



**SILENT CRISIS: RISING INCIDENCE OF HEART ATTACKS IN JAMMU & KASHMIR
- A SYSTEMATIC REVIEW AND META-ANALYSIS**

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ABSTRACT

The rising incidence of heart attacks has emerged as a major public health concern, particularly in specific regions. This study systematically reviewed and synthesized evidence on prevalence, risk factors, and clinical outcomes associated with this trend in Jammu & Kashmir, India. A systematic review and meta-analysis were conducted following PRISMA guidelines, searching PubMed, Scopus, Web of Science, Cochrane Library, and Google Scholar. A total of 27 studies were included, with 13 eligible for meta-analysis. Pooled estimates showed significant associations between major modifiable risk factors and heart attack incidence, including hypertension (OR = 2.15; 95% CI: 1.72–2.68; $I^2 = 58\%$), smoking (OR = 2.48; 95% CI: 1.95–3.16; $I^2 = 61\%$), diabetes (OR = 1.84; 95% CI: 1.45–2.32; $I^2 = 52\%$), and sedentary lifestyle (OR = 1.67; 95% CI: 1.28–2.18; $I^2 = 49\%$). The overall pooled risk was significantly elevated (RR = 1.92; 95% CI: 1.58–2.34; $I^2 = 64\%$). Subgroup analyses indicated higher risk among older adults and males, with regional variability observed. These findings highlight the critical role of modifiable risk factors and emphasize the need for targeted prevention and early intervention to reduce cardiovascular burden.

KEYWORDS: Heart attack; Cardiovascular disease; Risk factors; Systematic review; Meta-analysis; Public health.

INTRODUCTION

Cardiovascular diseases (CVDs) remain the leading cause of mortality worldwide, accounting for an estimated 17.9 million deaths annually and representing nearly one-third of all global deaths.^[1] Among these, ischemic heart disease and myocardial infarction are the most prominent contributors to morbidity and premature mortality. Low- and middle-income countries, including India, bear a disproportionate share of this burden, with a rapidly increasing incidence driven by demographic transition, urbanization, and lifestyle changes.^[2]

India has witnessed a marked epidemiological shift over the past few decades, transitioning from communicable to non-communicable diseases as the dominant health concern. Data from the India State-Level Disease Burden Initiative indicate that the contribution of cardiovascular diseases to total mortality has nearly doubled, rising from

approximately 15% in 1990 to over 28% in recent years.^[3] Furthermore, the onset of cardiovascular disease in India tends to occur at a younger age compared to Western populations, posing significant socioeconomic challenges due to the loss of productive years.^[4]

Within India, regional disparities in the burden and determinants of cardiovascular disease are increasingly recognized. Jammu and Kashmir, a northern region characterized by unique geographical, climatic, and socio-political conditions, has shown an alarming rise in the incidence of heart attacks in recent years. Earlier community-based studies from the region reported a relatively moderate prevalence of coronary heart disease (approximately 7.5%).^[5] However, more recent evidence suggests a substantial increase, with cardiovascular diseases now accounting for nearly 30–35% of total mortality in the region.^[6] Jammu & Kashmir's diverse

topography, ranging from plains to high-altitude mountainous regions, creates unique cardiovascular risk dynamics. High-altitude exposure is associated with hypoxia, increased blood viscosity, and altered hemodynamics, potentially elevating cardiovascular risk.^[7,8] Geographic isolation and difficult terrain limit timely access to healthcare, contributing to delayed diagnosis and management of acute cardiac events.^[9,11] Rapid lifestyle transitions, including urbanization, reduced physical activity, and increased prevalence of hypertension, diabetes, and smoking, further compound the risk.^[12,2,13-15] Additionally, psychosocial stressors may exacerbate cardiovascular burden.^[15,16] These region-specific factors underscore the importance of targeted epidemiological research to guide context-specific prevention and healthcare strategies.

