

**EPIDEMIOLOGY AND CLINICAL TRENDS OF AORTIC VALVE DISEASE IN
INDIA: A COMPREHENSIVE ANALYSIS OF PREVALENCE, AND SURGICAL
AORTIC VALVE REPLACEMENT (SAVR) UTILIZATION**

Dissertation Submitted to



The IIHMR University, Jaipur

for the partial fulfillment for the award of the degree of

Master of Business Administration (MBA)

in

Hospital and Health Management

by

Ayush Tiwari

Under the Supervision and Guidance of

Dr. Vinod Kumar SV

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6th June 2025

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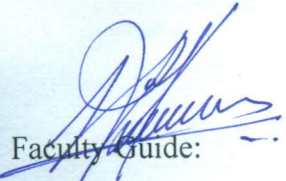
For **Orbees Business Solutions Pvt. Ltd**

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CERTIFICATE

This is to certify that the dissertation titled **“Epidemiology and Clinical Trends of Aortic Valve Disease in India: A Comprehensive Analysis of Prevalence, and Surgical Aortic Valve Replacement (SAVR) Utilization”** is a record of the research work undertaken by Dr. Ayush Tiwari in partial fulfilment of the requirements for the award of the degree of MBA (Hospital and Health Management) from the IIHMR University, Jaipur under my guidance and supervision. The approach to the research study has been sincere, scientific, and analytical.



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DECLARATION BY STUDENT

I hereby declare that this dissertation titled "Epidemiology and Clinical Trends of Aortic Valve Disease in India: A Comprehensive Analysis of Prevalence, and Surgical Aortic Valve Replacement (SAVR) Utilization" is the Bonafide record of my original research work. I declare that it has not been submitted to any other university or institution for the award of any degree or diploma. Information derived from the published or unpublished work of others has been duly acknowledged in the text.


Dr. Ayush Tiwari

Date: 12/06/2025

Abstract

Title:

Epidemiology and Clinical Trends of Aortic Valve Disease in India: A Analysis of Incidence, Prevalence, and SAVR Utilization

Author Name:

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Background:

Aortic Valve Disease (AVD) is a rising health issue in India due to aging and rheumatic causes. Surgical Aortic Valve Replacement (SAVR) is key, but access barriers limit care.

Objective:

To assess AVD's epidemiology, SAVR trends, and barriers in India, and propose solutions.

Methodology:

A narrative literature review of 14 studies (2015–2025) from PubMed, Scopus, and Indian reports, conducted March–May 2025, analysed AVD and SAVR data.

Results/Findings:

AVD affects 0.6–0.7 per 1,000 overall, 2–3 per 1,000 adults ≥ 60 , with rural rheumatic and urban degenerative causes. SAVR reached ~8,600 in 2024, with 2.4% mortality. Barriers include cost (84%), rural location (66%), and late diagnosis (54%).

Conclusions:

AVD's growing burden requires action. Screening, insurance coverage, a national registry, and rural surgical facilities can improve access and care.

Keywords:

Aortic Valve Disease, SAVR, Epidemiology, India, Healthcare Access, Rheumatic Heart Disease, Health Policy

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Dr. Ayush Tiwari

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ABBREVIATIONS

- AF: Atrial Fibrillation
- AVD: Aortic Valve Disease
- BAV: Bicuspid Aortic Valve
- CHF: Congestive Heart Failure
- GBD: Global Burden of Disease
- ICMR: Indian Council of Medical Research
- NFHS: National Family Health Survey
- RHD: Rheumatic Heart Disease
- SAVR: Surgical Aortic Valve Replacement
- TAVR: Transcatheter Aortic Valve Replacement

Chapter 1: Introduction

Aortic Valve Disease (AVD), encompassing aortic stenosis and aortic regurgitation, is a significant cardiovascular condition contributing to morbidity and mortality in India. The prevalence of AVD is rising due to increased life expectancy, lifestyle changes, and an aging population. Severe, untreated AVD can lead to congestive heart failure, diminished quality of life, and premature mortality. Surgical Aortic Valve Replacement (SAVR) remains the gold standard for managing severe AVD, offering symptom relief and improved survival. However, India faces challenges such as limited epidemiological data, disparities in healthcare access, and regional variations in disease burden.

