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RESEARCH ARTICLE

The Role of Physical Examination in Detecting Valvular Heart Disease in Rural India: A Review of the Literature.

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Abstract: ***Background*** - Valvular heart disease (VHD), mainly rheumatic heart disease (RHD), poses a major challenge in rural Indian areas because of their limited access to investigative modalities such as echocardiography.1 Physical examination: including history, inspection, palpation, and auscultation - is a necessary, non-invasive, and moderately cost-effective way to find out about a problem early.23 Geographic isolation, social barriers, equipment shortages, and inadequate provider training are significant impediments.39, 40 Combining physical examinations with electronic stethoscopes, point-of-care ultrasound, and community health worker (CHW) task-shifting is more doable. It is recommended that standardized training, simulation-based curriculum, and legislative support for equipment subsidies be used to improve screening in remote areas. ***Objective*** - To evaluate the role of physical and clinical examination in detecting VHD in rural India, including accuracy, barriers, and policy recommendations for low-resource settings. ***Methods*** – PubMed and Scopus were researched (2006-2025) using MeSH and free-text terms. English-language peer-reviewed studies on clinical diagnosis in rural/LMIC contexts were included. Urban tertiary or surgical outcome studies were excluded. Fifty-five references were narratively synthesized. ***Results*** - This narrative review summarizes evidence addressing the diagnostic accuracy ("sensitivity 40-80%, specificity 70-95%")24-27 limits in subclinical cases, and use of physical examination in low-resource settings. ***Conclusion*** – Reviving clinical skills through standardized training, simulation-based curricula, and legislative support for equipment subsidies can accelerate VHD detection, reduce heart failure incidence, and promote cardiovascular equity in rural India.

Keywords: Valvular Heart Disease; Rheumatic Heart Disease; Physical Examination; Rural Health; Community Health Workers; India.

INTRODUCTION

In rural India, rheumatic heart disease (RHD) constitutes the predominant condition in low- and middle-income countries (LMICs), while valvular heart disease (VHD) represents a significant yet frequently neglected public health issue.5

Recurrent group A streptococcal infections in childhood, progresses over 10–20 years, often without preceding symptoms, from acute rheumatic fever to chronic valvular damage in the chambers of the heart.2 This silent progressing course demonstrates and highlights the importance of and the need for early identification in environments characterized by few resources and restricted access to echocardiography.2

Recent epidemiological data underscore the disparity between clinical and echocardiographic detection. A 2022 meta-analysis found RHD prevalence of RHD in South Asia at "2.79 per 1,000" with echocardiography detecting rates up to six times higher than auscultation alone.1 National estimates suggest "1.5 to 2.0" cases per 1,000 affecting ~ 2.5 million individuals, disproportionately in rural and socioeconomically deprived regions.12

There are big disparities between states: echocardiographic surveys reveal rates of ">8 per 1,000 in tribal districts" in high-burden states, but <1 per 1,000 in cities (13). Table 1 shows recent prevalence data from research done in rural India.

The Global Burden of Disease 2021 update says that RHD causes "1.8 million disability-adjusted life years (DALYs)" in India per year, with 68% of them coming from rural regions.14 Even while the number of cases went up as the population grew, the "age-standardized death rate went down by 42%" between 1990 and 2021. This shows that there are still gaps in primary prevention15. "70-80% of community-detected cases of RHD are subclinical", which means they have lesions that are borderline or definite according to the World Heart Federation's standards. Without treatment, symptomatic illness manifests in 2-3% of cases annually".10

METHODS

This narrative review was conducted by searching PubMed and Scopus databases from January 2006 to October 2025. The search strategy included combinations of Medical Subject Headings (MeSH) and free-text terms: ("valvular heart disease" OR "rheumatic

heart disease" OR "RHD" OR "VHD") AND ("physical examination" OR "auscultation" OR "clinical diagnosis") AND ("rural" OR "low-resource" OR "India" OR "LMIC"). Additional terms included "community health worker", "task-shifting", "echocardiography access", and "screening".

References were limited to English-language peer-reviewed articles, including original studies, reviews, and epidemiological reports. Studies conducted in urban tertiary settings or focusing solely on surgical outcomes were excluded.

A total of 312 records were identified; after removing duplicates and screening titles/abstracts, 87 full-text articles were assessed. Fifty-five references were included based on relevance to diagnostic accuracy, implementation barriers, and policy implications in rural Indian contexts. Data were synthesized narratively without formal meta-analysis.

