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Socio-economic Disparities and Cardiovascular Disease in India: Impact of Healthcare Access and Policy Interventions

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Abstract:

Socio-economic disparities significantly exacerbate cardiovascular disease (CVD) burden in India, particularly among lower socio-economic status (SES) populations, driven by limited healthcare access and uneven policy interventions. This review examines how income inequality, low health literacy, caste-based exclusion, gender disparities, and urban-rural divides worsen CVD prevalence and mortality. High out-of-pocket expenditure (58% of healthcare costs), consuming 75% of lower SES household income, pushes 40 million Indians into poverty annually. Limited health insurance (20% coverage) and Ayushman Bharat's restricted reach (30% of CVD patients) hinder affordability, especially for rural and marginalized groups. Inadequate infrastructure, with only 0.1 cardiologists per 100,000 and 40% of rural health centers equipped for diagnostics, restricts timely care. Urban areas, hosting 70% of CVD facilities for 31% of the population, contribute to 15% pre-hospital CVD deaths. Policies like COTPA and NPCDCS curb tobacco and alcohol use but are limited by weak rural enforcement and low reach (10% rural screening). Air pollution, linked to 15% of CVD cases, is inadequately addressed, particularly in rural and slum areas. Gender norms reduce women's access to care by 20%, and caste-based exclusion disproportionately affects Scheduled Castes/Tribes. Recommendations include expanding rural healthcare infrastructure, increasing insurance coverage to 50%, enhancing health literacy, and strengthening policy enforcement for tobacco, alcohol, and environmental exposures. These findings highlight the need for equitable healthcare access and robust policy interventions to mitigate CVD disparities among lower SES populations.

Keywords: Cardiovascular Diseases, Socioeconomic Factors, Healthcare Disparities, Health Policy,

1. Introduction

Cardiovascular disease (CVD) remains one of the leading causes of morbidity and mortality worldwide and represents a major public health challenge in low- and middle-income countries (LMICs), including India [1,2]. he burden of CVD in India has increased substantially over recent decades, alongside the epidemiological transition characterized by population ageing, urbanization, changing dietary patterns, physical inactivity, tobacco and alcohol use, obesity, diabetes, and hypertension [3–5]. Although CVD has historically been associated with affluence, accumulating evidence indicates that its burden and consequences are increasingly shaped by socioeconomic conditions, with disadvantaged populations experiencing greater exposure to risk factors and greater barriers to prevention, diagnosis, treatment, and long-term disease management [6–8].

Socioeconomic position influences cardiovascular health through multiple, interconnected pathways. Income, education, occupation, living conditions, and financial security can affect exposure to Behavioural and metabolic risk factors as well as the ability to obtain timely and appropriate healthcare. However, socioeconomic disadvantage should not be considered synonymous with a particular geographic setting. Rural and urban populations are themselves heterogeneous, and differences in healthcare access may vary

substantially across states, districts, communities, and socioeconomic groups. In rural and geographically underserved settings, barriers may include distance from health facilities, transportation constraints, availability of trained healthcare professionals, and limited access to specialized cardiovascular services. At the same time, urban populations may experience different forms of disadvantage, including overcrowding, unhealthy built environments, occupational stress, and unequal access to affordable and continuous care. Therefore, understanding CVD inequities requires attention to both socioeconomic conditions and the structural context in which healthcare is accessed.

Healthcare access represents an important pathway linking socioeconomic conditions with CVD outcomes. Access is multidimensional and extends beyond the physical availability of health facilities to include affordability, geographic accessibility, availability of healthcare personnel and medicines, continuity of care, and the ability of individuals to obtain appropriate services when needed. In India, these dimensions of access are influenced by the organization and distribution of public and private healthcare services, household financial capacity, health insurance coverage, and out-of-pocket expenditure (8–10). Consequently, individuals from economically disadvantaged groups may face delayed diagnosis, interruptions in treatment, or reduced use of preventive and follow-up services even when healthcare facilities are formally available.

Policy interventions constitute a related but conceptually distinct pathway. National initiatives addressing non-communicable diseases and financial protection, including the National Programme for Prevention and Control of Non-Communicable Diseases (NP-NCD; formerly NPCDCS) and Ayushman Bharat, have sought to strengthen prevention, screening, primary healthcare, and access to treatment. Other regulatory and population-level measures, including tobacco-control initiatives, also contribute to reducing modifiable cardiovascular risk. However, the existence of a policy does not necessarily translate into equitable implementation or outcomes. Differences in programme coverage, service availability, awareness, continuity of care, and local health-system capacity may influence how effectively such interventions reach socially and economically disadvantaged populations. Thus, policy effectiveness needs to be considered not only in terms of programme design but also in relation to implementation and equity.

India's transition from a predominantly communicable-disease burden to a substantial burden of non-communicable diseases has further increased the importance of sustained cardiovascular prevention and chronic disease management. The coexistence of infectious diseases, maternal and child health priorities, and rapidly increasing NCDs creates a complex health-system environment in which competing demands for resources and services may influence the delivery of long-term cardiovascular care. Rather than characterizing this as a simple prioritization of acute diseases over chronic conditions, it is more appropriate to examine how health-system capacity, financing mechanisms, service delivery, and implementation gaps affect the continuity and equity of CVD prevention and care.

Despite a growing body of literature on CVD risk factors and socioeconomic inequalities in India, evidence remains fragmented across socioeconomic determinants, healthcare access, and policy responses. Existing studies frequently examine individual components—such as financial hardship, insurance coverage, rural–urban differences, or specific health programmes—without sufficiently integrating these factors into a broader framework explaining how socioeconomic disadvantage may translate into differential cardiovascular outcomes. Furthermore, variation in study populations, geographic settings, definitions, and data-collection periods makes direct comparison of estimates challenging. A critical synthesis that brings these dimensions together is therefore needed to clarify the pathways through which socioeconomic inequalities influence CVD outcomes and to assess the extent to which healthcare and policy responses address these inequities.

Accordingly, this review examines the relationship between socioeconomic disparities and CVD in India by considering three interconnected but distinct dimensions:

(1) socioeconomic determinants of cardiovascular risk and healthcare utilization,
(2) healthcare access and the structural and financial barriers influencing prevention and treatment, and
(3) policy interventions and their potential contribution to reducing inequities in cardiovascular care.

The review further considers implementation challenges and evidence gaps that may influence the effectiveness and equity of existing interventions. Figure 1 presents the conceptual framework guiding this review, illustrating how socioeconomic conditions may influence cardiovascular risk and healthcare access, while policy interventions can potentially modify these pathways through financial protection, service delivery, prevention, and health-system strengthening.