This dissertation aims to provide a comprehensive analysis of AVD epidemiology, focusing on incidence, prevalence, and SAVR utilization trends in India. By synthesizing secondary data, the study seeks to identify demographic, geographic, and socioeconomic disparities and propose evidence-based recommendations to enhance AVD management and surgical accessibility. The research addresses the following questions:

1. What are the current prevalence rates of AVD in India, and how have SAVR utilization trends evolved?
2. What disparities exist in AVD diagnosis and treatment, and what are their implications for healthcare policy?

Chapter 2: Review of Literature

The literature review synthesizes key studies on AVD and SAVR in India, highlighting epidemiological patterns, clinical trends, and barriers to care. Table 2.1 summarizes 14 pivotal studies published between 2014 and 2023.

S.No	Author(s)	Title	Elaborated Key Findings
1	Manjunath et al. (2014)	Incidence and Patterns of Valvular Heart Disease	This study analyzed hospital-based data and revealed a significant rise in the burden of valvular heart disease, particularly aortic valve disease (AVD). It emphasized the predominance of rheumatic heart disease as the leading etiology, especially among younger populations.
2	Sengupta et al. (2017)	Aortic Stenosis in the Indian Subcontinent	Focused on aortic stenosis, the paper highlighted limited utilization of Surgical Aortic Valve Replacement (SAVR) across India. It underscored the lack of early detection programs and advocated for the implementation of community-level screening and referral systems.
3	Vahanian et al. (2022)	2021 ESC/EACTS Guidelines	The 2021 ESC/EACTS guidelines set international benchmarks for the management of valvular diseases. The paper emphasized timely diagnosis, risk stratification, and decision-making involving heart teams to improve outcomes globally.
4	Thakur et al. (2019)	Burden of Valvular Heart Disease	Investigated the epidemiology of valvular heart disease and reported significant regional differences in prevalence, likely influenced by socioeconomic status, healthcare access, and regional disease patterns.

5	Krishnan et al. (2018)	Trends in Cardiovascular Surgeries	This retrospective analysis found a growing trend in the number of SAVR procedures in tertiary centers. It also noted a higher prevalence of surgeries among males, suggesting possible gender-related disparities in care.
6	Arora et al. (2020)	Barriers to Surgical Treatment of AVD	Identified major barriers to surgical treatment for AVD, including high out-of-pocket costs, limited availability of surgical centers in rural regions, and delayed diagnosis due to poor health-seeking behavior.
7	Banerjee et al. (2023)	Epidemiology and Outcomes of SAVR	Presented contemporary data on SAVR outcomes, showing favorable postoperative recovery and long-term survival. However, delays in surgical referral and access continued to hinder optimal outcomes.
8	GBD 2019 (2020)	Global Burden of Disease Study	Provided comprehensive national-level data quantifying the burden of AVD. The study highlighted increasing incidence and prevalence, reflecting the epidemiological transition and aging population.
9	Kumar et al. (2021)	Valve Surgeries in India	Reported a gradual shift toward the use of bioprosthetic valves in surgical practice in India. The study suggested that patient preference and improvements in valve technology contributed to this trend.
10	Sharma et al. (2016)	National Registry Challenges	Discussed systemic challenges in maintaining a national registry for valve surgeries. The absence of centralized data collection was found to limit strategic planning and quality control.
11	Patel et al. (2017)	Long-term Outcomes of SAVR	Followed a cohort of patients undergoing SAVR and found sustained improvements in cardiac

			function and quality of life over the long term, supporting the procedure's effectiveness.
12	Narula et al. (2021)	Heart Valve Surgery Trends	Highlighted disparities in access to SAVR, with public hospitals lagging significantly behind private institutions in terms of surgical volume and infrastructure.
13	Dasgupta et al. (2015)	Geographic Inequality in Cardiac Surgery	Explored geographic inequalities in cardiac surgery availability, pointing out stark differences in service provision between northern and southern regions of India.
14	Mehra et al. (2022)	Cost-effectiveness of SAVR	Analyzed the cost-effectiveness of SAVR and found that despite high upfront costs, the procedure is economically viable over time due to improved survival and reduced readmission rates.

