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The prevalence of myocardial infarction in the elderly: A systematic review and meta-analysis

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Original Article

Abstract

BACKGROUND: Myocardial Infarction (MI) refers to the destruction and death of cells in the myocardium of the heart. Its prevalence increases with age due to changes in the cardiovascular system. The aim of the present study was to combine, summarize, standardize, resolve inconsistencies in the results of studies, and investigate the impact of potential factors on the prevalence rate of MI in the elderly through a systematic review and meta-analysis.

METHODS: This systematic review and meta-analysis was conducted from 1987 to March 2022. All relevant published studies were searched in PubMed, Embase, Scopus, Web of Science (WoS) databases, and Google Scholar search engine using related MeSH/Emtree and Free Text words. The heterogeneity among studies was quantified using the I^2 index.

RESULTS: In the initial search, 35453 studies were identified. After eliminating irrelevant studies, finally, 29 articles with a sample size of 3279136 subjects were included in the meta-analysis. After combining the results of the studies included in the meta-analysis, the total prevalence of MI in the elderly was estimated to be 17.6% (95% CI: 12.8 - 23.7%), 16.1% (95% CI: 11.0 - 22.8%) in males, and 12.5% (95% CI: 9.2 - 16.8%) in females. The prevalence of MI increased with the year of publication and the mean age of the elderly (P < 0.001).

CONCLUSION: The results showed that due to the high prevalence of myocardial infarction (MI) in the elderly, it should be addressed within healthcare systems and policy makers should pay more attention to prevention of MI. However, considering the inclusion of heterogeneous studies, the pooled estimation should be interpreted with caution.

Keywords: Meta-Analysis; MI; Myocardial Infarction; Prevalence; Systematic Review

List of abbreviations: WoS: Web of Science; MeSH: Medical Subject Headings; PRISMA: Preferred Reporting Items for Systematic Reviews and Meta-Analysis; CI: Confidence Interval; JBI: Joanna Briggs Institute; MI: Myocardial Infarction; WHO: World Health Organization; ECG: Electrocardiogram; DE-CMR: Delayed-Enhancement Cardiovascular Magnetic Resonance; COPD: Chronic Obstructive Pulmonary Disease.

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Introduction

One of the significant demographic phenomena of the 21st century is population aging[1], an inevitable event in human life. Addressing the issues, problems, and needs of this stage is a social necessity[2]. According to the World Health Organization (WHO), individuals over the age of 60 are considered elderly, and a large percentage of this population resides in developing countries[3]. The elderly population is on the rise due to improvements in health status, a phenomenon

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known as the demographic revolution[4]. The WHO estimates that the number of elderly individuals will exceed 1.5 billion by 2050[5].

Aging is a life stage associated with decreased physical function, mobility limitations, increased health problems, chronic diseases, and dependency on others[5]. It also involves physical changes, such as cardiovascular disease, and psychological changes, such as anxiety and depression[6,7]. These problems can negatively impact the lives of the elderly[8].

Cardiovascular diseases (CVDs) are among the most common chronic diseases and leading causes of death worldwide[9]. Among ischemic heart diseases, MI is one of the most prevalent and dangerous diseases in industrialized countries[10]. MI refers to the permanent and irreversible cell death in a portion of the heart muscle (myocardium), which occurs due to the cessation of blood flow and severe ischemia in the myocardium.

The cessation of blood flow can occur suddenly and without any preceding symptoms, or following several angina attacks (chest pain). The absence of myocardial blood flow (MBF) for an extended period, due to the occlusion (blockage) of the coronary arteries, results in MI[11]. The disruption of blood flow leads to an inadequate oxygen supply to the heart muscle, causing death (necrosis) of the heart muscle[12]. MI is typically the result of gradual plaque buildup (atherosclerosis) and clot formation associated with atherosclerosis within a vein[11].

Heart diseases in middle-aged individuals often begin with a symptom, grow slowly, and eventually become severe[13]. In fact, the cardiovascular system undergoes irreversible changes, such as increased thickness and stenosis of arteries, with age. As a result of these changes, the heart is forced to pump blood with greater intensity and pressure, leading to a gradual increase in the individual's blood pressure. This ultimately results in impaired heart rate and the development of heart failure or MI[14,15]. Approximately, 83% of patients who die from MI are elderly[16].

Several primary studies on the prevalence of MI in the elderly have been conducted in various parts of the world in recent years. However, these studies have examined the prevalence rate in a limited area with a small sample size. Moreover, none of the studies investigated the effect of potential factors, such as the year of publication, sample size, mean age, and gender of the elderly, and did not report the prevalence by different continents. Furthermore, large differences in the reported prevalence rate are observed in their results. Therefore, it appears necessary to conduct a systematic review and meta-analysis study to combine, summarize, standardize, and resolve inconsistencies in the results of the studies and investigate the effect of potential factors on the prevalence rate. Consequently, the present study aimed to estimate the prevalence of MI in the elderly by systematic review and meta-analysis.