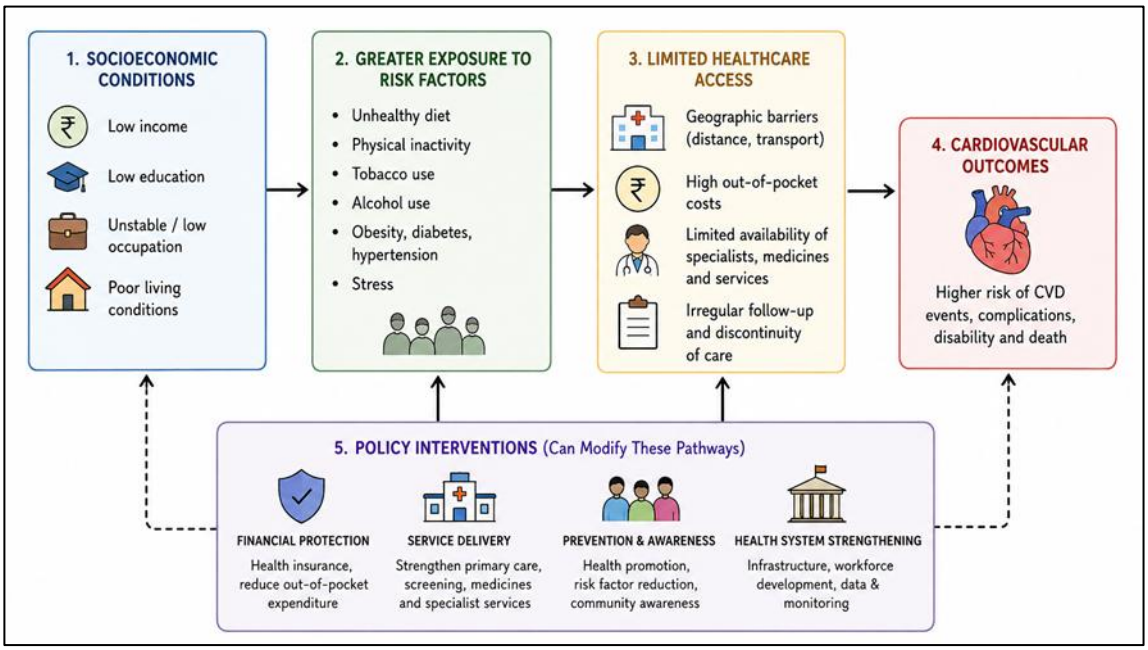

Figure. 1. Socioeconomic disparities, healthcare access, and policy pathways influencing cardiovascular disease outcomes in India. Conceptual framework illustrating the pathways linking socioeconomic conditions with cardiovascular risk and healthcare access, and the potential role of policy interventions in reducing financial, geographic, and health-system barriers to CVD prevention, diagnosis, treatment, and long-term management.

Methodology

Review Design and Literature Search and Information Sources: This study was conducted as a structured narrative review to synthesize evidence on socio-economic disparities in CVD in India, with particular emphasis on healthcare access and policy interventions. A narrative approach was considered appropriate because the available evidence includes diverse study designs, populations, geographical settings, outcome measures, and source types. The review therefore focused on critical and thematic synthesis rather than quantitative pooling of results. A structured literature search was conducted using PubMed, Scopus, and Google Scholar to identify relevant peer-reviewed publications. Additional information was obtained from official reports and documents published by the Government of India and recognized international health organizations. The search used combinations of terms related to CVD, socioeconomic conditions, healthcare access, and policy, including "cardiovascular disease," "cardiovascular health," "socioeconomic status," "socioeconomic inequality," "income," "education," "occupation," "healthcare access," "healthcare utilization," "out-of-pocket expenditure," "health insurance," "urban-rural disparity," "gender," "caste," "health literacy," "air pollution," "health policy," and "India." Boolean operators and database-specific subject headings or MeSH terms were used where applicable. Google Scholar was used as a supplementary source to identify relevant publications and policy-related evidence not readily identified through the primary databases. Reference lists of relevant publications were also examined to identify additional studies of importance to the review.

Eligibility Criteria: Studies and reports were included when they contributed to understanding the relationship between socioeconomic conditions, healthcare access, policy interventions, and CVD in the Indian context. Eligible evidence included studies that:

- examined CVD, cardiovascular risk factors, cardiovascular outcomes, or related healthcare utilization;
- addressed socioeconomic determinants such as income, education, occupation, gender, social disadvantage, or living conditions;
- examined healthcare access, affordability, health insurance, out-of-pocket expenditure, availability of services, or continuity of care;
- evaluated or discussed policies, programmes, or health-system interventions relevant to CVD prevention and management in India; or
- provided India-specific findings or relevant conceptual evidence for interpreting the Indian context.

Studies were excluded if they were unrelated to CVD or its major risk factors, did not address socioeconomic conditions or healthcare access, lacked sufficient information for interpretation, or were duplicate publications. Opinion articles and commentaries without substantive supporting evidence were not considered as primary evidence. India-specific evidence formed the primary basis of the review, while selected international sources were used only for broader conceptual or comparative context.

Evidence Extraction and Organization: Information from the selected literature was organized according to the objectives of the review. Key information included study characteristics, population and setting, geographical context, socioeconomic determinants, cardiovascular outcomes or risk factors, healthcare-access indicators, major findings, and relevant limitations. Differences in study populations, geographical settings, definitions of socioeconomic disadvantage, healthcare-access measures, and data-collection periods were considered when interpreting the findings.

Thematic Synthesis: The evidence was synthesized thematically across five major areas:

- Socioeconomic determinants of cardiovascular risk, including income, education, occupation, gender, social disadvantage, and living conditions.
- Cardiovascular risk factors and outcomes, including hypertension, diabetes, obesity, tobacco use, physical inactivity, morbidity, and mortality.
- Healthcare access and utilization, including geographic accessibility, affordability, health insurance, out-of-pocket expenditure, availability of healthcare professionals and medicines, and continuity of care.
- Policy interventions and health-system responses, including prevention, screening, primary healthcare, financial protection, tobacco control, and national non-communicable disease programmes.
- Equity and implementation gaps, including regional variation, differences within and between rural and urban populations, health-system capacity, programme coverage, and continuity of care.

This framework was used to examine how socioeconomic conditions may influence cardiovascular risk directly through exposure to behavioral and metabolic risk factors and indirectly through differences in access to preventive, diagnostic, and treatment services.

Critical Interpretation of Evidence: Because the included evidence differed in study design, population characteristics, geographical setting, outcome definitions, data sources, and study periods, findings were interpreted qualitatively rather than statistically pooled. Differences between studies were considered in relation to their population, setting, measurement methods, data-collection period, and definitions used. Descriptive estimates were not interpreted in isolation, and causal relationships were not inferred solely from observed associations. Rural and urban populations were considered heterogeneous groups, with differences interpreted in relation to socioeconomic conditions, regional characteristics, healthcare infrastructure, financial barriers, and other contextual factors.

Policy Evidence Synthesis: Policy interventions were examined in relation to the barriers they were intended to address, including financial burden, limited preventive services, inadequate screening, availability of medicines and healthcare professionals, and continuity of care. The review considered both the objectives of major policies and programmes and the available evidence regarding their implementation, reach, accessibility, and potential contribution to health equity. Policy effectiveness was interpreted cautiously, as the existence of a programme or policy does not necessarily demonstrate improved cardiovascular outcomes. Differences in implementation

capacity, programme coverage, awareness, service availability, and continuity of care were considered when interpreting potential policy effects.

