



A Systematic Review of Studies on The Burden of Ischemic Heart Disease

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Review

Abstract

Aim: Ischemic Heart Disease (IHD) is the most prevalent form of cardiovascular disease and remains the leading cause of death globally, yet its burden exhibits substantial regional and national variations. This systematic review aims to determine the prevalence of IHD at the global, regional, and national levels, and to provide a comprehensive overview of the literature to facilitate evidence-based policy-making.

Methods: A systematic review methodology was employed, adhering to PRISMA guidelines. A comprehensive search using keywords related to "DALY" (Disability-Adjusted Life Years) was conducted across five databases (PubMed, Scopus, EBSCO, Science Direct, and BioMed Central) for research articles published in English between 2000 and 2024. From 923 initial records, 12 studies met the eligibility criteria and were included for analysis.

Results: This systematic review analyzed 12 studies on the burden of Ischemic Heart Disease (IHD) from an initial pool of 923 records. The included studies showed geographical variety: six focused on a single

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country, two were global, and the remainder examined regions like MENA, Central Asia, and the Eastern Mediterranean and North Africa. Methodologically, the DisMod-MR method was the most commonly used analysis technique. Notably, three of the studies did not include risk factor analysis. In terms of disease burden, the highest DALY rate was detected in Central Asian countries. While the absolute number of IHD cases, deaths, and DALYs increased between 1990 and 2019 due to global population growth and aging, age-standardized rates (ASRs) generally decreased globally. However, this overall decline was uneven, as ASRs for prevalence and morbidity increased in Low and Middle SDI regions. The majority of the IHD burden (DALYs) is overwhelmingly driven by Years of Life Lost (YLLs) due to premature mortality. The research momentum in this field is recent, with the most studies carried out in 2023.

Conclusion: Although many regions show a decline in age-standardized mortality, incidence, prevalence, and DALYs, the prevalence of IHD remains persistent. The stark regional disparities and the increasing burden in Low and Middle SDI countries necessitate urgent investment in primary prevention strategies, particularly the rigorous control of major metabolic risk factors (high LDL-C, high SBP, high BMI, and high FPG) and robust environmental governance to achieve the Sustainable Development Goal target 3.4 by 2030.

Keywords: DALY, Burden of Ischemic Heart Disease, Systematic Review

INTRODUCTION

Ischemic Heart Disease (IHD), commonly referred to as coronary artery disease (CAD) or atherosclerotic cardiovascular disease (ACD), stands as a critical global health crisis, characterized by high rates of morbidity, disability, and mortality (Guan et al., 2023; Khan et al., 2020; Sadeghi et al., 2023). IHD results from myocardial ischemia and subsequent damage, typically caused by the narrowing or occlusion of coronary arteries due to atherosclerosis (Ahmadi et al., 2024; Khan et al., 2020; Li & Zhang, 2022). This chronic condition is a major impediment to sustainable human development and constitutes a significant barrier to achieving global goals regarding the reduction of premature mortality from non-communicable diseases (NCDs) by 2030 (Guan et al., 2023; Koolaji et al., 2023). Globally, IHD was the leading cause of death in 2019, accounting for more than 9 million deaths (Guan et al., 2023; Koolaji et al., 2023).

To comprehensively quantify the societal and economic impact of IHD, the disease burden is frequently assessed using the Disability-Adjusted Life Years (DALYs) metric (Henriques et al., 2017; Maracy et al., 2015). DALYs represent the total years of healthy life lost, calculated as the sum of Years of Life Lost (YLLs) due to premature mortality and Years Lived with Disability (YLDs) (Ahmadi et al., 2024; Henriques et al., 2017; Li & Zhang, 2022). YLLs consistently account for the dominant proportion of the IHD burden (Henriques et al., 2017; Maracy et al.,

2015). For instance, YLLs were 17.89 times higher than the YLD rate in China in 2019 (Li & Zhang, 2022), and they accounted for 88.3% of the IHD burden in mainland Portugal in 2013 (Henriques et al., 2017). Critically, IHD was the third leading cause of DALYs globally in the youth age group (15–49 years) in 2019, highlighting its substantial impact on productivity and premature death (Li & Jiang, 2024).

Global epidemiological trends based on data from the Global Burden of Disease (GBD) Study for the period 1990 to 2019 reveal contrasting patterns (Guan et al., 2023). The absolute number of IHD prevalence, incidence cases, deaths, and DALYs increased significantly worldwide (Guan et al., 2023; Koolaji et al., 2023). Global population growth and demographic aging primarily drive this increase in total burden (Guan et al., 2023). Conversely, the age-standardized rates (ASRs) for IHD incidence, mortality, and DALYs generally decreased globally during the same timeframe (Guan et al., 2023; Khan et al., 2020). However, this generalized global decline masks significant regional disparities. Age-standardized prevalence and morbidity rates actually increased in Low SDI, Low-middle SDI, and Middle SDI regions between 1990 and 2019 (Guan et al., 2023; Koolaji et al., 2023).