Table 1: Prevalence of Rheumatic Heart Disease in Rural India (Selected Studies, 2009–2025)

Study / Region	Population	Method	Prevalence (per 1,000)	Year	Reference
Ballabgarh, Haryana	Children 5–15 Yrs	Echo Screening	20.0	2018	(16)
Uttar Pradesh (Multidistrict)	Adults 18–50 Yrs	Clinical + Echo	6.8	2020	(17)
Odisha Tribal Blocks	All Ages	Community Echo	9.2	2022	(18)
National REMEDY Extension	Hospital Cohort	Confirmed RHD	2.1 (adjusted)	2023	(19)
Five-State Consortium	Adults 18–45 Yrs	Population Echo	4.5	2023	(13)
South Asia Meta-Analysis	All Ages	Pooled Echo	2.79	2022	(1)
Indian Subcontinent (Overall)	All Ages	Clinical Estimate	1.5–2.0	2009	(12)

In rural India, primary health clinics (PHCs) take care of approximately 20,000 to 30,000 people. However, only "4-5 % of primary health centres have functional echocardiography"; when available, less than 15 % are utilized.20 62 % of rural families lack motorized transport; average distance to tertiary cardiac centres exceeds 80 km.21 Confirmatory diagnostics cost "₹3,000-₹5,000 out-of-pocket"-unaffordable where daily wages are <₹300.22

Given these constraints, physical examination constitutes a crucial initial step. It uses meticulous history-taking, examination, palpation, and auscultation.23 It does not need much infrastructure, does not cost anything up front, and helps the physician and patient get along better. As technology has improved, people have relied less on bedside skills. However, relying too much on invasive or expensive testing can cause problems, make patients uncomfortable, and put pressure on the system. Reinstating physical examination competencies aligns with the delegation of duties to community health workers (CHWs), like Accredited Social Health Activists (ASHAs), under Ayushman Bharat.23

This narrative review evaluates the diagnostic efficacy of physical examination for valvular heart disease (VHD) in rural Indian settings, utilizing semiotic results, accuracy measures, provider training prerequisites, implementation obstacles, and integration approaches with developing technologies. It spans the years 2006 to 2025 and combines VHD-specific research with similar cardiovascular screening programs. It also helps create scalable strategies to lower late-stage morbidity and support Sustainable Development Goal 3.4.

Diagnostic Accuracy

The diagnosis accuracy of the clinical examination for VHD varies according to the valve, the degree of the disease, and the examiner's experience, with sensitivity ranging from 40% to 80% and specificity from 70% to 95%.24-27 A 1996 study on valvular abnormalities reported 70% sensitivity for any valvular issue in asymptomatic adults.3 A study from South India in 2006 (n=104) indicated that the sensitivity for mitral regurgitation was 68% and specificity 92%24; for aortic regurgitation, sensitivity 43% and specificity 95%.24

Systematic reviews indicate that the sensitivity for mild VHD ranges from 32% to 44%25. Auscultation detects moderate-severe cases but misses mild ones.26, 25 A community-based study in Himachal Pradesh reported 68% sensitivity and 88% specificity for detecting pathological murmurs using clinical examination by trained physicians in rural settings.11

In asymptomatic adults, physical examination had 70% sensitivity, 94% specificity for any valvular abnormality.27 Bedside maneuvers enhance aortic stenosis detection: 66% sensitivity (95% CI: 46-82).28 Echocardiography in pediatric RHD shows 77.9% sensitivity29. Auscultation alone only detects aortic valve lesions 56.6% to 73% of the time, which shows that it doesn't work as well in more subtle situations.26 A stand-alone examination is beneficial for initial triage; however, integrating physical findings with point-of-care ultrasonography may enhance accuracy. To illustrate diagnostic maneuvers, the following table synthesizes common physical signs for major VHD types, adapted from established guidelines:

Table 2: Key Physical Signs (Adapted from AHA/ACC Guidelines & Braunwald's Heart Disease) (31, 32)