Methods

Search strategy

The current systematic review and meta-analysis were conducted based on the guidelines of PRISMA 2020 (http://www.prisma-statement.org/), which includes identification, screening, eligibility, and inclusion[17] from 1987 to March 2022. All steps of identification, selection, and quality assessment of studies, as well as data extraction, were performed independently by two researchers (S.M and M.K) in accordance with the PRISMA guidelines. Any disagreement between the two researchers was resolved through consensus and consultation with a third researcher (F.R).

Identification of studies

A systematic literature review was conducted in the international databases of PubMed, Embase, Scopus, and Web of Science (WoS) to identify studies related to the prevalence of MI in the elderly. The searches included the combinations of the following MeSH/ Emtree and Free Text words: "Epidemiology", "Prevalence*", "Prevalent *", "Myocardial Infarction", "Myocardial Infarctions", "Infarction, Myocardial", "Infarctions, Myocardial", "Cardiovascular Stroke", "Cardiovascular Strokes", "Stroke, Cardiovascular", "Strokes, Cardiovascular", "Myocardial Infarct", "Infarct, Myocardial", "Infarcts, Myocardial", "Myocardial Infarcts", "Heart Attack", "Heart Attacks", "Elderly", "Old*", "Geriat*", "Elderlys", "Elderlies", and "Aged". No time limitation were considered for the search to retrieve as comprehensive as possible relevant studies. The Google Scholar motor engine and references of all relevant articles were manually reviewed to maximize the comprehensiveness of the search.

Inclusion Criteria

The inclusion criteria were original scientific-research studies, observational studies (cross-sectional study, cohort study, etc.), access to the full text of the article, and studies that reported the rate or frequency of MI in the elderly. If cohort studies were retrieved, the prevalence of MI was extracted from baseline data.

Exclusion Criteria

The exclusion criteria included irrelevant studies, interventional studies (clinical trial study and field trial study), qualitative studies, case series, case reports, letters to the editor, articles presented at conferences, systematic review and meta-analysis studies, dissertations, lack of access to the full text of the article after sending an email to the corresponding author three times, and studies with duplicate and overlapping data.

Selection Process of Studies

After identifying the search strategy for each database, all articles obtained from different databases were imported into EndNote X8 software. The studies with duplicate and overlapping data were initially eliminated. Then, the names of authors, institutes, and journals of all articles were deleted. The title and abstract of the studies were thoroughly screened to exclude irrelevant studies. The full text of the remaining articles was carefully assessed to remove the studies that did not meet the inclusion criteria. Ultimately, the quality assessment of all studies included in the systematic review and meta-analysis was conducted.

Quality assessment of the studies

The quality assessment of the studies was conducted using the Joanna Briggs Institute (JBI) checklist, a standard and well-known tool for assessing the quality of studies reporting prevalence data[18]. This checklist comprises nine items, including sample frame, participants, sample size, detailed description of study subjects and setting, data analysis, valid methods for identifying conditions, condition measurement, statistical analysis, and adequate response rate. The responses “Yes” for pointed, “No” for not pointed, and “Not applicable” for not reported are used for scoring. The total score range, based on the number of “Yes” responses, is between 0 and 9. Table 1 presents the results of the quality assessment of the studies included in the meta-analysis.

Data Extraction

Data were manually extracted from all studies included in the systematic review and meta-analysis using a pre-prepared checklist. This checklist included the name of the first author, year of publication, country and continent, sample size, age, diagnostic tools, prevalence rate, and quality assessment score.

Statistical analysis

In this study, the prevalence rate of MI in the elderly was reviewed. The rate or relative frequency of MI in each study was used to combine the results of different studies. Heterogeneity among studies was checked using the I^2 index. Given the high heterogeneity between the results of the studies included in the meta-analysis ($I^2 > 75\%$), the random effects model was used. Therefore, the results of the random effects model in heterogeneous conditions are more generalizable than those of the fixed effect model.

The funnel plot and Egger’s regression intercept were employed to assess the publication bias. Furthermore, meta-regression was used to examine the relationship between the prevalence rate of MI in the elderly and sample size, the year of publication, and mean age of the elderly.

Subgroup analysis was performed based on the different continents (Asia, Africa, Europe, and America) and gender (male and female). The comprehensive meta-analysis software (version 2) was used for meta-analysis and $P < 0.05$ was considered statistically significant.

Results

The summary of how studies included in the meta-analysis

The systematic literature search in various databases yielded 35435 articles, and 18 articles were identified through manual searches. After removing 26351 studies with duplicate and overlapping data via EndNote, 8974 irrelevant studies were excluded by screening the title and abstract. The full text of the remaining 128 studies was carefully inspected, and 99 articles (No primary outcome= 51, Irrelevant studies= 19, Study design= 6, and Overlapping data= 23) were eliminated due to not meeting the eligibility criteria. Finally, 29 articles were included in the meta-analysis after quality assessment. The PRISMA 2020 flow diagram (Figure 1) illustrates this process.