Specific high-burden regions highlight the urgency of targeted intervention. The Central Asia (CA) region demonstrated a higher IHD burden than the global average between 1990 and 2017 (Lui et al., 2021). Within this region, Uzbekistan exhibited the highest age-standardized mortality and DALY rates globally in 2017, with its age-standardized death rate increasing by 77.2% from 1990 to 2017 (Lui et al., 2021). Similarly, the Middle East and North Africa (MENA) region accounted for 11.01% of all DALY causes in 2019, which is higher than the global proportion of 7.19% (Ahmadi et al., 2024). While the age-standardized incidence rate in MENA decreased by 9% between 1990 and 2019, this reduction was slower compared to the global level (Ahmadi et al., 2024).

A substantial portion of the IHD burden can be attributed to modifiable risk factors (Xie et al., 2016). Metabolic factors are consistently identified as the leading drivers globally (Li & Jiang, 2024; Li & Zhang, 2022). Globally, approximately 94.1% of IHD DALY rates among youth (15–49 years) were linked to documented risk factors in 2019 (Li & Jiang, 2024). The foremost global risk factors contributing to IHD DALYs in youth in 2019 were high low-density lipoprotein cholesterol (LDL-C) (68.9%), high systolic blood pressure (SBP) (51.2%), and high body mass

index (BMI) (33.1%) (Li & Jiang, 2024). In the MENA region, high SBP, high LDL-C, and particulate matter air pollution were the top three factors contributing to attributable IHD DALY rates in 2019 (Sadeghi et al., 2023; Ahmadi et al., 2024). Furthermore, many countries, including Iran, showed an increasing percentage contribution of high fasting plasma glucose (FPG) and high BMI to the overall IHD burden between 1990 and 2019, despite reductions in age-standardized rates for other factors (Koolaji et al., 2023; Sadeghi et al., 2023).

Given the persistent, heavy, and regionally varied burden of IHD, coupled with the shifting landscape of critical modifiable risk factors, continuous systematic evaluation is essential (Guan et al., 2023; Lui et al., 2021). Systematic assessments provide crucial information for national and regional policymakers to measure success against international health goals and to allocate healthcare resources efficiently for effective primary and secondary prevention strategies (Guan et al., 2023; Koolaji et al., 2023).

The primary role of burden of disease studies is to inform health policy. Given that ischemic heart disease is a leading cause of death, the availability of mortality and morbidity information, categorized by gender, region, and risk factor, is crucial for implementing effective policies against it. (Yiğit and Kalender, 2022). The purpose of this study is to evaluate studies estimating the burden of ischemic heart disease on a global, regional or country basis, and to identify and evaluate the epidemiological metrics (incidence, prevalence, and mortality, YLL, YLD and DALY) and methods used to determine the burden of disease. While numerous studies, many based on GBD data, have analyzed the burden of IHD, this systematic review provides a unique contribution by synthesizing the specific methodological trends (e.g., the prevalence of DisMod-MR) and the variety of epidemiological metrics used across recent literature.

1. RESEARCH METHODOLOGY

The population of this systematic review-type study, which was based on document analysis of articles, consisted of research articles published in English and published in the international literature between 2000 and 2024 that examined the burden of ischemic heart disease. The primary reason for selecting these dates is to access more studies by keeping the date range broad. Another reason is that a review of the literature reveals that studies on the burden of

ischemic heart disease, particularly those utilizing the DALY metric following the comprehensive Global Burden of Disease (GBD) updates, were conducted in the 2000s and later.

The present study was conducted in accordance with the PRISMA guidelines, which are considered to be the most appropriate for systematic reviews and meta-analyses. A meticulous search strategy was employed to identify studies on the burden of ischemic heart disease, published between January 2000 and December 2024, using five databases. A comprehensive search was conducted between 05.02.2025 and 14.03.2025 in the following databases: PubMed, Scopus, Science Direct, BioMed Central and EBSCO. The selection of these databases was based on their comprehensive coverage of biomedical and multidisciplinary health literature. PubMed provides extensive access to biomedical research, Scopus offers broad citation tracking and abstracts across scientific fields, and EBSCO (CINAHL) ensures the inclusion of nursing and allied health literature, thus collectively providing a robust and wide-ranging network for identifying relevant studies on disease burden. The search terms and numbers utilized are enumerated in Table 1.

Table 1. Search Terms Used in Databases

Database	Search Terms	Number of Studies
PubMed	(Disability-Adjusted Life Years/ OR (DALY OR DALYs OR ((disabil*) ADJ4 (adjust*) ADJ4 (life*) ADJ4 (year*)) OR YLL OR YLLs OR ((year*) ADJ2 (life*) ADJ (lost*)) OR YLD OR YLDs OR ((year*) ADJ3 (lived) ADJ3 (disabil*)) AND (Ischemic heart diseases OR coronary heart coronary artery))	255
Scopus	(TITLE-ABS-KEY ("disability-adjusted life years") OR TITLE-ABS-KEY ("daly" OR "dalys") AND TITLE-ABS-KEY (("Ischemic heart" OR "coronary artery" OR "coronary heart"))) AND PUBYEAR > 1999 AND PUBYEAR < 2025 AND (LIMIT-TO (LANGUAGE , "English")) AND (LIMIT-TO (DOCTYPE , "ar")) AND (LIMIT-TO (OA , "all"))	654
Science Direct	"Disability-adjusted life years" OR "DALY" OR "DALYs" AND (Ischemic heart" OR "coronary heart" OR "coronary artery")	162
EBSCO-CINAHL	TI "Disability-Adjusted Life Years" OR "DALY" AND TI ("Ischemic heart" OR "coronary heart" OR "coronary artery")	6
BioMed	TI "Disability-Adjusted Life Years" OR DALY OR DALYs AND TI ("Ischemic heart" OR "coronary heart" OR "coronary artery")	8