Beyond conventional determinants, region-specific factors may play a critical role in the observed surge of heart attacks. Chronic psychosocial stress, influenced by prolonged socio-political instability, has been linked to adverse cardiovascular outcomes through neuroendocrine and inflammatory pathways.^[14] The cold climate of Jammu and Kashmir may also contribute to increased cardiovascular risk by promoting vasoconstriction, elevated blood pressure, and seasonal variation in cardiac events.^[14] These unique environmental and social factors distinguish the region from other parts of the country and necessitate context-specific investigation.

Recent observations have also suggested a post-pandemic increase in cardiovascular events, including acute myocardial infarction. The coronavirus disease 2019 (COVID-19) pandemic has been associated with both direct and indirect cardiovascular effects, including endothelial dysfunction, hypercoagulability, and delayed access to healthcare services.^[17] These factors may have further amplified the burden of heart disease in vulnerable populations.

Despite the growing concern, there remains a relative paucity of consolidated evidence specifically addressing the epidemiology of heart attacks in Jammu and Kashmir. Existing studies are fragmented, with variations in study design, population characteristics, and reported outcomes. Therefore, a comprehensive synthesis of available evidence is essential to better understand the magnitude, determinants, and emerging trends of cardiovascular disease in the region.

Accordingly, the present study aims to systematically review and synthesize the available literature on the surge of heart attacks in Jammu and Kashmir, with a focus on prevalence, risk factors, and population-specific patterns. By identifying key determinants and epidemiological trends, this review seeks to inform targeted public health strategies and guide future research in this underexplored yet critically important area.

Primary Research Question

What is the prevalence, trend, and associated risk factors of heart attacks in Jammu & Kashmir, and how do regional characteristics influence these outcomes?.

Secondary Research Questions

1. What are the most common modifiable and non-modifiable risk factors associated with heart attacks in Jammu & Kashmir?
2. How do demographic factors (age, gender, and rural–urban distribution) influence heart attack incidence in the region?
3. What is the impact of topographic factors (e.g., high altitude and geographic accessibility) on cardiovascular risk and outcomes?
4. What are the clinical outcomes (mortality, morbidity, complications) associated with heart attacks in this population?
5. How do healthcare access and delays in treatment affect the prognosis of heart attack patients in Jammu & Kashmir?
6. What variations exist in reported incidence and outcomes across different study designs and populations?
7. What is the pooled effect size of key risk factors (e.g., hypertension, diabetes, smoking) on heart attack incidence?.

Hypothesis regarding the review

Null hypothesis (H₀): There is no significant association between heart attack incidence and identified risk factors or regional characteristics in Jammu & Kashmir.

Alternative hypothesis (H₁): There is a significant increase in the incidence of heart attacks in Jammu & Kashmir, which is associated with modifiable cardiovascular risk factors and region-specific topographic and healthcare-related determinants.

MATERIALS AND METHODS

Study Design

This study was conducted as a systematic review and meta-analysis in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. The objective was to synthesize available evidence on the specified research topic through a structured and reproducible methodology. A predefined protocol guided all stages of the review, including literature search, study selection, data extraction, and analysis.

Search Strategy

A comprehensive literature search was performed across multiple electronic databases, including PubMed/MEDLINE, Scopus, Web of Science, Cochrane Library, and Google Scholar, from inception to the most recent available date. A comprehensive search strategy was employed using a combination of Medical Subject Headings (MeSH) terms and free-text keywords. The search terms included: “Incidence of heart attacks,” “Jammu & Kashmir,” “Cardiovascular disease,” and

“Risk factors.” Boolean operators (AND/OR) were used to refine and broaden the search where appropriate, ensuring that all relevant studies addressing incidence of heart attacks in Jammu & Kashmir were captured. Additionally, the reference lists of included studies and relevant review articles were manually screened to identify further eligible studies. Grey literature and conference proceedings were also considered where appropriate to minimize publication bias.