General characteristics of the studies

The meta-analysis included a total sample size of 3279136 from all the articles. The studies spanned from 1987 to 2021, with the USA contributing the most studies (12 articles). The study with the largest sample size was conducted by Duan et al. (2007) with 1519086 subjects, while the study with the smallest sample size was by Goch et al. (2009) with 40 subjects. Most studies employed Electrocardiogram (ECG) for diagnosing MI. The characteristics and data of the studies included in the systematic review and meta-analysis are detailed in Table 1.

Meta-analysis of the prevalence of MI in elderly

Given that the I^2 test for the total prevalence of MI in the elderly revealed significant heterogeneity among studies (I^2 = 99.99), the data were analyzed using a random effects model. The results of Egger's regression indicated no publication bias in the studies at the level of 0.05 (P = 0.441) (Figure 2). After combining the results of studies included in the meta-analysis, the prevalence rate of MI in the elderly was estimated to be 17.6% (95% CI: 12.8%-23.7%) based on the random effects model. As shown in Figure 3, the black square represents the prevalence rate, the length of the line segment displays the 95% CI in each study, and the rhombus symbol illustrates the total prevalence rate of MI in the elderly. The results of the sensitivity analysis demonstrated that the pooled estimation did not change significantly by removing each of the studies (Figure 4).

The meta-regression of the prevalence rate of MI in the elderly

The relationship between the sample size (Figure 5), year of publication (Figure 6), and mean age (Figure 7) and the prevalence of MI in the elderly was assessed

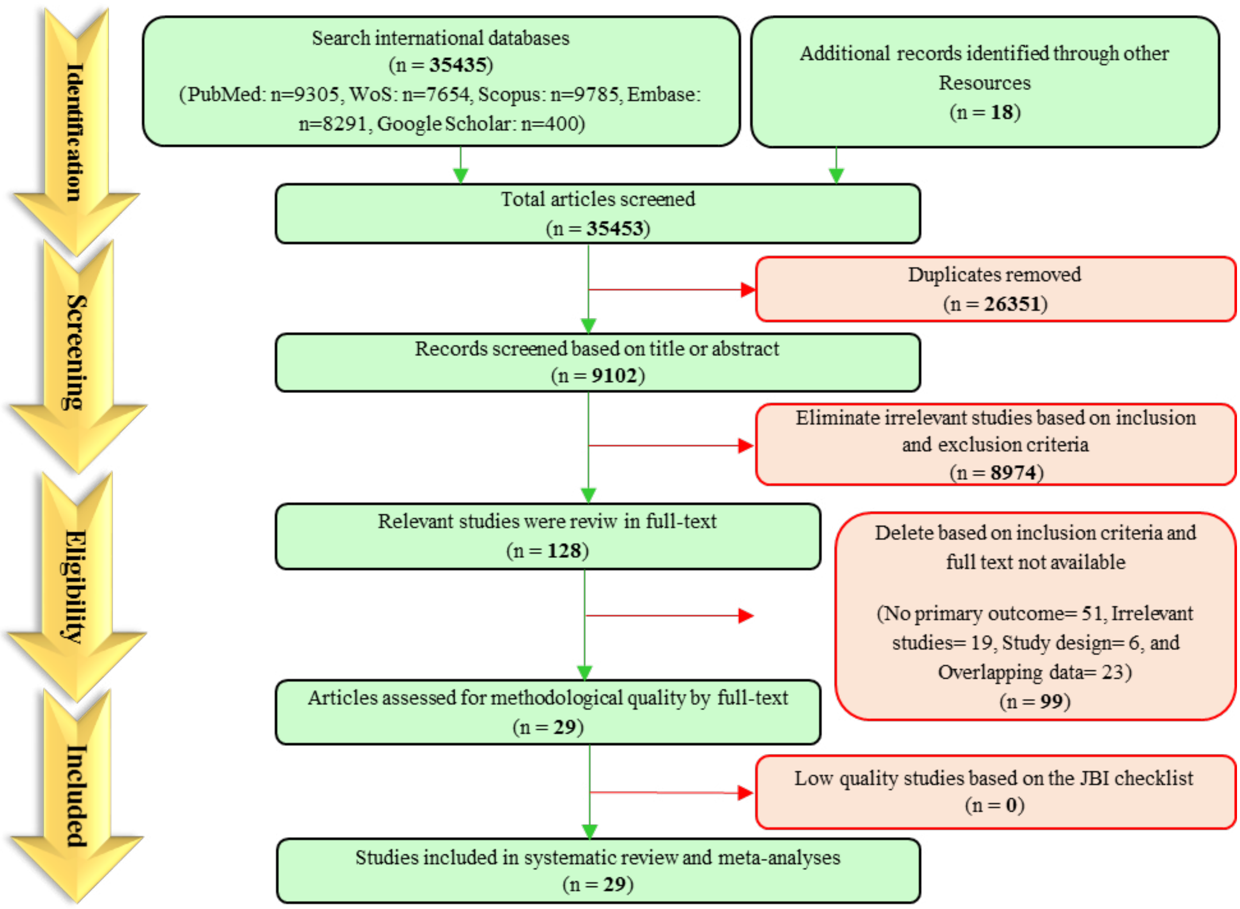


Figure 1. PRISMA 2020 search flow diagram

using meta-regression. The results indicated a significant difference between the prevalence rate of MI in the elderly and these potential factors ($P < 0.001$). The prevalence of MI in the elderly decreased with an increase in sample size and increased with the year of publication and mean age (Figures 5-7).