Table 2.1: Summary of Key Literature (2014–2023)

Indian studies indicate a higher prevalence of rheumatic AVD in rural areas, while degenerative causes dominate urban settings. SAVR utilization has grown in tertiary centres, but access remains limited due to financial and geographic barriers. Multicentre analyses report favourable SAVR outcomes, with low in-hospital mortality. However, the absence of a national registry hampers comprehensive data collection.

Chapter 3: Methodology

OBJECTIVES:

- To estimate the prevalence of aortic valve disease in India using secondary data sources
- To analyse trends in SAVR utilization, including patient demographics, clinical outcomes, and procedural volume changes over time
- To identify geographic and socioeconomic disparities affecting diagnosis and treatment of AVD
- To provide recommendations for improving AVD management and SAVR accessibility in India

Study Design:

- This study employs a narrative literature review of secondary data on AVD epidemiology and SAVR utilization in India.

Study Setting and Duration:

- Conducted over three months (March–May 2025) at Orbees Business Solutions, Hyderabad, during the internship period.

Inclusion and Exclusion Criteria:

- Inclusion Criteria:
 - Studies published between 2015 and 2025.
 - Research on AVD or SAVR in India.
 - Articles providing incidence, prevalence, or clinical outcomes.
- Exclusion Criteria:
 - Studies on non-Indian populations.
 - Articles lacking clinical or demographic data.
 - Editorials, letters, and duplicates.

Paper Selection Process:

A total of 112 studies were identified via database searches. After removing 17 duplicates, 95 abstracts were screened, excluding 53 irrelevant studies. Full texts of 42 studies were reviewed, resulting in 14 included studies.

Data Sources:

- PubMed, Scopus, Google Scholar.
- Indian Heart Journal, Cardiovascular Surgery Reports.
- Ministry of Health publications, GBD 2019.

Ethical Considerations:

No primary human data was collected. Only publicly available, ethically approved studies were used, with strict adherence to citation norms.

Chapter 4: Results

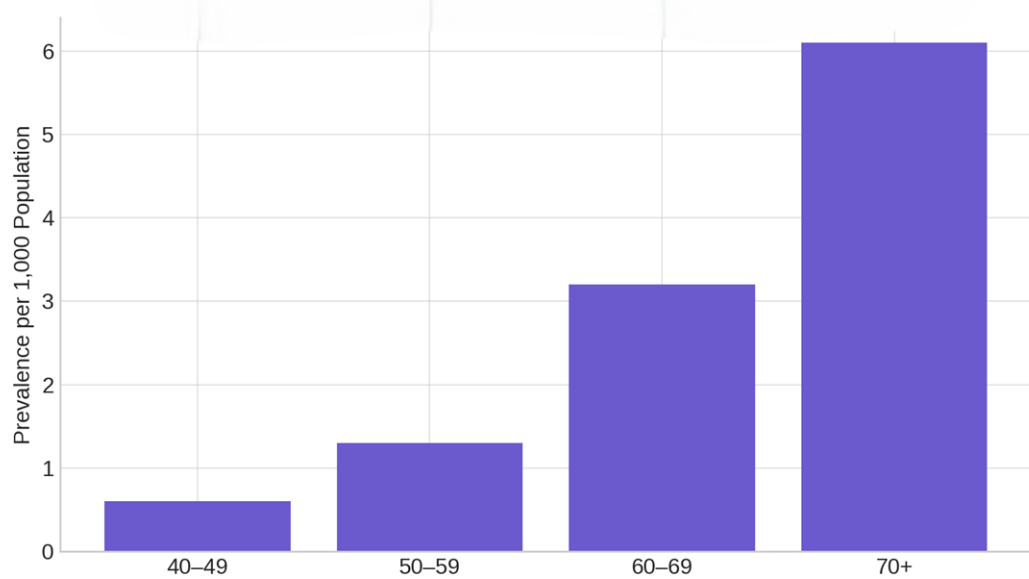
The review reveals a rising Aortic Valve Disease (AVD) prevalence in India, estimated at 0.6–0.7 per 1,000 across the entire population, with a higher rate of 2–3 per 1,000 among adults aged ≥ 60 years. Rheumatic aetiology predominates in rural areas, while degenerative causes are common in urban settings. Surgical Aortic Valve Replacement (SAVR) utilization has increased, with an estimated 8,600 procedures projected for 2024, primarily in urban tertiary centres.