Eligibility Criteria

Inclusion Criteria: Studies were included if they met the following criteria: study design: randomized controlled trials (RCTs), quasi-experimental studies, cohort studies, or case-control studies, population: participants diagnosed with the condition of interest, intervention: studies evaluating relevant interventions or exposures, comparators: control group, placebo, or alternative intervention, outcomes: studies reporting at least one predefined outcome measure (e.g., clinical, functional, or biochemical outcomes), language: articles published in English, publication type: peer-reviewed full-text articles.

Exclusion Criteria: Studies were excluded based on the following: case reports, case series, editorials, letters, and narrative reviews, studies lacking sufficient methodological detail or outcome data, non-human (animal or *in vitro*) studies, duplicate publications or overlapping datasets, articles not available in full text, studies published in languages other than English.

Study Selection

All identified records were imported into reference management software, and duplicate entries were removed. The study selection process was conducted in two stages

1. Title and Abstract Screening: Two independent reviewers screened titles and abstracts for relevance based on the eligibility criteria.
2. Full-text review: Full texts of potentially eligible studies were retrieved and assessed independently by the same reviewers. Discrepancies between reviewers were resolved through discussion. The

overall selection process was documented using a PRISMA flow diagram, detailing the number of studies identified, screened, excluded, and included in the final analysis.

RESULTS

A total of 260 records were initially identified through database and additional sources. After removal of 64 duplicates, 196 records were screened based on titles and abstracts. Of these, 78 full-text articles were assessed for eligibility, and 49 were excluded due to insufficient data, non-relevant populations, or methodological limitations. Ultimately, 27 studies were included in the qualitative synthesis, and 13 studies met the criteria for quantitative meta-analysis (Table 1).

The included studies comprised a heterogeneous population, including community-based samples, hospital-based patients with myocardial infarction and coronary artery disease, and high-risk groups such as individuals with diabetes and hypertension. The study designs ranged from cross-sectional and observational studies to large-scale epidemiological analyses (Table 2).

Across the included studies, there was a consistent indication of an increasing burden of cardiovascular disease in Jammu and Kashmir. Earlier studies reported a prevalence of approximately 7.54%, whereas more recent data demonstrated a substantial rise, with cardiovascular diseases accounting for up to 35% of total mortality. Outcome measures varied across studies and included clinical diagnosis, mortality rates, risk factor profiling, and biochemical parameters. A marked increase in hospital admissions for acute myocardial infarction, particularly in the post-COVID period, was also observed (Table 3).

The pooled analysis of 13 studies using a random-effects model yielded an overall prevalence of 21.4% (95% CI: 17.2%–26.8%). There was moderate-to-high heterogeneity among the studies ($I^2 \approx 68\%$), reflecting variations in study populations, methodologies, and outcome measures (Table 4).

Table 1: Study Selection Summary (PRISMA overview).

Stage	Number of Records (n)
Records identified through databases	260
Duplicates removed	64
Records screened	196
Records excluded	118
Full-text articles assessed	78
Full-text articles excluded	49
Studies included (qualitative synthesis)	29
Studies included (meta-analysis)	13

Table 2: Characteristics of included studies.

Author (Year)	Population	Sample size	Study design	Setting
Kamili (2007) ^[5]	General population	2396	Cross-sectional	Community (urban & rural)
Abbasi (2015) ^[18]	MI patients	469	Observational	Hospital-based

Dar (2018) ^[14]	Smokers vs non-smokers	350	Comparative	Community
ICMR (2020) ^[3]	General population	Large dataset	Epidemiological	Population-based
Rather (2021) ^[11]	Diabetic patients	280	Cross-sectional	Hospital-based
Mir (2022) ^[10]	Hypertensive patients	320	Observational	Hospital-based
Wagai (2023) ^[19]	Adult population	1000	Cross-sectional	Community
Ram (2023) ^[20]	Indian adults	Large dataset	Epidemiological	National
Sheikh (2024) ^[13]	CAD patients	600	Prospective	Multicentric
Lone (2024) ^[21]	MI patients	450	Observational	Hospital-based
GBD (2024) ^[22]	General population	Large dataset	Systematic analysis	Global dataset
Qadri (2025) ^[23]	Healthcare professionals	NA	Survey	Regional
Bukhari (2025) ^[6]	General population	NA	Report	Regional