Methodological Limitations: As a narrative review, this study does not provide a formal meta-analysis or pooled effect estimates. The synthesis may be influenced by differences in the availability and quality of published evidence, language restrictions, database coverage, publication bias, and heterogeneity among studies. These limitations were considered when interpreting the findings and formulating the conclusions and policy implications.

Thematic Synthesis

Socioeconomic Determinants Associated with CVD Risk and Outcomes

Socioeconomic conditions are important determinants of cardiovascular health in India, but their relationship with CVD risk is complex and varies across population groups and individual risk factors. Income, education, occupation, household wealth, and social position can influence exposure to behavioural and metabolic risk factors, health-related knowledge, healthcare utilization, and the ability to obtain timely and continuous care. Evidence from India therefore supports a multidimensional understanding of socioeconomic inequality rather than a simple distinction between low- and high-income populations. Key India-specific evidence on these socioeconomic patterns is summarized in Table 1.

Educational attainment is an important socioeconomic determinant of cardiovascular health. Education may influence health literacy, awareness of cardiovascular risk factors, treatment-seeking behaviour, and adherence to long-term management. However, Indian evidence indicates that the socioeconomic pattern differs between risk factors. Analysis of nationally representative National Family Health Survey data from 2015–16 and 2019–21 found that overweight and diabetes were initially more common among wealthier and more educated groups, whereas increases in overweight, diabetes, and hypertension were greater among less wealthy and less educated populations over time.

Similar heterogeneity has been reported in urban Indian populations. The CARRS study, conducted in Chennai and Delhi, found that behavioural, weight-related, and metabolic risk factors did not follow a single socioeconomic gradient. Tobacco use and inadequate fruit and vegetable intake were more common in some lower-education groups, whereas overweight, obesity, diabetes, hypertension, and dyslipidaemia were more prevalent among some more educated and affluent groups. (76)

Evidence from older adults in India provides further support for this complex pattern. Analysis of 59,672 adults aged 45 years and above using data from the Longitudinal Ageing Study in India found that higher income and education were associated with greater prevalence of several cardiometabolic risk factors, including overweight, obesity, central adiposity, high blood pressure, and high blood glucose, while smoking and excessive alcohol use showed different socioeconomic patterns. (77)

Occupation and working conditions may also contribute to socioeconomic differences in cardiovascular health. Occupational position can reflect income, employment security, working hours, physical demands, psychosocial stress, and opportunities for preventive healthcare. These factors may interact with diet, tobacco and alcohol use, physical activity, and healthcare-seeking behaviour. However, occupation should be interpreted alongside other socioeconomic characteristics because its relationship with CVD risk may differ according to sex, education, income, and type of employment. (78)

Socioeconomic differences are also evident in awareness, treatment, and control of cardiovascular risk factors. An Indian multicity study involving 6,198 adults reported differences in awareness, treatment, and control of hypertension, diabetes, and hypercholesterolaemia according to educational status. These findings suggest that socioeconomic conditions may influence cardiovascular outcomes not only through exposure to risk factors but also through recognition and management of established disease. (79)

Importantly, rural and urban residence should not be used as a direct substitute for socioeconomic status. Evidence from India demonstrates substantial variation in cardiovascular risk across geographical settings and

socioeconomic groups. Nationally representative analyses have shown changing socioeconomic patterns of overweight, diabetes, and hypertension, while other Indian studies have reported differences across metropolitan, smaller-city, and rural populations. (75,80) Therefore, rural–urban differences should be interpreted alongside local socioeconomic conditions, healthcare availability, education, and regional development rather than being treated as evidence of uniform disadvantage. These findings, together with other India-specific evidence summarized in Table 1, indicate that rural–urban differences should be interpreted alongside local socioeconomic conditions, healthcare availability, education, and regional development rather than being treated as evidence of uniform disadvantage.

Socioeconomic inequality is also relevant to healthcare utilization among people with established CVD. An analysis of Indian data found that healthcare utilization among individuals with CVD was concentrated among wealthier groups, with income and urban concentration contributing to horizontal inequity after accounting for healthcare needs. This suggests that socioeconomic disadvantage may influence CVD outcomes through differences in the ability to obtain appropriate healthcare, in addition to differences in exposure to cardiovascular risk factors. (81) The relevant evidence is summarized in Table 1.

Overall, the evidence indicates that socioeconomic disparities in CVD in India are multidimensional and vary across populations, risk factors, and study periods. The changing distribution of cardiovascular risk factors highlights the need to consider socioeconomic conditions alongside healthcare access when interpreting CVD inequalities in India.

Table 1. Selected India-specific evidence on socioeconomic determinants of cardiovascular risk and healthcare utilization

Socioeconomic domain	Population / data source	Key finding	Interpretation
Education and wealth	Nationally representative NFHS-4 and NFHS-5; adults aged 15–49 years	In 2015–16, several CVD risk factors were more common among socioeconomically advantaged groups. Between 2015–16 and 2019–21, overweight, diabetes and hypertension increased more rapidly among less wealthy and less educated groups.	Socioeconomic gradients in CVD risk are changing over time.[9]
Education, wealth and occupation	CARRS Study; adults from Chennai and Delhi	Tobacco use and inadequate fruit/vegetable intake were more common in some lower-education groups, whereas overweight and several metabolic risk factors were more common among higher-educated and wealthier groups.	Different cardiovascular risk factors show different socioeconomic gradients.[10]
Income, education and social group	LASI Wave 1; 59,672 adults aged ≥45 years	Socioeconomic differences were observed for hypertension, overweight, obesity, central adiposity, high blood glucose, smoking, alcohol use and physical inactivity.	Cardiovascular risk among older adults is not uniformly concentrated in lower SES groups.[11]
District	NFHS-4 and DLHS-	Higher education and household	Local development

development and individual SES	4/AHS; >2.4 million adults	wealth were associated with greater probability of diabetes, hypertension and obesity, while smoking showed an inverse educational gradient. Associations varied with district-level development.	modifies the relationship between SES and CVD risk.[12]
Rural–urban and asset differences	Three Indian population surveys; 22,144 adults	Ideal cardiovascular health varied across metropolitan, smaller-city and rural settings and across household asset groups.	Geographic setting and household resources should be considered together rather than as interchangeable measures.[13]
Healthcare utilization among people with CVD	Indian population data on individuals with CVD	Healthcare utilization was highly concentrated among wealthier CVD patients. After accounting for health needs, horizontal inequity remained significantly pro-rich; income and urban concentration were important contributors.	Socioeconomic inequality affects CVD care beyond differences in risk-factor exposure.[14]
Healthcare utilization across India	National Sample Survey data	Pro-rich inequities in outpatient and inpatient healthcare utilization were observed across rural and urban populations and in most states examined.	Healthcare access is influenced by socioeconomic position and health-system context.[15]

Healthcare Access and Utilization

Healthcare access is an important pathway through which socioeconomic conditions may influence CVD outcomes in India. Access involves more than the physical presence of a health facility and includes geographic accessibility, affordability, availability of healthcare services, and the ability to obtain appropriate care when it is needed. These dimensions can influence whether cardiovascular risk factors are detected, treated, and followed over time[16]. Evidence from India indicates that healthcare utilization is not evenly distributed across socioeconomic groups. Among individuals with CVD, healthcare utilization has been shown to be concentrated among wealthier groups. After accounting for differences in healthcare needs, horizontal inequity remained significantly pro-rich, with income and urban concentration identified as important contributors[14]. Evidence from broader Indian healthcare utilization studies shows a similar pattern. Analysis of National Sample Survey data found pro-rich inequalities in both outpatient and inpatient healthcare utilization across rural and urban populations, although the magnitude of inequality varied between states and settings. The study also reported greater horizontal inequity in several rural populations, highlighting the importance of considering geographic and socioeconomic context together[15].