Subgroup analysis

Considering the high heterogeneity among the studies ($I^2 = 99.99$), subgroup analysis was reported based on

Table 1. The characteristics of studies included in the systematic review and meta-analysis

First Author (Reference)	Year	Country (Continent)	Sample size (n) Total	Male	Female	Age (year)	Type of study	Diagnostic tool	Prevalence (%) Total	Male	Female
Sheifer et al [19]	2000	USA (America)	5888	2355	3533	72.1	Cross-Sectional	ECG	15.3	-	-
Rathore et al [20]	2000	USA (America)	106780	53283	53497	76.8	Cross-Sectional	ECG	22.1	-	-
Aronow et al [21]	1987	USA (America)	708	469	239	82±8	Cross-Sectional	ECG	30.0	27.7	34.7
Mehta et al [22]	2001	USA (America)	163140	101963	61177	>65	Cross-Sectional	ECG	28.2	-	-
Rathore et al [23]	2001	USA (America)	3402	-	-	>65	Cross-Sectional	ECG	8.3	-	-
Lusiani et al [24]	1994	Italy (Europe)	94	60	34	68.5±11.5	Retrospective	ECG	32	27	36
O'Neal et al [25]	2014	Senegal (Africa)	4608	1843	2765	>65	Cross-Sectional	ECG	17.3	22.0	14.1
Brugts et al [26]	2005	Netherlands (Europe)	4484	1628	2856	69.6±8.8	Cross-Sectional	ECG	4.86	7.6	3.2
Nadelmann et al [27]	1990	USA (America)	390	139	251	79±3, >75	Cross-Sectional	ECG	8.8	-	-
Duan et al [28]	2007	USA (America)	1519086	607634	911452	76	Population-Based Cross-Sectional and Cohort Study	ECG	8.8	7.3	9.9
Dangelser et al [29]	2005	France (Europe)	1672	1256	416	79	Cross-Sectional	ECG	20.45	-	-
Barbier et al [30]	2011	Sweden (Europe)	394	206	188	>75	Population-Based Cross-Sectional	ECG	30	37	23
Khera et al [31]	2013	USA (America)	1434579	-	-	≥65	Cross-Sectional	ECG	35.7	-	-
Claussen et al [32]	2014	Norway (Europe)	4092	3088	1004	≥65	Prospective Cohort Study	ECG	10.6	-	-
Reiter et al [33]	2011	Spain (Europe)	404	218	186	78 (74-82)	Multi-Centre Study	ECG	36	-	-
Goch et al [34]	2009	Poland (Europe)	40	25	15	81 (75-95)	Cross-Sectional	ECG	52.5	65	52
Pastori et al [35]	2015	England (Europe)	3223	1812	1411	73.2±8.7	Prospectively	ECG	25.1	-	-
Sato et al [36]	2020	Japan (Asia)	6596	4141	2455	≥65	Prospective, Multicenter, and Observational Study	-	8.1	-	-
Schelbert et al [37]	2012	Iceland (Europe)	936	452	484	76 (72-81)	Cohort	ECG	16.23	15.04	18.36
Maynard et al [38]	2006	USA (America)	7054	6936	118	73.5±10.0	Retrospective Cohort Study	ECG	11.2	-	-
Amann et al [39]	2016	Germany (Europe)	1191	678	513	79 (75-84)	Observational Population-Based Study	ECG	41	-	-
DeLuca et al [40]	2006	USA (America)	287	204	83	63±8	Cross-Sectional	ECG	22.6	-	-
Ahto et al [41]	1998	Finland (Europe)	1196	488	708	74±7	Observational Population-Based Study	ECG	9.5	14	7
Kim et al [42]	2009	USA (America)	185	122	63	60.4±11.2	Prospective Study	DE-CMR	27	-	-
Figueroa-Triana et al [43]	2021	Colombia (America)	1015	679	336	66.4±13.7	Retrospective Cohort Study	ECG	38	-	-
Kılıç et al [16]	2020	Turkey (Europe)	1626	1149	477	61.5±12.5	National Multi-Center, Observational Study	ECG	6.7	5.22	10.27
Gianfagna et al [44]	2018	Italy (Europe)	3755	2391	1364	68.5±4.3	Population Based Cross-Sectional Study	ECG	6.4	8.9	2.1
Kohn et al [45]	2005	USA (America)	1633	784	621	>65	Retrospective Cohort Study	ECG	10.7	-	-
Sajadieh et al [46]	2005	Denmark (Europe)	678	397	281	64.5±6.8	Cross-Sectional	ECG	11.4	9.6	13.8