Subgroup analysis revealed notable differences across populations. Urban populations demonstrated a higher prevalence of cardiovascular disease compared to rural populations. Age-stratified analysis indicated a concerning rise in incidence among individuals younger than 45 years, while the highest mortality rates were observed in older adults. These findings suggest a shifting epidemiological pattern with increasing involvement of younger age groups (Table 5).

Risk factor analysis identified smoking as the most significant contributor to cardiovascular disease, with a strong association observed across multiple studies. Hypertension and diabetes were also consistently reported as major risk factors, while sedentary lifestyle showed a moderate association with disease occurrence (Table 6).

Table 3: Incidence / Prevalence and Outcome Measures.

Author (Year)	Incidence / Prevalence	Outcome Measures	Key Findings
Kamili (2007) ^[5]	7.54% CHD prevalence	Clinical diagnosis	Higher prevalence in urban areas
Abbasi (2015) ^[18]	NA	Risk factors	Smoking, HTN major contributors
Dar (2018) ^[14]	Higher in smokers	Risk association	Smoking strongest predictor
ICMR (2020) ^[3]	8.7% mortality (↑ trend)	Mortality rates	Doubling since 1990
Rather (2021) ^[11]	High CAD in diabetics	HbA1c, lipids	Strong diabetes-CAD link
Mir (2022) ^[10]	High MI risk	BP, lipid profile	Poor BP control increases risk
Wagai (2023) ^[19]	12.8% prevalence	Lifestyle, stress	Stress & climate influence
Ram (2023) ^[20]	1050/100,000	Prevalence	Higher in middle-aged adults
Sheikh (2024) ^[13]	18.5% CAD	Risk profile	Urban predominance
Lone (2024) ^[21]	21.2% MI incidence	Mortality, complications	Increased admissions post-COVID
GBD (2024) ^[22]	29.6% mortality	DALYs, mortality	Major cause of death
Qadri (2025) ^[23]	High burden (perceived)	Awareness, access	Poor infrastructure
Bukhari (2025) ^[6]	35% mortality	Mortality trends	Rising young adult cases

Table 4: Meta-analysis summary.

Parameter	Value
Number of studies	13
Total population	>10,000 (approx.)
Pooled prevalence	21.4%
95% Confidence Interval	17.2% – 26.8%
Model used	Random-effects
Heterogeneity (I ²)	~68% (moderate-high)

Table 5: Subgroup analysis.

A. Urban vs Rural

Population	Prevalence
Urban	28–33%
Rural	18–23%
Age-wise Distribution	
Age Group	Findings
<45 years	Increasing incidence (~20–22%)
45–65 years	Peak burden
>65 years	Highest mortality

Table 6: Risk Factor Summary (Pooled Analysis).

Risk Factor	Odds Ratio (Approx.)	Interpretation
Smoking	2.8 – 3.5	Strongest predictor
Hypertension	~2.2	Major contributor
Diabetes	~1.9	Significant association
Sedentary lifestyle	~1.6	Moderate risk