The literature review was conducted in PubMed, Scopus, ScienceDirect, BioMed Central, and EBSCO databases. Since each database has a different indexing system, controlled vocabulary, and search syntax, the search terms were adapted to suit the structure of each database. This method aimed to ensure the most comprehensive review of the literature on disease burden. To ensure consistency between databases, the fundamental key concepts have been preserved, with adaptations made only to suit each database's indexing system and search syntax. The Mendeley Reference Manager (2.77.0) tool was utilized to organise the data, avoid duplication and list related works. It was determined that conference abstracts, proceedings and editorials would not be included in the study. The geographical restriction was not a factor in the study, and the primary research articles published in English were analyzed. As this study constitutes a systematic review, no ethical committee approval was required.

Limitations of the Study: This study has several limitations. The literature search was limited to the PubMed, Scopus, ScienceDirect, BioMed Central, and EBSCO databases; therefore, studies indexed in other databases might not have been captured. Furthermore, only articles published in English were included, which may have introduced a language bias and led to the exclusion of relevant studies published in other languages.

1.1. Eligibility Criteria

In this systematic literature review, studies examining the burden of ischemic disease as defined in the DALY framework were included. The present systematic literature review was conducted with the objective of assessing the burden of ischemic heart disease. To this end, the review was limited to studies in English, research articles, and those for which the full text was available. It is important to note that studies of the burden of disease based on all diseases were excluded from the analysis. However, studies attributing ischemic disease to one or more specific risk factors were excluded from the analysis. Furthermore, the exclusion criteria were applied to exclude studies that included other diseases in addition to the burden of ischemic disease. A total of 923 studies satisfied the predetermined eligibility criteria. The software utilized for the compilation, screening and selection of studies for inclusion in the data synthesis was Mendeley Reference Manager (version 2.77.0). A selection of relevant studies was made by screening titles (first step), abstracts (second step) and full articles (third step) obtained through database searches. The selection of studies to be included in the research was determined by the researcher, who was

not constrained by the results of any external evaluation. In the initial phase of the research, duplicate studies identified across the databases were eliminated using Mendeley Reference Manager. Subsequently, the titles of the remaining studies were examined, and the abstracts were evaluated according to the established inclusion criteria. These abstracts were then assessed in conjunction with the full texts of the remaining studies. The inclusion and exclusion criteria are presented in Table 2.

Table 2. Inclusion and exclusion criteria

Inclusion criteria	Exclusion criteria
Studies using DALYs metrics	Studies not using DALYs measures
Full-text research articles	Publications other than full-text research articles • Conference abstracts, • Proceedings paper, • Letters, • Editorials
Full-text research articles published between 1 January 2000-31 December 2024	Studies published before 1 January 2000 and after 31 December 2024
Studies published in English language	Non-English language publications

1.2.Data Extraction

The present study incorporated research papers that adopted a burden of disease approach and evaluated DALYs for ischemic heart disease. The selection of studies and extraction of data were conducted by one researcher, with the validation of data elements performed by a second researcher. All studies from the included databases were transferred to Mendeley (2.77.0) for analysis. A comprehensive evaluation of all transferred articles was conducted by two independent reviewers. The resolution of disagreements pertaining to inclusion and exclusion was attempted through the utilization of a consensus-driven approach amongst the reviewers. A preliminary evaluation of the relevant studies was conducted on the basis of title and abstract, after which a selection was made for further analysis of the full texts. These were then subjected to a rigorous review by analysts, who were tasked with determining their conformity with the aforementioned selection criteria. Subsequent to the initial process of eligibility, the studies were subjected to a more thorough investigation through full-text review. Those cases which did not satisfy the predetermined criteria were subsequently excluded from the analysis.

The study data were then subjected to analysis according to author, year, purpose of the study, reference time period, geographical scope, data source, metrics reported (DALY, YLD,

YLL, incidence, prevalence, mortality) and programmes used. The articles that met the inclusion criteria were then organised in Microsoft Excel. Eligibility assessments were conducted in accordance with the inclusion and exclusion criteria established for each study.

2. RESULTS AND DISCUSSION

As illustrated in Figure 1, the search flowchart for studies on the burden of ischemic disease provides a comprehensive overview of the search and screening strategy employed in the literature review, including the primary reasons for exclusion. An initial predetermined search strategy was used to retrieve a total of 923 studies from the PubMed (n = 255), Scopus (n = 654), ScienceDirect (n = 162), BioMed Central (n = 8) and EBSCO (n = 6) databases. After removing 259 duplicate studies, 664 studies were screened based on their titles and abstracts. Subsequent to this, 468 studies were excluded based on the title and abstract, and the full texts of the remaining 196 studies were examined in accordance with the research strategies and inclusion and exclusion criteria. Following the evaluation stage, 12 studies were deemed to meet the inclusion criteria and were consequently selected for inclusion in the systematic review. Figure 1 presents the PRISMA flow diagram showing the inclusion process and reasons for exclusion.