Geographical location should therefore not be treated as a direct substitute for socioeconomic status. Rural and urban populations are heterogeneous, and access can vary according to household resources, distance from health facilities, transportation, local service availability, and state-level health-system characteristics. Recent nationally representative evidence among older adults also demonstrates pro-rich inequalities in doctor visits and hospitalization, with private-sector use contributing substantially to these differences[17].

Access to primary care is particularly important for CVD prevention because conditions such as hypertension and diabetes require early identification, regular monitoring, treatment, and referral when necessary. Evidence from an Indian community-based study in urban slums showed that linkage from community screening to primary-care facilities was incomplete. Lower socioeconomic position and greater distance from the primary-care facility were independently associated with failure to establish linkage, demonstrating how financial and geographic factors can interact even after screening has taken place[18].

The choice between public and private healthcare also has implications for equity. Evidence from India suggests that economically better-off groups are more likely to use private healthcare, whereas public facilities are relatively more important for poorer populations. In studies of inpatient care for non-communicable diseases, poorer groups made greater use of public facilities, while richer groups used private facilities proportionately more. Differences in out-of-pocket expenditure between public and private services can therefore influence the ability of households to sustain treatment[19].

Continuity of care is particularly relevant to CVD because prevention and management generally require repeated contact with healthcare services. Blood-pressure and glucose monitoring, lipid management, medication use, lifestyle counselling, and follow-up may extend over many years. Interruptions in access can therefore affect long-term disease management even when an individual has initially been diagnosed and treated. Evidence from Indian health-system research indicates that financial constraints, geographic barriers, and limitations in service availability can contribute to unmet healthcare needs[20].

Overall, the evidence indicates that healthcare access in India is a multidimensional pathway linking socioeconomic circumstances with CVD prevention and care. Socioeconomic inequality is evident in healthcare utilization, while the magnitude and pattern of inequality vary according to healthcare need, geographic setting, type of provider, and state. The evidence therefore supports a context-specific interpretation of healthcare disadvantage rather than assuming that all rural or economically disadvantaged populations experience the same barriers. Table 2 summarizes selected India-specific evidence on healthcare access and utilization relevant to CVD.

Table 2 summarizes selected India-specific evidence on healthcare access and utilization relevant to CVD.

Domain	India-specific evidence	Relevance to CVD equity
CVD-specific healthcare utilization	Healthcare utilization among individuals with CVD was concentrated among wealthier groups; after adjustment for healthcare needs, horizontal inequity remained pro-rich.	Socioeconomic position may influence access to appropriate CVD care.[14]
Outpatient and inpatient utilization	National Sample Survey analysis identified pro-rich inequalities in outpatient and inpatient healthcare utilization across rural and urban populations, with variation across states.	Socioeconomic and geographic inequalities may influence healthcare use.[15]
Healthcare inequality among older adults	Nationally representative evidence showed pro-rich inequalities in doctor visits and hospitalization, with private healthcare use contributing substantially to inequality.	Economic disadvantage may reduce access to healthcare services among older adults at risk of CVD.[17]
Primary-care	In an urban-slum cohort, lower wealth and greater distance from a	Geographic and socioeconomic barriers can affect continuity

linkage	primary-care facility were associated with non-linkage after CVD risk screening.	between screening and primary care.[18]
Public versus private care	For NCD hospitalization, poorer groups used public facilities proportionately more, whereas richer groups used private facilities more; OOP expenditure differed substantially by provider type.	Provider choice and affordability can influence equitable access to treatment.[19]
Financial and accessibility barriers	Indian evidence identifies affordability, availability, and accessibility as important contributors to unmet healthcare needs, particularly among marginalized populations.	These barriers may affect timely diagnosis and long-term CVD management.[20]

Financial Barriers and Out-of-Pocket Expenditure

Financial burden is an important component of healthcare inequality in India, particularly for conditions that require hospitalization, long-term medication, repeated investigations, and specialist care. CVD can place substantial pressure on household finances because treatment may involve both direct medical expenses and indirect costs such as transportation, loss of income, and time away from work[21].

Out-of-pocket (OOP) expenditure remains an important source of financial pressure for Indian households. Disease-specific analysis of nationally representative data has shown that hospitalization for heart disease is associated with substantial OOP spending. In one analysis based on the 2014 National Sample Survey, the mean OOP expenditure for hospitalization was approximately ₹40,947 for heart disease, and more than one-third of households hospitalized for heart disease reported distress financing[22]. These findings illustrate that the financial consequences of CVD are not limited to the cost of medical treatment but may extend to borrowing, use of savings, or sale of household assets.

The burden becomes particularly important when healthcare expenditure is considered relative to household resources. Analysis of the 2017–18 National Sample Survey found that households seeking treatment for cardiovascular diseases were among those experiencing relatively high healthcare expenditure. Across all conditions examined, 41.4% of households spent more than 10% of total household consumption expenditure on hospitalization, while 24.6% spent more than 20%. Catastrophic expenditure and impoverishment were more common among households using private facilities than among those using public facilities. These findings indicate that the financial impact of healthcare depends not only on the disease itself but also on the type of facility used and the economic capacity of the household.

Socioeconomic position influences the ability to absorb these costs. National evidence on hospitalization has shown that although absolute OOP payments may sometimes be higher among households with greater resources, the financial burden relative to household consumption is greater among poorer households. This pattern is consistent with a regressive financing structure, in which the same healthcare expense can represent a substantially greater economic sacrifice for a low-income household[23]. CVD-related financial hardship should therefore be interpreted in relation to household capacity to pay rather than by considering treatment expenditure alone.

Health insurance and other financial-protection mechanisms can reduce, but do not necessarily eliminate, this burden. Evidence from patients with acute myocardial infarction in India showed that uninsured patients had substantially higher cardiovascular OOP expenditure than insured patients and had a higher risk of catastrophic

health spending and distress financing[24]. More recent evidence from a large multicentre study of patients with heart failure also found substantial OOP spending, with catastrophic health spending and distress financing occurring less frequently among insured than uninsured households[25].