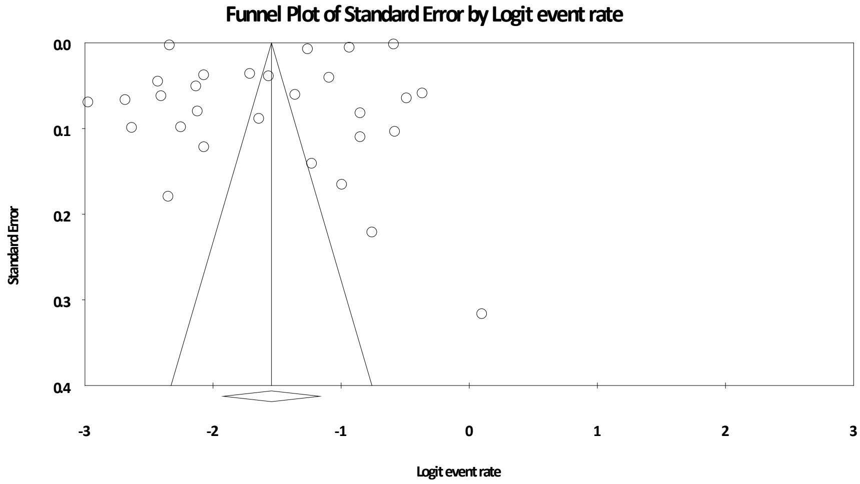
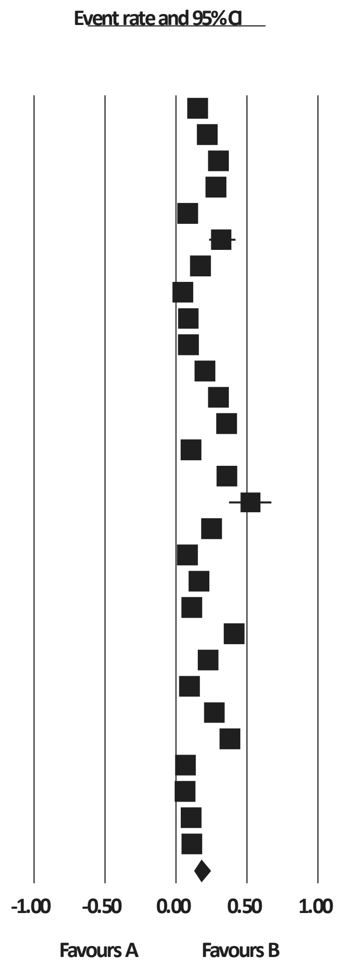


Figure 2. The Funnel plot of the results of the overall estimation of the prevalence rate of MI in the elderly

Study name	Event rate	Lower limit	Upper limit	Z-Value	p-Value
Sheifer, 2000	0.153	0.144	0.162	-47.268	0.000
Rathore, 2000	0.221	0.219	0.223	-170.818	0.000
Aronow, 1987	0.299	0.267	0.334	-10.359	0.000
Mehta, 2001	0.282	0.280	0.284	-169.856	0.000
Rathore, 2001	0.083	0.074	0.093	-38.656	0.000
Lusiani, 1994	0.319	0.233	0.420	-3.424	0.001
O'Neal, 2014	0.173	0.162	0.184	-40.174	0.000
Brugts, 2005	0.049	0.043	0.055	-42.829	0.000
Nadelmann, 1990	0.087	0.063	0.120	-13.084	0.000
Duan, 2007	0.088	0.088	0.088	-816.452	0.000
Dangelser, 2005	0.205	0.186	0.225	-22.401	0.000
Barbier, 2011	0.299	0.256	0.347	-7.725	0.000
Khera, 2013	0.357	0.356	0.358	-337.661	0.000
Claussen, 2014	0.106	0.097	0.116	-41.987	0.000
Reiter, 2011	0.359	0.314	0.407	-5.593	0.000
Goch, 2009	0.525	0.373	0.673	0.316	0.752
Pastori, 2015	0.251	0.236	0.266	-26.911	0.000
Sato, 2020	0.081	0.075	0.088	-53.819	0.000
Schelbert, 2012	0.162	0.140	0.187	-18.511	0.000
Maynard, 2006	0.112	0.105	0.120	-54.841	0.000
Amann, 2016	0.410	0.382	0.438	-6.195	0.000
DeLuca, 2006	0.226	0.182	0.279	-8.709	0.000
Ahto, 1998	0.095	0.080	0.113	-22.854	0.000
Kim, 2009	0.270	0.211	0.339	-6.000	0.000
Figueroa-Triana, 2021	0.380	0.351	0.411	-7.552	0.000
K?l?ç, 2020	0.067	0.056	0.080	-26.553	0.000
Gianfagna, 2018	0.064	0.057	0.072	-40.232	0.000
Kohn, 2005	0.107	0.093	0.123	-26.500	0.000
Sajadieh, 2005	0.112	0.090	0.138	-17.000	0.000
	0.176	0.128	0.237	-8.037	0.000