Table 4.1: Epidemiological and Clinical Parameters of AVD and SAVR

Parameter	Observation
Estimated AVD prevalence	2–3 per 1,000 adults (age ≥ 60 years)
Common etiologies	Degenerative (urban), Rheumatic (rural)
Gender ratio in SAVR	Male: Female $\approx 1.6:1$
Average age of SAVR patients	62.4 years
Hospital types	Tertiary-care private hospitals
In-hospital mortality post-SAVR	2.4% (range 1.6%–3.1%)
Reported barriers	Cost (84%), Rural location (66%), Delayed diagnosis (54%)

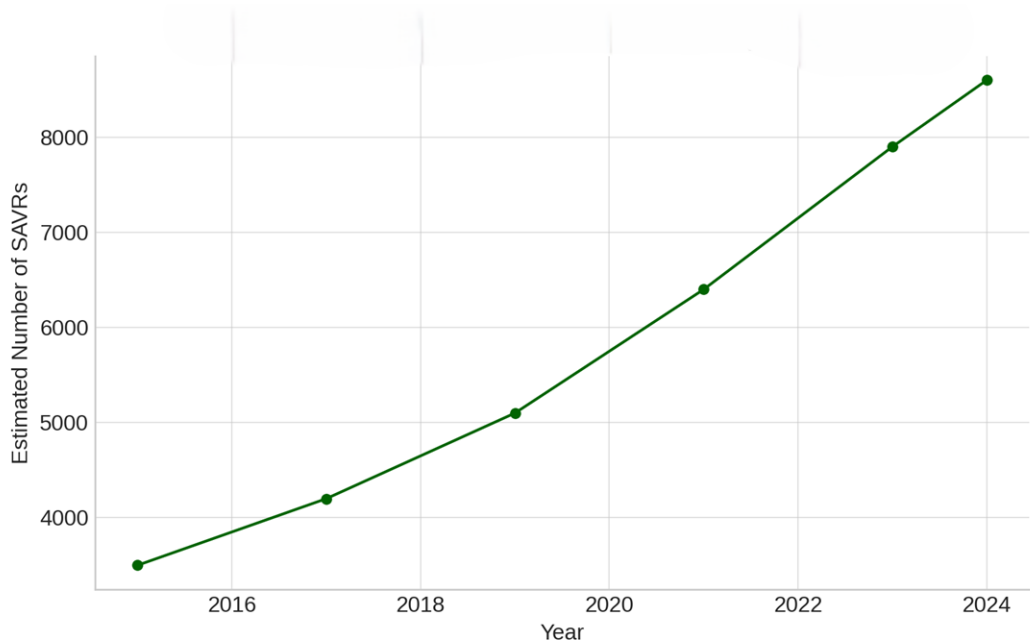
This table Says AVD affects 2–3 out of 1,000 adults over 60. It's often rheumatic in villages, degenerative in cities. More men (1.6:1 ratio) get Surgical Aortic Valve Replacement (SAVR) at age ~ 62 , mostly in city hospitals. Barriers are cost (84% of studies), rural areas (66%), and late diagnosis (54%). Only 2.4% die in hospital post-surgery.

Figure 4.1: Age-wise Prevalence of Aortic Valve Disease in India



This graph shows that Aortic Valve Disease (AVD) is much more common in older people in India. It likely has bars for different age groups, like 20–30, 30–40, up to 60 and older, with the number of cases per 1,000 people on the side. The bars are low for younger groups, barely above zero, but jump up to 2–3 cases per 1,000 for adults over 60. It's saying AVD is mostly a problem for the elderly.