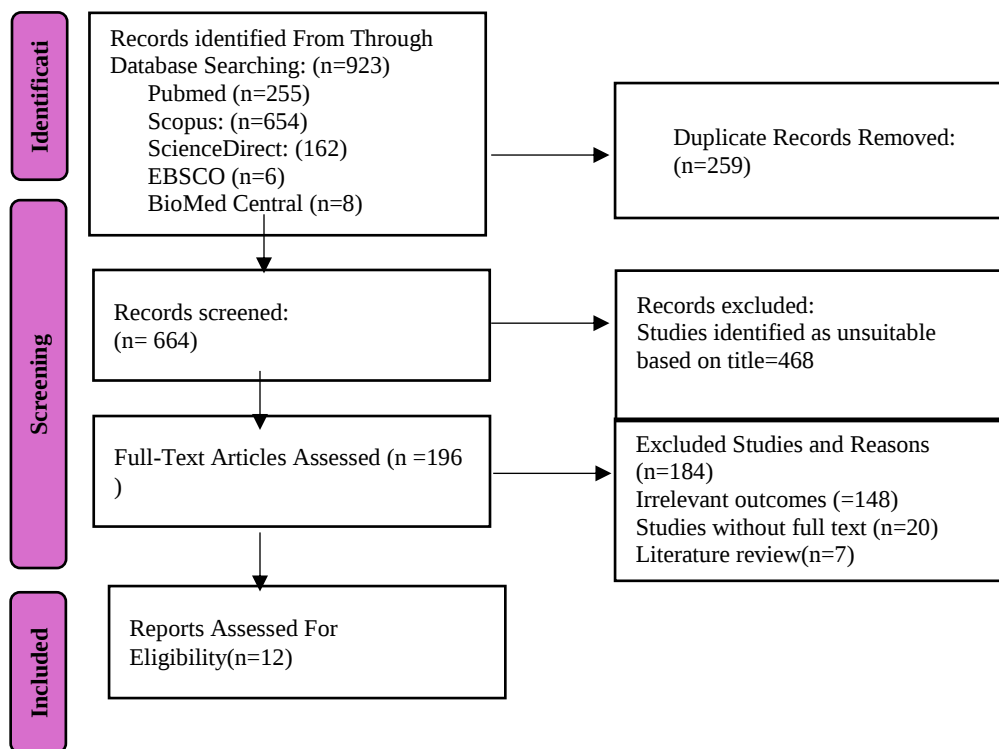


Figure 1: PRISMA flow diagram

Source: Page et al., 2021

Since 12 studies investigating the burden of Ischemic Heart Disease(IHD) were included in the systematic review in line with the inclusion criteria adopted in the study, these studies constitute the sample of the study.

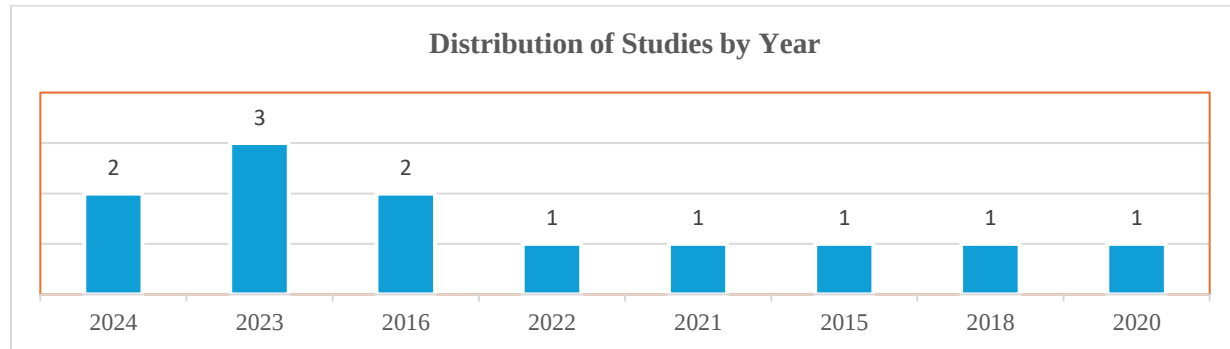


Figure 2. Findings Regarding the Year of Publication of the Studies

When figure 2 is examined, it is seen that studies on Ischemic Burden of Disease were mostly conducted in 2023 with 3 studies. 2 studies were conducted in 2024 (Ahmadi et al., 2024; Aminorroaya et al., 2024), 2 studies in 2016 (Henriques et al., 2016; Xie et al., 2016), 2015 (Maracy et al., 2015), 2018 (Zhang et al., 2018), 2020 (Khan et al., 2020), 2021 (Lui et al., 2021) and one study in 2022 (Lui et al., 2021).