Statistics for each study

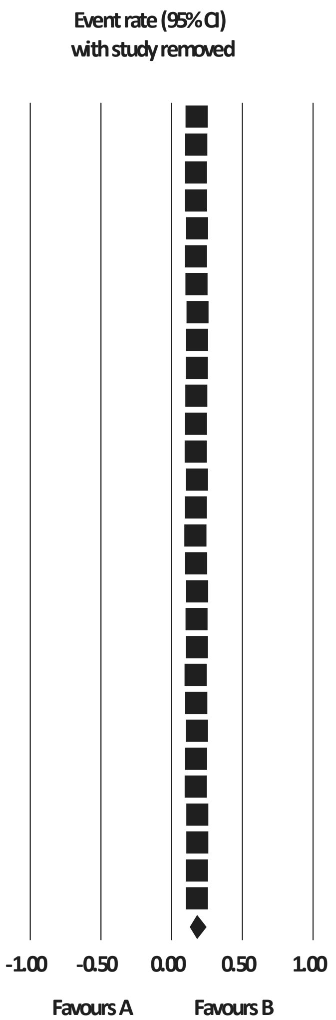


Meta Analysis

Figure 3. The forest plot of the overall estimation of the prevalence rate of MI in the elderly based on the random effects model

Study name	Point	Lower limit	Upper limit	Z-Value	p-Value
Sheifer, 2000	0.177	0.128	0.240	-7.853	0.000
Rathore, 2000	0.175	0.124	0.240	-7.543	0.000
Aronow, 1987	0.172	0.124	0.234	-8.021	0.000
Mehta, 2001	0.173	0.121	0.242	-7.257	0.000
Rathore, 2001	0.180	0.131	0.244	-7.739	0.000
Lusiani, 1994	0.172	0.124	0.234	-8.040	0.000
O'Neal, 2014	0.176	0.127	0.239	-7.880	0.000
Brugts, 2005	0.184	0.133	0.248	-7.639	0.000
Nadelmann, 1990	0.180	0.130	0.244	-7.756	0.000
Duan, 2007	0.178	0.154	0.204	-17.733	0.000
Dangelser, 2005	0.175	0.126	0.237	-7.925	0.000
Barbier, 2011	0.172	0.124	0.234	-8.022	0.000
Khera, 2013	0.171	0.130	0.220	-9.746	0.000
Claussen, 2014	0.179	0.129	0.242	-7.785	0.000
Reiter, 2011	0.171	0.123	0.232	-8.072	0.000
Goch, 2009	0.168	0.121	0.229	-8.185	0.000
Pastori, 2015	0.174	0.125	0.236	-7.966	0.000
Sato, 2020	0.181	0.131	0.244	-7.735	0.000
Schelbert, 2012	0.176	0.127	0.239	-7.877	0.000
Maynard, 2006	0.179	0.129	0.242	-7.793	0.000
Amann, 2016	0.170	0.122	0.231	-8.109	0.000
DeLuca, 2006	0.174	0.126	0.237	-7.954	0.000
Ahto, 1998	0.180	0.130	0.243	-7.768	0.000
Kim, 2009	0.173	0.125	0.235	-7.998	0.000
Figueroa-Triana, 2021	0.171	0.123	0.232	-8.086	0.000
K?l?ç, 2020	0.182	0.131	0.246	-7.699	0.000
Gianfagna, 2018	0.182	0.132	0.246	-7.690	0.000
Kohn, 2005	0.179	0.129	0.242	-7.790	0.000
Sajadieh, 2005	0.179	0.129	0.242	-7.801	0.000
	0.176	0.128	0.237	-8.037	0.000

Statistics with study removed



Meta Analysis

Figure 4. The sensitivity analysis chart of the prevalence rate of MI in the elderly

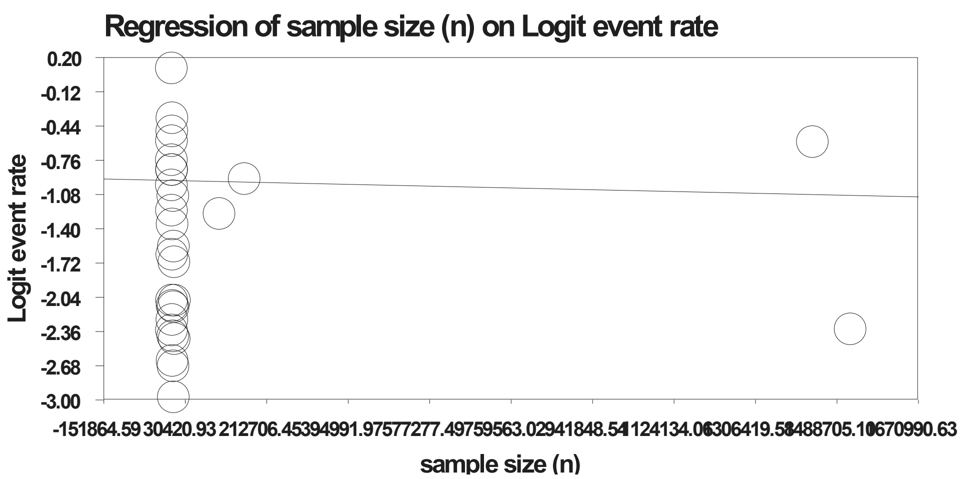


Figure 5. The meta-regression of the relationship between sample size and the prevalence of MI in the elderly

the different continents (Asia, Africa, Europe, and America) and gender (male and female) (Table 2). The results of the subgroup analysis illustrated that the highest prevalence rate of MI in the elderly was related to the America continent with 18.4% (95% CI: 11.4 - 28.4%) and male with 16.1% (95% CI: 11.0 - 22.8%). However, there was still a high level of heterogeneity between studies (Table 2).