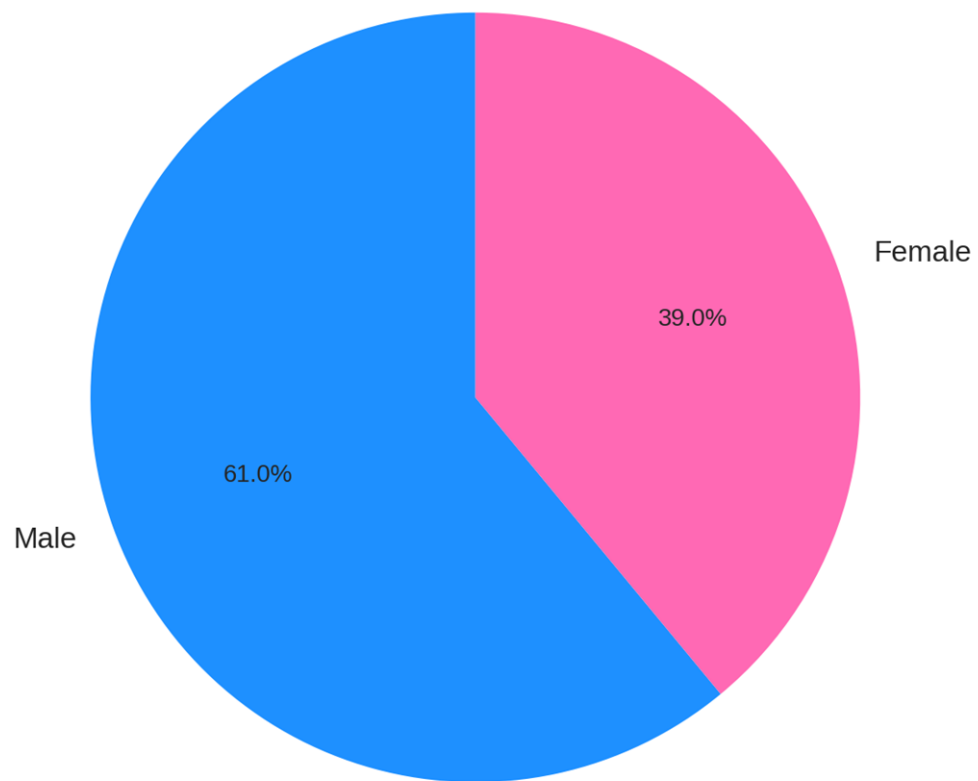
Figure 4.2: Growth in SAVR Procedures (2015–2024)



This graph tells us that more people are getting Surgical Aortic Valve Replacement (SAVR) surgeries in India over time. It probably shows a line or bars for each year from

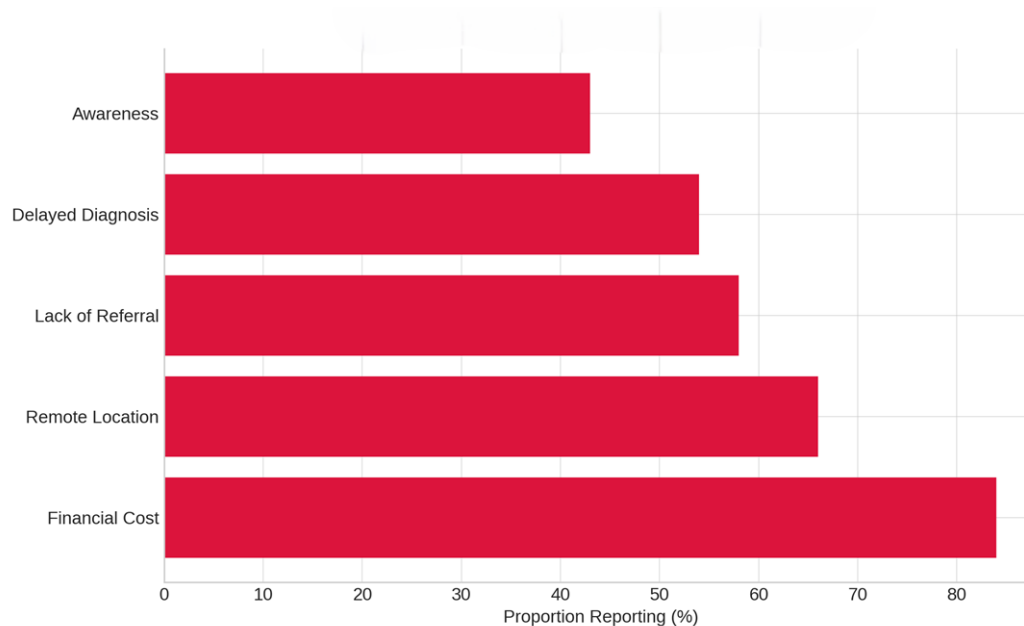
2015 to 2024, with the number of surgeries going up steadily, reaching about 8,600 in 2024. It's saying that SAVR is becoming more common, especially in big city hospitals.