Evidence concerning publicly financed health insurance also suggests potential financial benefits. A household-level evaluation of PM-JAY across six Indian states found that the scheme was associated with a relative reduction in OOP expenditure and catastrophic health expenditure, with the reduction in financial burden particularly evident among users of private facilities. However, these findings should be interpreted as evidence of an association within the evaluated population rather than as proof that insurance has eliminated financial barriers across India[26].

The public–private distinction is therefore relevant when examining financial barriers. Private facilities may provide greater availability of specialized services in some settings but can involve higher household expenditure. Public facilities may offer lower-cost care and greater financial protection, although availability, quality, staffing, and service capacity can vary across regions. National evidence has shown that the financial burden of hospitalization differs according to provider type, socioeconomic position, sex, state development, and disease category[23].

Financial barriers should also be considered alongside geographic and regional differences. Rural and urban populations are not homogeneous, and the financial burden of CVD cannot be explained by residence alone. Household income, insurance status, availability of public facilities, distance to specialized services, transportation costs, and state-level health-system characteristics may all influence the final cost of care. Therefore, describing rural populations as uniformly financially disadvantaged would oversimplify the evidence. Instead, socioeconomic and geographic factors should be considered together when examining affordability and financial protection. Key India-specific evidence on financial burden, OOP expenditure, catastrophic health expenditure, distress financing, and financial protection is summarized in Table 3.

Table 3. Financial barriers associated with CVD and healthcare expenditure in India

Financial indicator	India-specific evidence	Interpretation for CVD equity
Household economic burden of CVD	CVD-affected households had higher inpatient expenditure and a greater share of OOP spending in total household expenditure than matched households without CVD.	CVD can place substantial pressure on household finances, particularly among economically vulnerable households.[21]
OOP expenditure for heart disease	Mean hospitalization OOP expenditure for heart disease was approximately **₹40,947** in the 2014 NSS analysis.	Hospital-based CVD care can generate considerable direct financial costs.[22]
Catastrophic health expenditure	In the 2017–18 national analysis, 41.4% of households spent >10% of household consumption expenditure on hospitalization across conditions; cardiovascular disease was among conditions associated with relatively high financial burden.	CVD treatment can contribute to potentially catastrophic household spending.[20]
Distress financing	More than one-third of households hospitalized for heart disease reported distress financing in the 2014 NSS analysis.	Families may rely on borrowing or asset sales to meet CVD-related costs.[22]
Socioeconomic inequality	The relative burden of hospitalization OOP payments was greater among poorer households despite variation in absolute expenditure.	Financial burden is better assessed relative to household ability to pay.[23]

Health insurance and acute MI	Uninsured patients with acute myocardial infarction had higher cardiovascular OOP expenditure and greater risk of catastrophic spending and distress financing.	Insurance may provide important financial protection during acute cardiovascular events.[24]
Heart failure	Recent multicentre evidence reported substantial OOP expenditure among patients with heart failure; catastrophic spending and distress financing were lower among insured patients than uninsured patients.	Long-term CVD management can generate persistent financial pressure.[25]
PM-JAY	Evaluation across six Indian states found reductions in OOP expenditure and catastrophic health expenditure associated with PM-JAY.	Publicly financed insurance can improve financial protection, although effects may vary by setting and provider.[26]

Gender and Social Inequalities in CVD

Gender and social position can influence cardiovascular health through differences in exposure to risk factors, health awareness, healthcare-seeking behaviour, treatment, and access to financial and social resources. In India, these inequalities do not operate independently. Education, household economic status, caste, place of residence, and access to healthcare may interact with gender and shape the cardiovascular health of different population groups.

Gender differences in CVD care have been documented in Indian studies. Evidence from the PINNACLE India Quality Improvement Program, which included patients with coronary artery disease, heart failure, and atrial fibrillation, found that women had fewer healthcare encounters than men and were less likely to receive several guideline-directed cardiovascular therapies. For example, among patients with coronary artery disease, aspirin and beta-blocker use was lower among women than men. Women also had a higher prevalence of some cardiovascular comorbidities despite receiving fewer recommended therapies. These findings suggest a potential gender gap in cardiovascular care, although the study was based on participating clinical practices and therefore may not represent the entire Indian population[27].

Nationally representative evidence also indicates that socioeconomic and geographic factors influence cardiovascular risk among women. Analysis of National Family Health Survey data found socioeconomic and regional inequalities in hypertension awareness, treatment, and control among women aged 15–49 years. Only about one-third of women with hypertension in that analysis were receiving treatment, while blood-pressure control was lower still. The extent of inequality varied by wealth, education, and geographic region, demonstrating that women's cardiovascular care cannot be understood through gender alone[28].

Education is another important social determinant. An Indian multicity study involving 6,198 adults found differences in awareness, treatment, and control of hypertension, diabetes, and hypercholesterolaemia according to educational attainment. These findings support the view that education may influence cardiovascular health through health literacy, recognition of risk factors, treatment-seeking behaviour, and engagement with long-term disease management[29].

Socioeconomic position may also influence the use of secondary preventive treatment after cardiovascular disease has already been diagnosed. Evidence from the PURE study in South Asia, including Indian communities, found that use of cardioprotective medicines among people with coronary heart disease or stroke was particularly low among participants with lower household wealth and lower education. Rural residence was also associated with lower use of several recommended therapies. Because the study included India together with Pakistan and Bangladesh, its findings should be interpreted as regional evidence rather than as an exclusively India-specific estimate.

Caste and social position represent additional dimensions of inequality in India. Caste may influence access to education, employment, household resources, social networks, and healthcare opportunities. Importantly, the

relationship between caste and cardiovascular health is not uniform. A nationally representative study of more than 648,000 women using NFHS-4 data found differences in hypertension across caste groups and examined how these differences varied according to education and household wealth[30]. The findings indicate that social position and socioeconomic resources can interact rather than operating as separate determinants.

Evidence concerning Scheduled Castes and Scheduled Tribes also needs to be interpreted carefully. Studies of healthcare-seeking behaviour among Scheduled Tribe communities in India have identified financial, geographic, cultural, and service-related factors that can influence the use of healthcare. However, much of this evidence concerns general healthcare utilization rather than CVD-specific outcomes. Therefore, it would be inappropriate to assume that patterns observed for general healthcare automatically represent CVD mortality or treatment disparities.

More broadly, social disadvantage can operate through overlapping dimensions of class, caste, and gender. Analysis of nationally representative Indian data has shown that unmet healthcare needs are shaped by these intersecting social characteristics rather than by a single socioeconomic variable. This is relevant to CVD because individuals facing multiple forms of disadvantage may encounter barriers at several stages of the care pathway, including recognition of symptoms, decision-making about seeking care, affordability, and continuation of treatment[31]. Key India-specific evidence on gender, education, caste, and social inequalities relevant to cardiovascular health is summarized in Table 4.