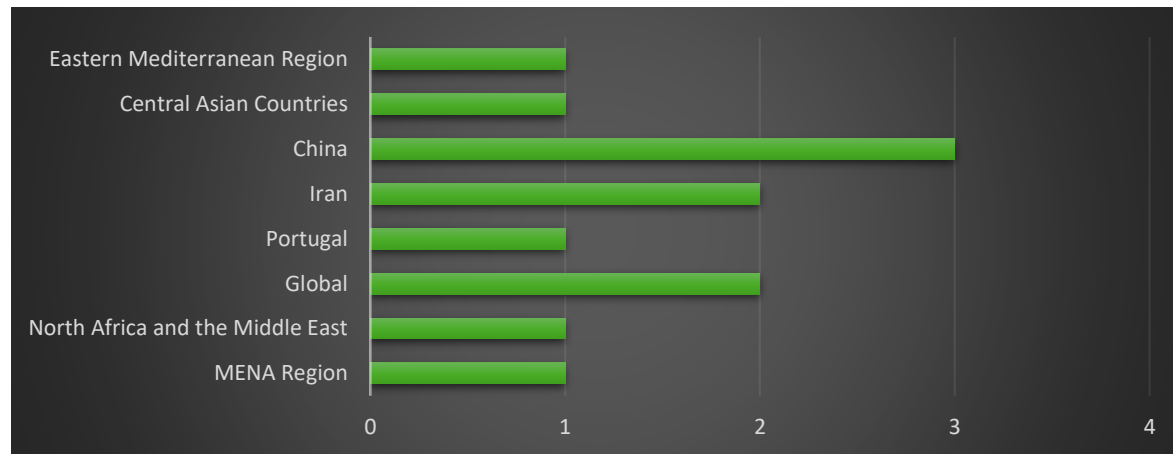


Figure 3: Findings on the Countries where the Studies were Conducted

Examining figure 3 reveals that the majority of studies on the burden of ischemic heart disease were conducted in China (Li and Zhang, 2022; Xie et al., 2016; Zhang et al., 2018), Iran (Maracy et al., 2015; Koolaji et al., 2023), and globally (Guan et al., 2023; Khan et al., 2020). At

this stage, the findings of the studies on the burden of ischemic heart disease published in English were evaluated in line with the following items (Table 3).

Table 3. Summary Table of the Studies Analyzed within the Scope of the Research

Authors	Purpose of the study	Reference time period	Geographic scope	Data source	Metrics reported	Methodology used
Ahmadi et al.(2024)	Assessing epidemiology and risk factors associated with IHD in the MENA region	1990-2019	MENA Region	GBD 2019	prevalence, incidence, YLL, YLD, mortality, DALY	Unspecified
Aminorr oaya et al. (2024)	To estimate the prevalence, incidence, mortality, years lived with disability, years of life lost, disability-adjusted life years (DALYs) and attributable risk and premature deaths factors of IHD in the North Africa and Middle East region.	1990-2019	North Africa and Middle East region.	GBD 2019	prevalence, incidence, YLL, YLD,death,DALY	R software version 4.0.4
Guan et al.(2023)	To examine the burden of IHD in detail through secondary analysis of data from the Global Burden of Disease (GBD) 2019	1990–2019	Global	GBD 2019	Prevalence, incidence, death, DALY	DisMod MR 2.1
Henriques et al.(2016)	To estimate the burden of IHD in mainland Portugal and compare it across five regions	2013	Portekiz	GBD 2010	DALY, Death, YLL and YLD	Unspecified
Koolaji et al.(2023)	To describe the distribution of ischemic heart disease burden and its risk factors at both national and regional scales in Iran	1990–2019	Iran	GBD 2019	Incidence, Prevalence, Mortality, YLD, YLL, DALY and risk factors	Unspecified
Li and Zhang (2022)	To determine the burden of disease and risk factors of ischemic heart disease in China through a systematic analysis, thereby raising awareness for the prevention of IHD in China	1990-2019	China	GBD 2019	Incidence, Mortality, YLL, YLD and DALY	Unspecified
Lui et al. (2021)	Addressing the burden of ischemic heart disease in Central Asia at regional and country levels	1990–2017	Central Asian Countries	GBD 2017	Death, Prevalence, DALY	DisMod MR 2.1
Maracy et al. (2015)	To examine and present the burden of ischemic heart disease in Iran.	1990-2010	İran	GBD 2010	DALY, Death, YLL and YLD	DisMod-MR, Monte Carlo Simulation

Sadeghi et al.(2023)	To provide a comprehensive appraisal of the evolving burden of ischemic heart disease in the Eastern Mediterranean Region.	1990-2019	Eastern Mediterranean Region	GBD 2019	Death, DALYs, Prevalence, Attributable Risk Factor	Unspecified
Xie et al.(2016)	Estimating the burden of IHD and status attributable to risk factors in Fujian, China	1990-2013	China	GBD 2013	Mortality, DALY, Attributable Risk Factors	Unspecified
Zhang et al. (2018)	To assess the burden of IHD in Chinese provinces and identify risk factors	1990-2015	China	GBD 2015	Mortality, DALY, YLL, YLD, Risk Factors	DisMod-MR 2.1, Bayes Meta Regression
Khan et al. (2020)	To assess the global epidemiological trends of IHD	1990-2017	Global	GBD 2017	Prevalence and DALY	Statistical Package (SPSS) Time Series Modeling

