD, PhD et al., (2017)	France	Prospective observational registry	1872 Patients with acute myocardial infarction admitted to cardiac ICUs	51-60 years	1403 M 469 F	Multivariate logistic regression analysis	Over the study period, there was an increase in the proportion of STEMI patients, use of primary PCI, and DAPT. In-hospital and six-month mortality rates decreased significantly.
Akram, Mohd Vaseem et al. (2020)	India	Cross-sectional study	50 acute MI patients	18-45 years	42 M 8 F	Logistic regression analysis	Hypertension (39.5%), smoking (37%), family history of CAD (28%), dyslipidemia (23.5%), obesity (22%), and diabetes mellitus (11%) were the most common risk factors identified.
Bahall, et al., (2018)	Trinidad	Retrospective, observational, case–control study.	251 AMI patients & 464 Non-AMI patients	>45 years	138 M 113 F	Multiple regression analysis	The study found that the significant risk factors for AMI were hypertension, diabetes mellitus, hypercholesterolemia, obesity and smoking.
Mina Abolfazli et al., 2020	Iran	Case-control study	361 participants	60-71 years	259 M 102 F	Multivariate logistic regression analysis	Hypertension, dyslipidemia, smoking, diabetes, obesity, family history of premature CAD, sedentary lifestyle, psychosocial stress, and high-sensitivity C-reactive protein (hs-CRP)

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3. RESULTS AND DISCUSSION

3.1 Selection of Studies:

Initially, 334 articles on the incidence, prevalence, epidemiology, and risk factors of MI in patients were found, but 186 were excluded due to repetitive or irrelevant titles. Abstracts of the remaining 148 articles were examined, leading to 69 more exclusions. In the third stage, the full texts of the remaining 79 articles were reviewed, and 73 were excluded due to methodological issues and incompatible data sources. Ultimately, six articles were found eligible for the study's objectives as shown in Figure 1.

3.2 Study Characteristics:

Table 1 summarizes the key characteristics of the studies included in the systematic review, providing an overview of their main features. All six studies were published in peer-reviewed journals, suggesting that they met adequate quality standards for scientific literature. These studies were conducted in various countries, including the USA & Canada [13], Australia [14], France [15], India [16], Trinidad [17], and Iran [18], suggesting a global reach and potential generalizability of findings to populations worldwide. Overall, the quality and diversity of the included studies indicate a comprehensive review of the prevalence, incidence, and risk factors of MI in different regions of the world.

The systematic review analyzed six studies to examine the prevalence, incidence, and risk factors of myocardial infarction (MI) in different populations. The review found that the non-modifiable risk factors, including age, sex, family history, and ethnicity, as well as modifiable risk factors such as diabetes, hypertension, smoking, and total cholesterol levels, were examined in all studies. The combined sample size of the studies was 32,585 cases, comprising 26,020 males and 6,564 females. It is worth noting that the smallest sample size was from the study conducted by Akram et al., [16] with only 50 cases, while the study by Keri et al. [13] had the largest sample size, with 29,515 cases. This variation in sample size suggests that there may be differences in the prevalence of AMI across different populations.

From Table 2, it is evident that one of the key findings of the systematic review was that the incidence of male patients with MI was significantly higher than that of females, with 79.8% of the study subjects being men and 20.1% being women. The age range of 61-70 years had the highest frequency of study subjects, accounting for 59.5%, while less than 1.3% of the study subjects were under 30 years old. Additionally, 20.4% of the patients reported a positive family history of MI. In terms of race and ethnicity, 32.3% of the study subjects were white, 28.1% were black, and 36.1% belonged to other ethnicities. The mean BMI (kg/m2) was 19.6, ranging from 25.0 to 39.9.

Among the modifiable risk factors in the population with MI, hypertension was reported in 48.9% of cases, followed by smoking in 42.2% of cases. The incidence of diabetes and hypercholesterolemia was measured as 24.4% and 40.9%, respectively. Overall, the systematic review provides valuable insights into the prevalence, incidence, and risk factors of MI in different populations. The findings suggest that there may be differences in the prevalence of AMI across different populations and that males are at a higher risk than females. The review also highlights the importance of addressing modifiable risk factors, such as hypertension, smoking, diabetes, and hypercholesterolemia, in preventing and managing MI.