Table 4. Evidence on gender and social inequalities relevant to CVD in India

Dimension	Evidence from India	Interpretation
Gender and cardiovascular treatment	Women in the PINNACLE India programme had fewer healthcare encounters and lower use of several guideline-directed cardiovascular therapies than men.	Suggests potential gender differences in cardiovascular care; findings are based on participating clinical practices.[32]
Women and hypertension care	National NFHS-4 analysis found socioeconomic and regional inequalities in hypertension treatment and control among women aged 15–49 years.	Gender interacts with wealth, education, and geography in determining cardiovascular risk-factor management.[28]
Education and CVD risk-factor management	Multicity Indian data showed differences in awareness, treatment, and control of major cardiovascular risk factors by educational status.	Health literacy and education may influence recognition and management of CVD risk.[29]
Household wealth and secondary prevention	Lower household wealth was associated with lower use of cardioprotective medicines among people with CHD/stroke in the South Asian PURE study.	Financial resources may influence long-term cardiovascular prevention.[33]
Caste and hypertension	NFHS-based research identified caste differences in hypertension among women and examined their interaction with education and household wealth.	Caste and socioeconomic resources may jointly influence cardiovascular risk.[30]
Scheduled Tribe communities	Indian studies identify socioeconomic, geographic and social factors influencing healthcare-seeking behaviour in Scheduled Tribe communities.	Relevant to healthcare equity, although direct CVD-specific evidence remains limited.[34]
Intersection of class,	National survey evidence demonstrates that unmet healthcare needs are influenced by	Cardiovascular inequities may arise through multiple, overlapping forms

caste and gender	intersecting social characteristics.	of disadvantage.[31]

Taken together, the evidence suggests that gender and social inequalities in CVD are multidimensional. Women may experience differences in cardiovascular treatment and preventive care, while education and economic resources influence awareness and healthcare utilization. Caste and social position may further shape access to resources and healthcare, although direct CVD-specific evidence for some marginalized groups remains limited. These findings support an intersectional approach in which gender, socioeconomic position, education, caste, and geographic context are considered together rather than treating any single characteristic as a universal explanation for cardiovascular inequality.

Socio-economic Factors Driving CVD Disparities

Socio-economic factors significantly increase CVD prevalence and mortality among lower SES populations in India [35]. These include income inequality , education [36], occupational class, urban-rural divide, healthcare access, health literacy, lifestyle, tobacco and alcohol use, environmental exposures, OOP expenditure, gender disparities, caste-based exclusion, health insurance, inadequate infrastructure, and uneven policy implementation [37,38]. **Fig. 3** illustrates their interconnected impact on CVD outcomes. Lower SES households spend 75% of monthly income on CVD treatments like angioplasty, compared to 40% for higher SES groups [39]. In 2024, 58% of healthcare expenditure in India is OOP, pushing 40 million people annually below the poverty line. Only 20% of the population has health insurance, worsening financial burdens for marginalized groups [40]. Low educational attainment increases CVD mortality by 20% among lower SES groups, who struggle with symptom recognition and treatment adherence [36,41]. Rural populations, with lower literacy, are less likely to adopt preventive behaviors due to inadequate awareness campaigns [42].

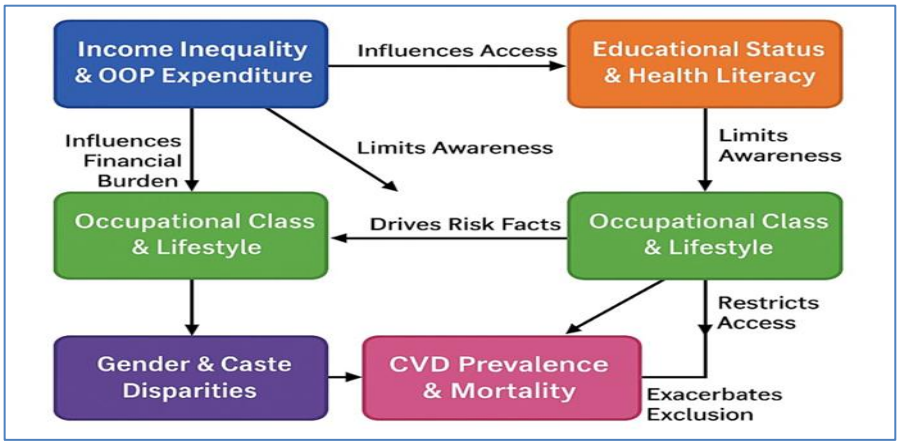

Fig. 3 Interplay of Socio-Economic Factors in CVD Outcomes. This figure illustrates the interconnected impact of socio-economic factors on CVD outcomes, showing how income inequality and OOP expenditure, educational status and health literacy, occupational class and lifestyle, and gender and caste disparities influence healthcare access, drive risk factors, and exacerbate CVD prevalence and mortality.

Manual laborers in lower SES groups face a 15% higher CVD incidence due to occupational stress, poor diets (e.g., high-salt intake), and tobacco use, exacerbated by economic constraints and targeted marketing [43]. Lifestyle interventions are less accessible due to time and resource limitations [44]. Urban areas, with 70% of hospitals, serve only 31% of India's population. Rural lower SES groups face higher mortality, with only 40% of rural health centers equipped for CVD diagnostics. Transportation barriers contribute to 15% of pre-hospital deaths [45]. Women receive 20% less CVD treatment due to social norms prioritizing household needs. Scheduled Castes and Tribes face higher mortality due to systemic discrimination, limited access to quality care, and low health insurance uptake, compounded by social stigma [46].

Policies Targeting CVD Risk Factors

Policies addressing CVD risk factors—such as tobacco, alcohol, poor diet, and air pollution—are vital for reducing disparities, especially among lower SES populations in India [47,48]. These groups face elevated risks due to income inequality, low health literacy, caste-based exclusion, gender disparities, inadequate healthcare infrastructure, and uneven policy implementation [49]. **Fig. 4** illustrates these policies' impact and limitations for lower SES communities.