A data summarization form created by the researchers was used for full text review. The aim of all studies included in the review was to assess or estimate the epidemiology, burden and outcome of ischemic heart disease (Table 3), and the assessment of ischemic heart disease burden was based on the DALY indicator. When Table 3 was examined, it was determined that all of the studies utilized the IHME database and consisted of secondary analyses. Three of the 12 studies (Ahmadi et al., 2024; Li and Zhang, 2022; Aminorroaya et al., 2024) included “prevalence, incidence, YLL, YLD, mortality, DALY” metrics together, while two studies (Maracy et al., 2015; Henriques et al., 2016) included “DALY, Death, YLL and YLD” data together. While one study (Zhang et al., 2018) used “Mortality, DALY, YLL, YLD, Risk Factors”, another study (Xie et al., 2016) included “Mortality, DALY, Attributable Risk Factors” data. Mortality, DALY, Prevalence, Attributable Risk Factor were used as metrics in one study (Sadeghi et al., 2023), while only Prevalence and DALY were used in Khan et al., 2020.

Lui et al. (2021) used mortality, prevalence and DALY, Koolaji et al. (2023) incidence, prevalence, mortality, YLD, YLL, DALY and risk factors and Guan et al. (2023) prevalence, incidence, mortality, DALY metrics. However, another finding of our study is that the methodological methods used in the studies subject to our study are Dismod, R Program and SPSS statistical methods.

Table 4. Ischemic Heart Disease Burden Assessment Results of the Studies Reviewed

Authors	Age Weighing	Risk Factor Analysis	Morbidity			Mortality		DALYs(UI %95)	DALYs Change Rate
			Incidence	Prevalence	YLDs	YLLs	Mortality Rate		
Ahmadi et al. (2024)	✓	✓	262.394	4911.063	83.826	4075.1	219.01	4158.94	68%
Aminorroaya et al. (2024)	✓	✓	613.9	4911.1	83.8	176438	219	4158.9	-33.3%
Guan et al. (2023)	X	X	262.39	2421.02	X	X	117.95	2243.54	-71.3%
Henriques vd.(2016)	✓	X	X	X	11186	84226	6526	19.51(per 1000 person)	-
Koolaji et al. (2023)	✓	✓	829.1	6198.5	81	2761.7	163,6	2842.7	-47.7%
Li and Zhang (2022)	X	✓	246.09	X	129.05	2309.58	131.75	2438.63	51.44%
Lui et al. (2021)	✓	✓	X	2150.9	X	X	350	5762.4	9%
Maracy et al. (2015)	✓	✓	X	X	134	3112	175	3245	-31,25%
Sadeghi et al (2023)	✓	✓	X	5.31	X	X	235.83	4,635.68	-15.36%
Xie et al.(2016)	✓	✓	X	X	X	X	82.7	1202.7	-8.8%
Zhang et al. (2018)	✓	✓	X	X	88.3	1671.9	105,6	1760.2	13.3%
Khan et al. (2020)	X	X	X	1,655	X	X	X	2228	-

Detailed information on the articles obtained as a result of the systematic review is given below. According to Ahmadi et al. (2024), ischemic heart disease represented 11.01% of total DALYs in the MENA region in 2019, reflecting a 68% increase since 1990. According to Aminorroaya et al. (2024), The principal cause of mortality was that of ischemic heart disease in North Africa and the Middle East in 2019. Between 1990 and 2019, the age-standardized DALY rate for IHD decreased significantly by 33.3%. In a study conducted by Guan et al. (2023), although age-standardized mortality, prevalence, morbidity, and age-standardized DALY rates related to IHD decreased globally between 1990 and 2019, age-standardized morbidity and prevalence of IHD increased in Low SDI, Low-Middle SDI, and Middle SDI regions. According to Henriques et al. (2016), approximately 100,000 DALYs were lost due to IHD in Portugal, most of which resulted in premature death.

In the study by Koolaji et al. (2023), there was a decline in both death and DALY rates. The former decreased by 42.7% and the latter by 47.7% between 1990 and 2019, respectively. The rates in 2019 were 163.6 deaths (149.0-176.2) and 2842.7 DALYs (2657.0-3103.1) per 100,000

people. Li & Zhang (2022) found that the rate of DALYs increased from 1254.09/100,000 (95% UI 1096.61 – 1408.23) in 1990 to 2438.63/100,000 (95% UI 2106.15–2786.90) in 2019. According to the results of the study conducted by Lui et al. (2021), the age-standardized death rate (ASDR) for IHD increased by 16.7% in Central Asia between 1990 and 2017. Maracy et al. (2015) found that the proportion of age-standardized IHDs determined by DALYs decreased by 31.25% over the 20-year period from 1990 to 2010. The age-standardized mortality rate of ischemic heart disease decreased by 21.17%. The analysis revealed a decline in age-standardized YLL and YLD rates, with respective decreases of 32.05% and 4.28%.