Table 2. The demographic characteristics of patients with acute myocardial infarction by modifiable/non-modifiable factors

Variable	N= 32585	Mean	Percentage %
Non-modifiable risk factors			
Gender	Male	26020	79.8
	Female	6564	20.1
Age (n=2064)			
	<30 years	27	1.3
	31-40 years	148	7.2
	41-50 years	224	10.8
	51-60 years	290	14.0
	61-70 years	1229	59.5
	>70 years	146	7.1
Family history (n=3070)		625	20.4
Race and ethnicity (n-598)			
	White	193	32.3
	Black	168	28.1
	Hispanic	20	3.3
	Other	216	36.1
	Unknown or missing	1	0.2
Mean BMI (Kg/m^2)		19.6	Ranging from 25.0-39.9
Modifiable risk factors (n=3417)			
Diabetes mellitus		834	24.4
Hypertension		1673	48.9
Smoking		1441	42.2
Total Cholesterol/Hypercholesterolemia		1399	40.9

3.3 Data Analysis & Discussion

This systematic analysis examined the incidence, sex disparities, ages, risk factors, and patterns in the etiology of acute myocardial infarction (AMI) in large groups of people. Myocardial infarction, an acute complication of disruptive cardiovascular disease, develops on when plaque due to atherosclerosis completely blocks a coronary artery. It is critical to discover both controllable and non-modifiable risk factors to lower the likelihood of heart attack and subsequent complications given the increasing incidence of MI in both male and female demographics. Risk factors that are changeable and those that are not were separated into two distinct groups for the study parameters. Six age groups were created in order to investigate the prevalence of acute myocardial infarction in each group. The age range of 61 to 70 years indicated a significant rate of MI (59.5%), with the age range of under 30 years reporting the lowest prevalence (1.3%). Identification of high-risk individuals and the development of prompt treatment and preventive programs can be aided by a knowledge of the prevalence of MI among various age groups.

The age distribution of acute myocardial infarction varied across the studies. A study reported the highest frequency in the age group of 61-75 years [19], while Kim et al. found the highest incidence in subjects aged 70-79 years [20]. Both studies showed a higher proportion in men. The current study also found a significantly higher incidence of AMI in men (79.8%) than in women (20.1%). Studies have consistently shown that cardiovascular disease is more prevalent in men and that gender and age play a significant role in the incidence of this disease. Moreover, >50% of the individuals in both genders had a positive family history of cardiovascular disease. This finding is consistent with a study by Salehi et al., which reported a 23.8% incidence of cardiovascular disease [21].

The modifiable risk factors for myocardial infarction were divided into four categories including hypertension, smoking, hypercholesterolemia, and diabetes. The prevalence of hypertension was reported as the highest followed by smoking, hypercholesterolemia, and diabetes. The prevalence of all three modifiable factors was found to be higher in males than females. The study reported that less than half of individuals (42.2%) with myocardial infarction reported a history of smoking, which was found to be higher among men [22]. In a similar study by Leifheit-Limson et al. [23], a history of smoking of more than 50% was reported in both genders. In the male population, the prevalence of hypertension and diabetes was found to be more than 90%, while the prevalence of hypercholesterolemia was found to be more than 50%. A study by Dan et al. [22] also reported higher prevalence rates of all three modifiable factors in males than females.

The study found that as patients' age increased, the prevalence of modifiable risk factors such as hypertension, smoking, hypercholesterolemia, and diabetes also significantly increased. Aging can cause weight gain, insulin

resistance, and high blood pressure [23]. Similar risk factors link diabetes and hypertension. Other studies also showed significant relationships between age, gender, and the incidence of myocardial infarction. However, some studies did not find significant relationships between myocardial infarction and hypertension or diabetes, possibly due to differences in age groups, sample size, and sample selection [24-29].

One potential limitation of our study is that it only included English language articles, which could affect the precision of our estimates. Another limitation is the incompleteness of medical records for some patients, resulting in missing data on modifiable and non-modifiable variables.

4. CONCLUSION

The study revealed that myocardial infarction incidence was higher in men and the age group of over 60 years, and the incidence of underlying diseases like hypertension, diabetes, and hyperlipidemia increased with age, leading to coronary artery occlusion. Therefore, promoting healthy lifestyles and controlling modifiable factors from an early age can prevent cardiovascular diseases in the future. However, the study did not find any articles related to the association between socioeconomic status and the risk of premature MI. Hence, further research is necessary to determine whether socioeconomic status is associated with the risk of premature MI. To reduce the burden of risk factors and premature MI, interventions need to be developed at the person, population, and policy levels. At the person level, patients can be educated about healthy lifestyles and modifiable risk factors such as smoking, hypertension, and diabetes. Additionally, healthcare providers should consider the patients' socioeconomic status while providing care and developing prevention strategies. At the population level, public health campaigns can be implemented to raise awareness about healthy lifestyle choices and cardiovascular disease prevention. For instance, campaigns to encourage physical activity, healthy eating, and smoking cessation can be introduced. At the policy level, regulations and policies can be established to promote cardiovascular disease prevention, such as increasing taxes on tobacco products and improving access to healthy foods. The government can also allocate resources to improve the healthcare system's ability to prevent, diagnose and treat cardiovascular diseases. In conclusion, this study highlights the importance of early prevention of cardiovascular diseases and the need for further research to understand the association between socioeconomic status and premature MI. Interventions at the person, population, and policy levels are necessary to reduce the burden of risk factors and premature MI.

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