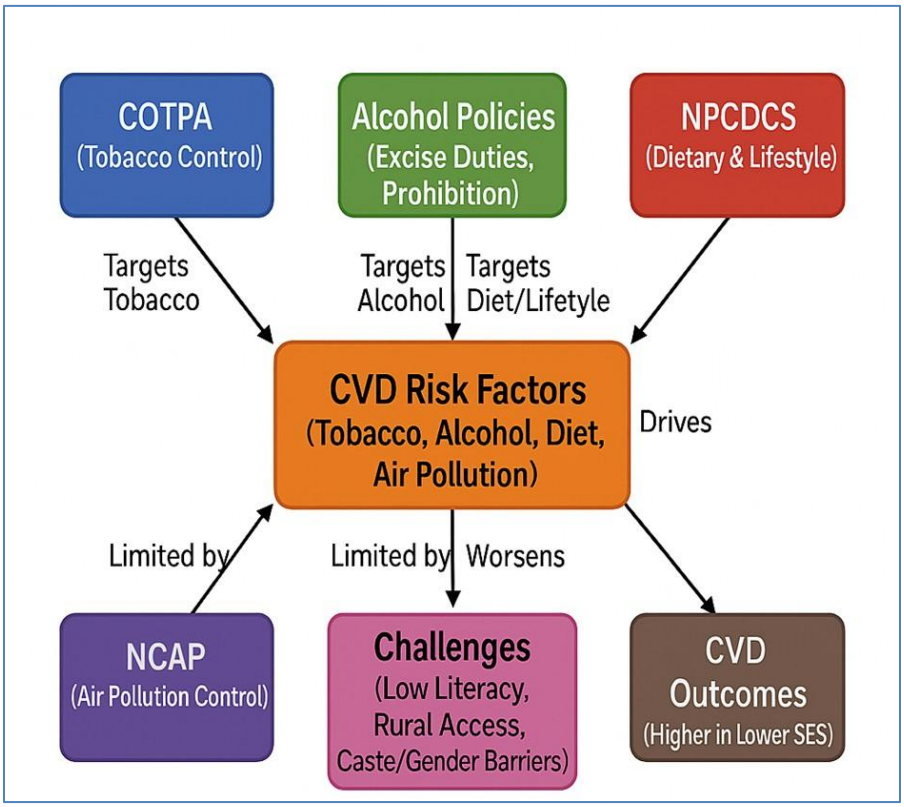

Fig 4 Impact and Limitations of Policies Targeting CVD Risk Factors. This figure illustrates the impact of policies such as the Cigarettes and Other Tobacco Products Act (COTPA), state-level excise duties, the National Programme for Prevention and Control of Cancer, Diabetes, Cardiovascular Diseases and Stroke (NPCDCS), and the National Clean Air Programme (NCAP) on reducing CVD risk factors (e.g., tobacco, alcohol, poor diet, air pollution) among lower SES populations in India. It also highlights limitations, including weak rural enforcement, low health literacy, income disparities, and inadequate infrastructure, particularly affecting marginalized groups.

The Cigarettes and Other Tobacco Products Act (COTPA), amended in 2023, includes graphic warnings, advertising bans, and a 25% tax increase, reducing tobacco use by 18% among lower SES groups [50]. However, weak rural enforcement, low health literacy, and illicit markets undermine progress, particularly for marginalized castes targeted by marketing [51]. Rural lower SES groups, with limited access to cessation programs, account for 30% of tobacco-related CVD cases [52]. State-level excise duties and partial prohibition reduced urban alcohol consumption by 10% by 2024 [53]. However, unregulated rural liquor markets, where 70% of lower SES populations live, limit effectiveness [54]. Occupational stress and low health literacy drive alcohol use among male manual laborers, increasing CVD risk [55]. The National Programme for Prevention and Control of Cancer, Diabetes, Cardiovascular Diseases and Stroke (NPCDCS), updated in 2024, promotes low-salt diets and physical activity [56]. Only 20% of lower SES individuals access these services due to income constraints and urban-rural disparities [57]. Poor dietary habits, driven by economic limitations, increase CVD risk by 25% in lower SES groups, with women less likely to adopt interventions due to household priorities [58]. The National Clean Air Programme (NCAP), launched in 2019, targets urban air pollution, linked to 15% of CVD cases in

slums [59]. However, its urban focus neglects rural and slum areas, where lower SES groups face high exposure due to occupational and environmental factors, compounded by inadequate infrastructure [60].

2. Healthcare Infrastructure and Access Barriers

India's limited healthcare infrastructure and access barriers exacerbate CVD disparities, particularly for lower SES populations [61]. Inadequate facilities, urban-rural divides, limited health insurance, high OOP expenditure, low health literacy, caste-based exclusion, and gender disparities restrict timely CVD care [62]. **Table I** summarizes key metrics, and **Fig. 5** illustrates these barriers' impact on CVD outcomes.

Table 1: Key Infrastructure and Access Metrics for CVD Care

Metric	Value	Source
Primary Health Centers (PHCs) per 10,000 population	0.8	[63]
Community Health Centers (CHCs) with NCD clinics	35%	[64]
District hospitals with cardiology departments	20%	[64]
Cardiac Care Units (CCUs) per million population	0.7	[65]
Catheterization labs (Cath labs) per million population	0.4	[66]
Urban CVD facilities (% of total)	65%	[67]
Cardiologists per 100,000 population	0.15	[67]
Nurses trained in cardiac care per 100,000	0.8	[68]
Physicians trained under NPCDCS	15%	[56]
Patient-to-doctor ratio in CVD clinics	1,500:1	[56]
Rural facilities with ECG/echo/TMT	50%	[64]
Facilities with biomarker testing	30%	[64]
PHCs with essential CVD medicines	60%	[64]
CVD patients covered by Ayushman Bharat	40%	[69]
OOP expenditure (% of healthcare costs)	55%	[69]
Average rural travel time to cardiac facility	1.5 hours	[70]
Private-to-public facility access ratio	2.5:1	[70]
Rural population screened under NPCDCS	15%	[56]
Referral delays (% of cases)	50%	[64]
Facilities with health information systems	25%	[64]

These metrics highlight the systemic barriers to equitable CVD care, disproportionately impacting rural, low-SES, and marginalized populations in India.