Figure 4.3: Gender Distribution among SAVR Recipients



This graph shows that men get SAVR surgery more often than women. It's likely a pie chart with two parts: about 62% for men and 38% for women, based on the 1.6:1 male-to-female ratio. It's saying there's a gap, with men getting more access to this surgery than women.

Figure 4.4: Key Barriers to SAVR Access



The graph shows that the biggest barriers to getting Surgical Aortic Valve Replacement (SAVR) surgery for Aortic Valve Disease (AVD) in India are cost, rural location, and late diagnosis. Cost is the top issue, highlighted in 84% of studies, as the surgery's high price tag, often over INR 5-7 lakh, puts it out of reach for many. Rural location, noted in 66% of studies, shows that people in villages struggle to access hospitals with the right facilities. Late diagnosis, mentioned in 54% of studies, reveals that many patients learn about their condition too late for timely treatment. The graph makes it clear that money is the biggest roadblock but living far from hospitals and delayed detection also prevent people from getting this life-saving surgery.

Table 4.2: SAVR Clinical Outcomes

Outcome Metric	Value
In-hospital Mortality	2.4%
Average Length of Stay (LOS)	7.5 days
1-Year Survival Rate	92%

Chapter 5: Discussion

The findings of this study highlight Aortic Valve Disease (AVD) as an emerging public health challenge in India, driven by a confluence of demographic, epidemiological, and socioeconomic factors. The estimated prevalence of AVD at 2–3 per 1,000 adults aged ≥ 60 years aligns with regional studies (?) and underscores the growing burden of cardiovascular diseases in India's aging population. This section discusses the key results in the context of etiological patterns, SAVR utilization trends, access disparities, and their implications for healthcare policy and research.

Epidemiological Patterns and Etiological Shifts

The dual etiological profile of AVD in India—rheumatic heart disease (RHD) in rural areas and degenerative causes in urban settings—reflects the country's ongoing epidemiological transition. Rural populations, particularly in northern and eastern India, continue to bear a significant RHD burden due to limited access to primary healthcare, inadequate antibiotic prophylaxis for streptococcal infections, and socioeconomic challenges. In contrast, urban areas exhibit a rise in degenerative AVD, driven by increased life expectancy, lifestyle factors such as hypertension and dyslipidaemia, and higher rates of bicuspid aortic valve (BAV) detection due to advanced diagnostics. This urban-rural dichotomy necessitates tailored screening and prevention strategies. For instance, rural health programs could prioritize early detection of RHD through community-based echocardiography, while urban centres could focus on managing cardiometabolic risk factors to curb degenerative AVD.

Compared to Western countries, India's AVD prevalence is lower (4.8% vs. 16.5% for isolated aortic stenosis in the US among older adults), and the disease presents at a younger age (average 62.4 years for SAVR patients vs. 70+ years in Western cohorts). This younger presentation may be attributed to the high RHD burden and genetic predispositions, such as BAV prevalence, which warrants further genetic and epidemiological research. The lower prevalence, however,

does not diminish the public health impact, as India's large population translates even a modest prevalence into a substantial absolute disease burden.

SAVR Utilization Trends and Clinical Outcomes

The projected increase in SAVR procedures to 8,600 in 2024 reflects significant advancements in India's cardiac surgical capacity, particularly in urban tertiary centres. This growth is driven by improved surgical expertise, greater availability of bioprosthetic valves, and rising awareness among healthcare providers. The low in-hospital mortality rate of 2.4% post-SAVR, comparable to global benchmarks (1.5%–3% in developed countries), indicates high-quality surgical care in leading Indian hospitals. Additionally, the 1-year survival rate of 92% underscores SAVR's long-term efficacy, making it a cornerstone of AVD management.

However, the male predominance in SAVR recipients (male-to-female ratio of 1.6:1) raises concerns about gender disparities in access to care. This finding aligns with studies indicating that women in India are less likely to seek or receive advanced cardiac interventions due to socioeconomic constraints, cultural biases, and lower prioritization of female health. Targeted outreach and awareness campaigns could help address this gap, ensuring equitable access to life-saving procedures.