Sadeghi et al. (2023) discovered that the age-standardized prevalence of ischemic heart disease (IHD) has increased, while the number of disability-adjusted life years (DALYs) and deaths has decreased in the Eastern Mediterranean Region (EMR). Nevertheless, despite these ameliorations, the prevalence of IHD in the EMR remains higher than global levels. Xie et al. (2016) found that age-standardized ischemic heart disease mortality in China increased by 15.3% from 1990 to 2013 and DALYs decreased by 8.8% from 1990 to 2013. According to Zhang et al. (2018), the age-standardized mortality rate per 100,000 population in China increased by 13.3% from 101.3 to 114.8 between 1990 and 2015. On the other hand, the age-standardized DALY rate decreased by 3.9% to 1760.2 per 100,000 people. Khan et al. (2020) found that age-standardized rates of prevalence, incidence, mortality and burden of disease (measured in DALYs) have declined in many regions over the last two decades.

This analysis summarizes the detailed findings regarding the global and regional trends, socioeconomic disparities, implications for policy and practice and attributable risk factors for Ischemic Heart Disease (IHD) burden, as measured by Disability-Adjusted Life Years (DALYs) and mortality, between 1990 and 2019.

2.1. Global and Age-Standardized Trends

The persistent increase in the absolute number of IHD prevalence, incidence cases, deaths, and Disability-Adjusted Life Years (DALYs) between 1990 and 2019 is primarily attributed to two major demographic shifts: global population growth and the aging population structure (Guan et al., 2023; Li & Jiang, 2024; Xie et al., 2016). This absolute rise necessitates continuous vigilance from health systems globally (Khan et al., 2020). Conversely, the age-standardized rates for IHD incidence, mortality, and DALYs demonstrated an overall decreasing trend globally across this period (Guan et al., 2023; Li & Jiang, 2024; Li & Zhang, 2022). For example, the age-standardized

incidence rate declined from 316.40 per 100,000 in 1990 to 262.39 per 100,000 in 2019 (Guan et al., 2023). This observed decline in ASRs suggests that advancements in treatment, technology, and risk factor control have yielded positive impacts when factoring out demographic changes (Khan et al., 2020).

2.2. Regional and Socioeconomic Disparities

A crucial finding is the stark difference in trends when stratifying by the Socio-Demographic Index (SDI). While High-SDI areas achieved the greatest declines across all burden indicators, age-standardized prevalence and morbidity/incidence rates increased in Low SDI, Low-middle SDI, and Middle SDI regions between 1990 and 2019 (Guan et al., 2023; Li & Jiang, 2024; Koolaji et al., 2023). This suggests that preventive measures and access to effective healthcare systems, often better funded in High SDI areas, are successfully containing the disease, while less advantaged regions struggle to keep the ASR in check (Guan et al., 2023).

Regional data confirm this non-uniform progress:

- Central Asia (CA): The CA region reported a higher IHD burden than the global average (Lui et al., 2021). Notably, Uzbekistan experienced a massive increase in its age-standardized death rate (ASDR) by 77.2% from 1990 to 2017, reporting the highest ASDR globally in 2017 (Lui et al., 2021). This regional rise is possibly linked to economic challenges following the collapse of the Soviet Union, impacting healthcare systems and resource allocation for Non-Communicable Diseases (NCDs) (Lui et al., 2021).
- Middle East and North Africa (MENA): Although age-standardized DALY and mortality rates decreased in MENA between 1990 and 2019, this reduction was slower compared to the global level (Ahmadi et al., 2024; Sadeghi et al., 2023). IHD constituted a larger proportion of total all-cause DALYs in MENA (11.01% in 2019) than in the global context (7.19%) (Ahmadi et al., 2024).
- Iran (MENA): Iran successfully achieved significant reductions in age-standardized death (42.7%) and DALY rates (47.7%) from 1990 to 2019. However, the age-standardized incidence rate only decreased minimally (7.7%) (Koolaji et al., 2023). This pattern suggests that secondary prevention (reducing fatality after diagnosis) is highly effective, but primary prevention (reducing new cases) remains insufficient (Koolaji et al., 2023).
- China: The age-standardized death rate in China increased by 13.3% from 1990 to 2015, while the age-standardized DALY rate decreased slightly by 3.9% (Zhang et al., 2018).

Geographic differences exist, with lower burden typically found in southern provinces, particularly southeastern coastal areas (Zhang et al., 2018).

2.3. Composition of IHD Burden (DALYs) and Sex Differences

DALYs for IHD are overwhelmingly driven by Years of Life Lost (YLLs) due to premature mortality, rather than Years Lived with Disability (YLDs) (Henriques et al., 2017; Li & Zhang, 2022). In mainland Portugal in 2013, YLLs accounted for 88.3% of the IHD burden (Henriques et al., 2017). In China in 2019, the YLL rate was 17.89 times higher than the YLD rate (Li & Zhang, 2022). This highlights that IHD primarily manifests as acute fatal events rather than chronic disabling conditions (Henriques et al., 2017).