Discussion

After combining the data obtained from 29 articles included in the meta-analysis with more than three million sample size, the present study estimated the prevalence of MI in the elderly to be 17.6% using systematic review and meta-analysis. The highest quality assessment score, based on the JBI checklist,

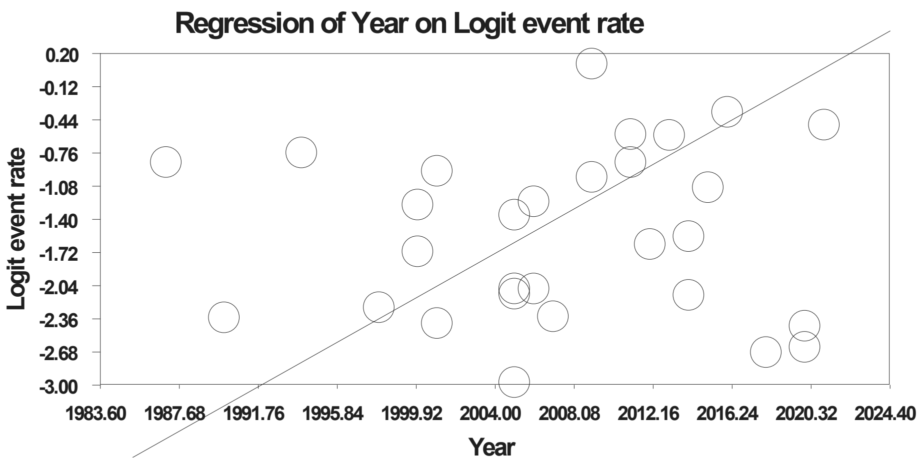


Figure 6. The meta-regression of the relationship between the year of the publication and the prevalence of MI in the elderly

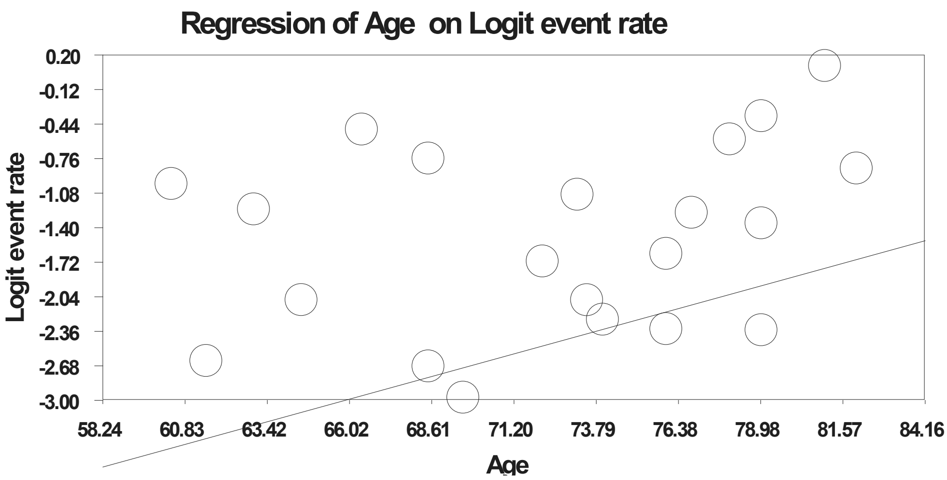


Figure 7. The meta-regression of the relationship between the mean age and the global prevalence of MI in the elderly

Table 2. The subgroup analysis of estimating the prevalence rate of MI in the elderly by continents and gender

Subgroups		Number Studies	Point estimate	Lower limit	Upper limit	*Z*-value	*P*-value	*P*-value between	I^2 (%)	Tau	Egger's regression intercept
Continents	Africa	1	0.173	0.162	0.184	-40.174	0.000	0.000	0.000	0.000	-
	America	13	0.184	0.114	0.284	-5.168	0.000		99.99	1.033	0.607
	Asia	1	0.081	0.075	0.088	-53.819	0.000		0.000	0.000	-
	Europe	14	0.177	0.120	0.254	-6.545	0.000		99.24	0.869	0.875
Gender	Male	12	0.161	0.110	0.228	-7.489	0.000	0.000	98.99	0.745	0.011
	Female	12	0.125	0.092	0.168	-11.076	0.00		97.79	0.575	0.447

was attributed to a Turkish study with a score of 9, which reported the prevalence of MI in the elderly as 6.7%[16]. This was followed by studies conducted in Colombia, the USA (38%), and Italy (6.4) with a score of 8. Given that the study conducted in Colombia was a retrospective cohort study, the results of the other two studies can provide a more accurate representation of the prevalence of myocardial infarction in the population.