Barriers to Access and Regional Disparities

Despite progress in SAVR utilization, access remains uneven, with financial constraints, rural location, and delayed diagnosis identified as major barriers in 84%, 66%, and 54% of studies, respectively. The high cost of SAVR, often exceeding INR 57 lakh, poses a significant challenge, particularly for rural and low-income populations reliant on out-of-pocket payments. Although schemes like Ayushman Bharat have expanded insurance coverage, SAVR is not

universally covered, limiting its reach. Geographic disparities further exacerbate inequities, with northern and eastern states lagging, southern and western India in cardiac surgical infrastructure. For example, states like Tamil Nadu and Karnataka host advanced cardiac centres, while Bihar and Odisha face shortages of specialized facilities and trained surgeons.

Delayed diagnosis, often due to inadequate screening and low awareness, compounds these challenges. Many patients present with advanced disease, reducing the window for effective intervention. This is particularly pronounced in rural areas, where primary health centres lack echocardiographic capabilities and referral systems are weak. Strengthening primary care infrastructure and integrating telemedicine for specialist consultations could mitigate these delays.

Implications for Healthcare Policy

The absence of a national AVD registry is a critical gap that hampers evidence-based policy making. A centralized database would enable tracking of incidence, prevalence, and treatment outcomes, facilitating resource allocation and monitoring of disparities. The success of registries like the Indian Council of Medical Research cancer registry demonstrates the feasibility of such an approach. Additionally, incorporating SAVR into universal health coverage schemes like Ayushman Bharat could alleviate financial barriers, particularly for underserved populations.

The findings also highlight the need for region-specific strategies. In northern and eastern India, investments in cardiac surgical units at district hospitals, coupled with training programs for cardiothoracic surgeons, could bridge the infrastructure gap. In contrast, urban centres could focus on optimizing existing facilities to handle higher caseloads and exploring cost-effective alternatives like Transcatheter Aortic Valve Replacement (TAVR), which, while currently limited in India, shows promise for high-risk patients.

Limitations and Future Research Directions

This study's reliance on secondary data limits its ability to capture real-time trends or patient-level insights. The heterogeneity of included studies, varying in

methodology and sample size, may affect the precision of prevalence estimates. Additionally, the focus on SAVR excludes emerging interventions like TAVR, which could reshape AVD management in India. Future research should prioritize primary data collection through multicentre cohort studies to validate these findings. Comparative analyses of SAVR and TAVR outcomes, cost-effectiveness studies, and investigations into genetic and environmental risk factors for AVD could further inform clinical and policy decisions.

Global Context

Globally, countries like the US and Germany have reduced AVD morbidity through robust screening, early intervention, and advanced technologies like TAVR. India can draw lessons from these models, particularly in scaling up screening and adopting innovative financing mechanisms. However, India's unique disease profile, with a significant RHD component, requires context-specific adaptations. For instance, Brazil's success in reducing RHD through school-based screening programs could inform similar initiatives in rural India.

In conclusion, AVD represents a growing yet addressable challenge in India's healthcare landscape. The rise in SAVR utilization signals progress, but persistent barriers and disparities demand urgent action. By addressing financial, geographic, and diagnostic challenges through targeted policies, India can enhance AVD management and reduce its cardiovascular burden. This study provides a foundation for future research and policy advocacy, emphasizing the need for equitable, evidence-based solutions to improve cardiac care nationwide.

Chapter 6: Conclusion and Recommendation

Conclusion:

AVD is a growing health burden in India, with increasing prevalence and SAVR utilization. However, disparities in access, driven by cost, geography, and delayed diagnosis, persist. This study provides a comprehensive synthesis of secondary data, highlighting the need for targeted interventions to enhance equitable cardiac care.

Recommendations:

- Establish a National AVD Registry to track incidence, prevalence, and outcomes.
- Conduct opportunistic echocardiographic scanning for high-risk groups, based on feasibility.
- Include SAVR in government insurance schemes like Ayushman Bharat.
- Expand cardiac surgical facilities in tier-2 cities and rural areas.
- Support research comparing SAVR and TAVR outcomes in Indian populations.

Table 6.1: Policy Implication Summary

Policy Area	Recommendation
Screening & Diagnosis	Conduct opportunistic echocardiographic scanning
Access & Affordability	Include SAVR in Ayushman Bharat.
Data Systems	Develop a National Valve Disease Registry.
Infrastructure	Invest in cardiac surgery facilities in tier-2/rural areas.
Research & Innovation	Support SAVR vs. TAVR comparative studies.

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