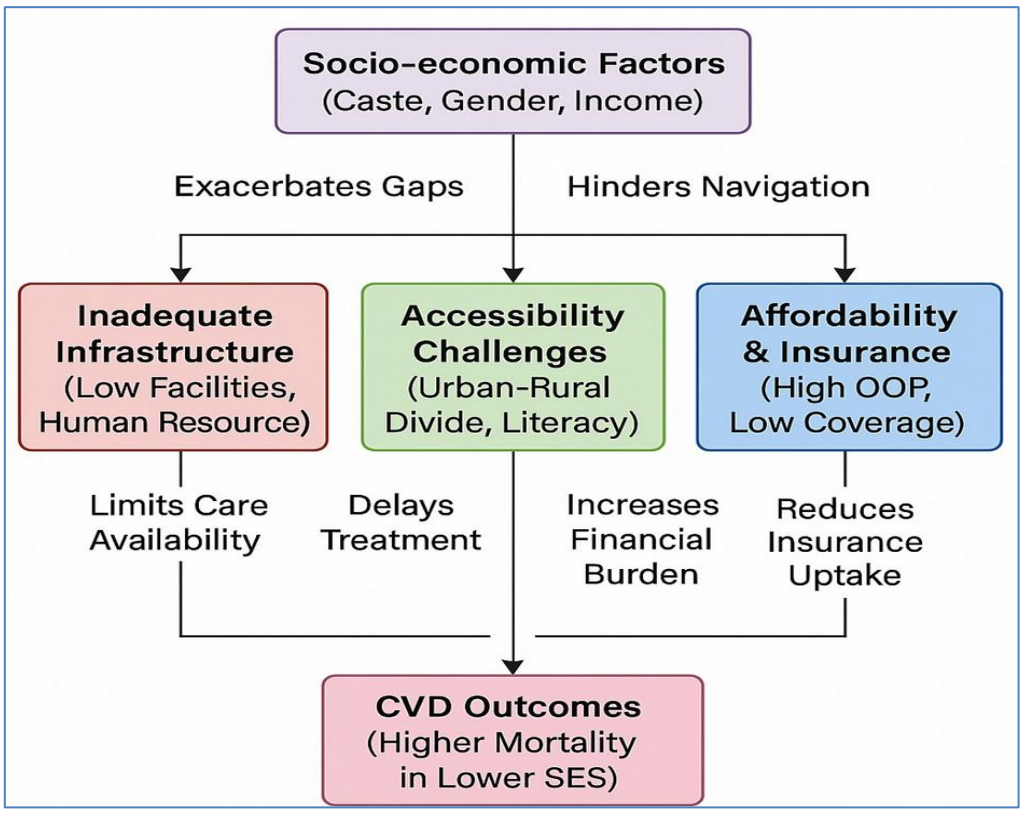

Fig. 5 Healthcare Infrastructure and Access Barriers Impacting CVD Outcomes. This figure illustrates how socio-economic factors (caste, gender, income) exacerbate gaps in inadequate healthcare infrastructure (low facilities, human resources) and hinder navigation of accessibility challenges (urban-rural divide, literacy), while affordability and insurance issues (high out-of-pocket expenditure, low coverage) increase financial burden and reduce insurance uptake, collectively driving higher CVD mortality in lower SES groups.

5.1. Availability of Healthcare Facilities

India has only 1.2 PHCs per 10,000 population, with 20% of CHCs equipped with NCD clinics [71]. Only 15% of district hospitals offer specialized CVD care, and tertiary care hospitals with cardiac care units (CCUs) are scarce (0.5 per million population) [72]. Catheterization labs are limited to 0.3 per million, mostly in urban areas, where 70% of CVD facilities serve 31% of the population [73]. The shortage of trained cardiologists (0.1 per 100,000) and cardiac care nurses (0.5 per 100,000) restricts CVD management [74]. Only 10% of NPCDCS-trained physicians are equipped for CVD care, with a patient-to-doctor ratio of 2,000:1 in CVD clinics [75]. Only 40% of rural health centers provide ECG, echocardiography, or treadmill tests, and 25% offer biomarker testing (e.g., troponin, lipid profile) [76]. Essential CVD medicines (e.g., statins, beta-blockers) are available in 50% of PHCs, and interventional services (e.g., angioplasty, CABG) are limited to urban tertiary centers, inaccessible to rural lower SES groups [77]. Only 30% of CVD patients are covered by Ayushman Bharat or other schemes, with OOP expenditure averaging 58% of healthcare costs [78]. Rural patients face a 2-hour average travel time to cardiac facilities, compared to 30 minutes in urban areas, with a 3:1 private-to-public facility access ratio [79]. NPCDCS community screening reaches only 10% of rural populations due to uneven implementation [80]. Referral systems are weak, with 60% of referrals delayed, and health information systems for follow-up are available in only 20% of facilities [81]. Low health literacy, prevalent among less-educated and marginalized castes, hinders care-seeking [82]. Gender disparities result in women receiving 20% less CVD treatment due to social norms [83]. Transportation barriers contribute to 15% of pre-hospital CVD deaths. OOP expenditure pushes 40 million people into poverty annually, with health insurance covering only 20% of the population, particularly low among Scheduled Castes/Tribes and women [84]. Ayushman Bharat's 40% rural hospital empanelment limits affordability for lower SES groups [85].

5.2. Out-of-Pocket Expenditure and Financial Burden

High OOP expenditure and limited health insurance exacerbate CVD disparities, particularly for lower SES populations [86]. In 2024, OOP accounts for 58% of healthcare costs, with lower SES households spending 75% of their income on CVD treatments (e.g., angioplasty, CABG), compared to 40% for higher SES groups [87]. This burden, driven by income inequality, pushes 40 million Indians below the poverty line annually, disproportionately affecting rural populations and marginalized groups like Scheduled Castes and Tribes [88]. Health insurance covers only 20% of the population, with 30% of CVD patients covered by Ayushman Bharat, limited by uneven implementation and 40% rural hospital empanelment [89]. Gender disparities result in women receiving 20% less CVD care due to social norms prioritizing household expenses [83]. Low health literacy among less-educated groups reduces insurance uptake and awareness of subsidized care, while caste-based exclusion limits financial protection for marginalized communities [90]. Rural patients face higher travel costs to urban tertiary care, compounding OOP burdens [91]. Lifestyle factors like tobacco and alcohol use, driven by economic stress, increase CVD risk, yet preventive care remains unaffordable for lower SES groups [92]. **Table II** summarizes financial burden metrics.

Table 2: Key Financial Burden Metrics for CVD Care

Metric	Value	Source
Out-of-pocket expenditure (% of total health expenditure)	47.1% (2021–22)	[93]
Lower SES income spent on CVD treatment	Up to 75% of monthly income	[94]
Higher SES income spent on CVD treatment	~40% of monthly income	[94]
Households pushed into poverty due to CVD hospitalization	19%	[95]
Health insurance coverage (% of population)	51% (2023)	[96]
Coverage of CVD patients under Ayushman Bharat	Cardiac procedures are fully covered, including angioplasty, bypass surgery, pacemaker implantation, and valve replacements. However, no specific percentage of CVD patients covered is publicly reported.	[97]
Rural hospitals empaneled under Ayushman Bharat	Thousands empaneled; % not publicly specified	[98]
Women receiving less CVD care due to gender norms	20% less care compared to men	[37]

3. Recommendations

To address socio-economic disparities in CVD outcomes for lower SES populations in India, the government should expand rural healthcare infrastructure by increasing PHCs and CHCs with NCD clinics, targeting 80% diagnostic tool coverage (e.g., ECG, biomarker testing) by 2030. Doubling cardiologists and cardiac nurses, alongside enhanced NPCDCS training, can improve the 2,000:1 patient-to-doctor ratio. Health insurance

coverage should rise to 50%, with campaigns targeting women and marginalized castes, and Ayushman Bharat's rural hospital empanelment should reach 70% for affordable care. Strengthening rural tobacco and alcohol control policies, launching community-based health literacy programs, extending the National Clean Air Programme to slums and rural areas, and integrating digital health platforms in 50% of facilities by 2030 will enhance screening, referrals, and equitable access, significantly reducing the CVD burden.

4. Conclusion

Socio-economic disparities continue to be a major determinant of cardiovascular disease burden in India. Lower SES groups face delayed diagnosis, limited healthcare access, and financial barriers, leading to higher preventable mortality. Structural gaps—such as low insurance coverage, urban-rural imbalance in CVD facilities, and inadequate diagnostic capacity—further widen inequities. Moreover, low health literacy, gender gaps, and caste-based exclusions restrict utilization of available services. While national programs and risk-reduction policies show potential, their reach remains insufficient for underserved populations. Strengthening primary care systems, improving financial protection, and ensuring equitable policy implementation are essential to reduce CVD disparities and improve population-level cardiovascular outcomes.

Declarations

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- Consent for Publication: None
- Data Availability: No primary datasets were generated or analysed for this narrative review. All data used in this manuscript are derived from previously published studies, which are fully cited within the reference list
- Materials Availability: Not applicable
- Code Availability: Not applicable

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