Meta-analysis studies have reported that the prevalence of MI varies in different populations. This variation may be attributed to factors such as the structure of the study population, underlying and concomitant diseases, sample size, and physiological changes occurring in the cardiovascular system of individuals with aging or certain diseases. The prevalence of MI is reported to be 5.03% in pregnancy[47], 1.7% in patients with multiple sclerosis[48], and 34% in occluded culprit artery (OCA)[49]. The risk of MI is estimated to be 1.72 in patients with COPD, 1.69 in patients with rheumatoid arthritis, 1.47 in patients with gout, 1.41 in patients with psoriatic arthritis, and 1.24 in patients with ankylosing spondylitis[50,51].

The results of the meta-regression indicated that the prevalence of MI increases with age. Subtle physiological changes gradually occur in the cardiovascular system with age. The aging process of the heart is associated with myocardial stiffness, due to an increase in the size of the ventricular muscle cells and a decrease in the number of these cells. Furthermore, the intercellular matrix and collagen increase, and the heart muscle becomes fibrous. These structural changes gradually lead to an increase in the thickness of the left ventricular wall[52]. Left Ventricular Hypertrophy (LVH) occurs in the elderly independent of concomitant hypertension. LVH is independently associated with an increased risk of coronary heart disease (CHD), sudden cardiac death, MI, and stroke[53].

With age, the thickness of the arterial wall increases, primarily due to the enhancement of collagen fibers and the destruction of elastin fibers in the middle layer of vessels and its calcification[54,55]. As a result, vascular compliance decreases, leading to the dilation of the artery, increased pulse pressure, and increased pulse wave velocity. This condition predisposes the elderly to isolated systolic hypertension, the most common type of hypertension in this age group[56]. Increased intima-media thickness (IMT) is a significant indicator of the risk of atherosclerosis, and the predictive value of increased IMT for future acute cardiovascular events is equal to or greater than the classic cardiovascular risk factors[57].

Based on the results of the meta-regression, the prevalence of MI in the elderly increased from 1987 to 2022. This increase can be attributed to factors such as decreased mobility and physical activity, increased obesity, depression, and diabetes in recent years[58-60]. Therefore, it is crucial for health officials and policymakers to implement measures to promote weight loss, increase physical activity, and prevent cardiovascular disease, depression, and diabetes.

Given the variations in population structure, culture, diet, mobility and physical activity, genetics, stress, anxiety, depression, etc. across different countries and geographical areas, a subgroup analysis was performed based on different continents. Although the number of studies conducted in Asia was limited, the lowest prevalence rate of MI was reported in the elderly Asian population. This could be attributed to factors such as the traditional Asian diet (TAD) [61], and lower rates of depression in the elderly[58], among others.

The results of the subgroup analysis revealed that the prevalence of MI is higher in men than in women. Men are exposed to MI much earlier than women during their lifetime. Estrogen provides more protection for women against heart disease before menopause. Consequently, the mean age of MI occurrence in women is higher than that in men[22]. Furthermore, the difference in the prevalence of MI between the male and female population can be attributed to other factors such as differences in lifestyle, smoking, hyperlipidemia, insulin resistance, obesity, diabetes, hypertension, etc. [16,30,37,44].

The high prevalence of MI in the elderly population and its increasing trend in recent years (Figure 6) in the present systematic review and meta-analysis study indicated the need for further investigations and follow-up for this disease. CVDs and the incidence of MI are considered as one of the most important public health problems, resulting in important health consequences, such as death, disability, and higher economic costs. The need to adopt policies and strategies focused on reducing and controlling risk factors can reduce the health and economic burden of disease in society in the longterm. However, identifying higher-risk populations and providing effective and quality periodic medical care can slow the progression of the disease and reduce the complications and death caused by MI.

Limitations

One of the limitations possibility of the lack of access to all articles and unpublished reports, lack of uniform reporting of articles, non-random selection of some samples, non-uniform study design, and lack of accurate and quality reporting in some studies. In addition, high heterogeneity among studies (more than 99%) led to perform subgroup analysis, which reduced a small amount of heterogeneity ,according to previous meta-analysis [62,63]. However, there was still high heterogeneity in all subgroups, which may be due to sample size, demographic characteristics, and Study design.

Conclusions

The findings of this systematic review and meta-analysis study indicate that the prevalence rate of MI in the elderly is high and has been increasing with age in recent years. It is suggested to conduct systematic review and meta-analysis studies on the prevalence of other CVDs in the elderly, as well as the prevalence of MI in other subgroups and comorbid populations, such as youth and individuals with underlying conditions like diabetes and those undergoing hemodialysis. It is recommended that health officials and policymakers pay more attention to the prevention and control of this disease.

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Conflict of Interest

The authors declare that they have no conflict of interest.

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Author's Contributions

M.K, F.R and M.R contributed to the design, M.K and F.R participated in most of the study steps. M.K, F.R and M.C prepared the manuscript. F.R, M.R and M.K assisted in designing the study, and helped in the, interpretation of the study. All authors have read and approved the content of the manuscript.

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