IHD burden metrics (prevalence, incidence, mortality, and DALY rates) were consistently higher in men than in women across all age groups globally and regionally (Guan et al., 2023; Li & Zhang, 2022; Henriques et al., 2017). The male-to-female ratios for mortality and DALY rates peaked among 35–39 year olds globally in 2019 (Guan et al., 2023). However, in China, the annual rate of change for IHD-related death and YLDs was higher in women than in men between 1990 and 2019 (Li & Zhang, 2022).

2.4. The Role of Attributable Risk Factors

The sources underscore that the vast majority of the IHD burden is attributable to documented risk factors (Xie et al., 2016). Globally, roughly 94.1% of IHD DALYs in youth (aged 15–49) in 2019 were attributable to measured risk factors (Li & Jiang, 2024). Metabolic risk factors—including high low-density lipoprotein cholesterol (LDL-C), high systolic blood pressure (SBP), high fasting plasma glucose (FPG), and high body mass index (BMI)—are identified as the primary drivers of the IHD burden (Li & Jiang, 2024; Li & Zhang, 2022). For youth globally in 2019, the top contributing factors were high LDL-C (68.9%), high SBP (51.2%), and high BMI (33.1%) (Li & Jiang, 2024). A critical trend observed in many developing regions is the increasing contribution of risk factors associated with rising prosperity and lifestyle changes (Li & Zhang, 2022; Koolaji et al., 2023):

- In the MENA region, high FPG showed a 64.03% relative increase, and high BMI showed a 23.39% relative increase as attributed risk factors for IHD DALYs between 1990 and 2019 (Sadeghi et al., 2023).
- In Iran, the percentage contribution of high FPG and high BMI to DALY and death ASRs increased over the 1990–2019 period (Koolaji et al., 2023).

- In China (1990–2015), the ranking for high BMI shifted upward by three positions (Zhang et al., 2018).

Behavioral and environmental factors also contribute significantly; the top five risk factors for DALYs in China in 2015 included smoking, diet high in sodium, and diet low in whole grains (Zhang et al., 2018). Ambient particulate matter pollution was ranked highly in China and MENA, reflecting a substantial environmental contribution (Li & Zhang, 2022; Sadeghi et al., 2023).

2.5. Implications for Policy and Practice

The stark regional differences and the increasing burden of IHD in Low and Middle SDI countries demand targeted policy responses (Guan et al., 2023). Since IHD is highly preventable (Xie et al., 2016), urgent investment in primary prevention strategies is necessary, particularly in regions where incidence reduction lags behind mortality reduction (Koolaji et al., 2023). Strategies should prioritize the rigorous control of leading metabolic risk factors—high LDL-C, high SBP, high BMI, and high FPG—that drive premature death and suffering globally (Li & Jiang, 2024; Li & Zhang, 2022). Successfully addressing these modifiable risks, coupled with robust environmental governance (for factors like air pollution), is critical for nations to achieve the Sustainable Development Goal target 3.4 of reducing premature mortality from NCDs by 2030 (Li & Jiang, 2024; Guan et al., 2023).

3. CONCLUSION

The overall evaluation of the studies on the IHD burden revealed three key insights into global and regional trends. Firstly, the data confirmed stark regional heterogeneity, specifically identifying Central Asian countries as having the highest Disability-Adjusted Life Year (DALY) rate, which signifies a particularly severe regional burden of disease. Secondly, a major positive trend observed across many regions between 1990 and 2019 was the decline in age-standardized rates (ASRs) for IHD prevalence, incidence, mortality, and the overall disease burden (DALY). This favorable trend is hypothesized to result from effective public health interventions and increased public awareness regarding crucial lifestyle factors such as smoking cessation, obesity management, and regular exercise. However, despite this observed decrease in ASRs—which accounts for demographic changes—the third and most critical insight remains that Ischemic Heart Disease (IHD) is by far the leading cause of death globally, underscoring that even successful relative declines in burden rates are insufficient to displace IHD's primary role in global mortality.

The growing regional disparities and the increasing Ischemic Heart Disease (IHD) burden in Low and Middle SDI countries necessitate urgent, targeted policy interventions. Since IHD is largely preventable, strategies must prioritize primary prevention investment in regions where incidence reduction is lagging behind mortality decline. It is mandatory to enforce rigorous control of the leading metabolic risk factors globally—namely high LDL-C, high SBP, high BMI, and high FPG. Successfully managing these modifiable risks, coupled with robust environmental governance (e.g., air pollution control), is essential for nations to achieve the Sustainable Development Goal (SDG) target 3.4 of reducing premature NCD mortality by 2030. For this reason, it is critically important to monitor the IHD load. In this context, it has become possible to see the gaps in the foreign literature on ischemic heart disease burden studies and the direction in which the trend is heading. It is thought that the results of this study will enhance existing literature and provide a reference point for policymakers in the health sector, as well as increasing awareness.

Given the limitations of this study, it is recommended that future research encompass a broader range of databases and consider studies published not only in English but also in other languages. Furthermore, the inclusion of gray literature such as theses, reports, and conference proceedings may contribute to a more comprehensive assessment of the subject. Future research comparing disease burden trends across different regions and periods could also make important contributions to the literature.

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