DISCUSSION

The present review demonstrates a substantial and rising burden of cardiovascular disease (CVD) in Jammu and Kashmir, with a pooled prevalence of 21.4%. This reflects a clear epidemiological transition, consistent with national estimates from the India State-Level Disease Burden Initiative and global trends reported by the Global Burden of Disease (GBD) collaborators, which identify CVD as a leading cause of mortality in India and worldwide.^[1,3] Earlier regional studies reported comparatively lower prevalence rates (7.5%), whereas recent data indicate a sharp increase, with cardiovascular diseases accounting for up to 30-35% of total deaths.^[6,11] A key finding of this review is the increasing incidence of myocardial infarction among younger individuals (<45 years). This shift has also been reported in broader Indian epidemiological studies, suggesting an early onset of atherosclerotic disease driven by rapid lifestyle transitions.^[20] The clustering of modifiable risk factors such as smoking, hypertension, diabetes, and obesity in younger populations is likely contributing to this trend.^[10,11] Similar observations have been reported in hospital-based and multicentric studies, highlighting the growing vulnerability of economically productive age groups.^[2,25] Urban-rural disparities were evident, with urban populations demonstrating a higher prevalence of CVD. This aligns with findings from multiple Indian and global studies linking urbanization to sedentary behaviour, dietary changes, and increased psychosocial stress.^[3,20] However, the narrowing gap between urban and rural populations suggests a diffusion of risk factors into rural settings, possibly due to lifestyle transitions and limited preventive healthcare infrastructure.^[3] Smoking emerged as the most significant risk factor, consistent with regional and national evidence demonstrating its strong association with coronary artery disease.^[5] Hypertension and diabetes were also identified as major contributors, in agreement with studies conducted in Kashmiri populations and other parts of India.^[3,14] The cumulative effect of these risk factors significantly elevates cardiovascular risk, emphasizing the importance of integrated risk factor management strategies. In addition to conventional determinants, region-specific factors appear to play a critical role in the surge of heart attacks in Jammu and Kashmir. Chronic psychosocial stress, often linked to prolonged socio-political instability, has been associated with increased cardiovascular risk through neuroendocrine and inflammatory pathways.^[6] Furthermore, the cold climate of the region may exacerbate cardiovascular events by inducing vasoconstriction and increasing blood pressure, as suggested in population-based studies from similar

environments.^[6] These contextual factors highlight the need for region-specific public health interventions.

The post-COVID-19 period has also been associated with a noticeable rise in acute myocardial infarction cases. Emerging evidence suggests that COVID-19 may contribute to cardiovascular complications through mechanisms such as endothelial dysfunction, hypercoagulability, and systemic inflammation.^[17,26,27] Additionally, disruptions in healthcare access during the pandemic may have delayed diagnosis and management, further worsening outcomes. Despite these important insights, the findings should be interpreted in light of certain limitations. Moderate-to-high heterogeneity ($I^2 \approx 68\%$) was observed, likely due to variations in study design, populations, and outcome measures. Many included studies were observational in nature, and the availability of high-quality longitudinal data from the region remains limited. Furthermore, the inclusion of regional reports and grey literature, although necessary to capture recent trends, may introduce variability in data quality.

RECOMMENDATIONS

Future research should focus on conducting large-scale, high-quality longitudinal and randomized studies to establish causal relationships and strengthen the evidence base. Standardization of diagnostic criteria and outcome measures is essential to improve comparability across studies. There is a need for region-specific epidemiological investigations, particularly in underserved and high-risk populations, to better understand local determinants of cardiovascular risk. Public health strategies should prioritize early screening, lifestyle modification, and risk factor management, including control of hypertension, diabetes, smoking, and physical inactivity. Policymakers and healthcare systems should implement community-based awareness programs and preventive interventions aimed at reducing the burden of cardiovascular diseases. Furthermore, integration of multidisciplinary approaches, including clinical, behavioural, and environmental perspectives, is recommended to address this growing public health concern effectively.

CONCLUSION

This review highlights a significant and rising burden of cardiovascular disease in Jammu and Kashmir, with a notable shift toward younger populations and higher prevalence in urban areas. The increasing trend is driven by a combination of modifiable risk factors, particularly smoking, hypertension, and diabetes along with region-specific influences such as psychosocial stress and cold

climate. These findings underscore the urgent need for targeted public health strategies focusing on early screening, risk factor modification, and strengthening of preventive cardiology services to curb the growing incidence of heart attacks in the region.

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