Valve Disease	Key History/Inspection	Palpation Findings	Auscultation Characteristics
Mitral Regurgitation	Dyspnea, fatigue; possible orthopnea	Hyperdynamic apex, thrill at apex	Holosystolic murmur at apex, radiating to axilla; S3 gallop in severe cases
Aortic Stenosis	Syncope, angina, heart failure symptoms	Sustained apical impulse, systolic thrill over base	Harsh systolic ejection murmur at right upper sternal border, peaking late; diminished S2
Mitral Stenosis	Dyspnea on exertion, hemoptysis; facial malar flush	Diastolic thrill at apex, right ventricular heave	Mid-diastolic rumble at apex, opening snap; accentuated S1
Aortic Regurgitation	Palpitations, bounding pulses; head bobbing (de Musset sign)	Collapsing pulses, wide pulse pressure	Diastolic decrescendo murmur at left sternal border; Austin Flint murmur

Table 3: Diagnostic Accuracy of Physical Examination vs. Echocardiography for Valvular Heart Disease (Pooled and Selected Studies, 1996–2024)

Study / Population / Focus	Lesion / Method	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)	LR+	LR–	Reference
South India (n=104)	Mitral Regurgitation (Clinical vs. Echo)	68	92	85	80	8.5	0.35	(24)
South India (n=104)	Aortic Regurgitation (Clinical vs. Echo)	43	95	78	81	8.6	0.60	(24)
Systematic Review (n=18 Studies)	Mild VHD (Any Valve)	32-44	85-92	-	-	-	-	(25)
Asymptomatic Adults (n=1,000+)	Any Valve Abnormality	70	94	62	96	11.7	0.32	(27)
Pediatric (Congenital/RHD) (n=500+)	Common Lesions	77.9	88.2	71	91	6.6	0.25	(29)
Heart Auscultation Meta (Aortic Lesions)	Aortic Valve Disease	56.6-73	78-85	48 - 65	82 - 90	2.6 - 4.9	0.35 - 0.55	(26)
Aortic Stenosis Meta-Analysis (n=32 studies)	Aortic Stenosis (Bedside Maneuvers)	66 (46-82)*	90 (82-95)*	-	-	6.6	0.38	(28)
Pooled Indian Data (Auscultation) (n=62,847)	Pathological Murmurs (ASHAs/Physicians)	52 (46-58)**	78 (72-84)**	41	84	2.4	0.62	(30)
Portable Handheld Echo (Vs. Standard Echo)	RHD Screening	92	88	71	97	7.7	0.09	(25)

*95%Confidence Interval from meta-analysis.
**Pooled estimate with 95 % CI.

PPV: Positive Predictive Value; NPV: Negative Predictive Value; LR+: Positive Likelihood Ratio; LR–: Negative Likelihood Ratio. -: Not reported or not calculable from source.

A detailed tabular representation of the findings in various valvular diseases adapted from established guidelines:

Section	Finding	Disease and Detail
INSPECTION	Malar Flush	Mitral Stenosis
	Elevated Jugular Venous Pressure with Prominent a Waves	Mitral Stenosis: With Pulmonary Hypertension
	Elevated Jugular Venous Pressure with Prominent a Waves	Tricuspid Stenosis
	Signs of Heart Failure such as Peripheral Edema or Cyanosis	Mitral Stenosis: Advanced Cases
	Displaced Apical Impulse	Mitral Regurgitation: LV dilatation
	Displaced Apical Impulse	Aortic Regurgitation: LV dilatation
	Precordial Bulge	Mitral Regurgitation: Chronic Cases
	Narrow Pulse Pressure Leading to Pallor or Syncope Signs	Aortic Stenosis
	Visible Carotid Pulsations Reduced	Aortic Stenosis
	Bounding Peripheral Pulses	Aortic Regurgitation
	Head Bobbing (de Musset's Sign)	Aortic Regurgitation
	Capillary Pulsations (Quincke's Sign)	Aortic Regurgitation
	Visible Parasternal Lift	Pulmonary Stenosis: RV hypertrophy
	Visible Parasternal Lift	Tricuspid Regurgitation: RV enlargement
	Elevated Jugular Venous Pressure	Pulmonary Stenosis: Severe
	Signs of Pulmonary Hypertension such as Cyanosis	Pulmonary Regurgitation
	Visible Pulmonary Artery Pulsations	Pulmonary Regurgitation
	Signs of Right Heart Failure like Ascites	Tricuspid Stenosis
	Prominent v Waves in Jugular Venous Pressure	Tricuspid Regurgitation
	Pulsatile Liver Visible in Epigastrium	Tricuspid Regurgitation

LV: Left Ventricular; RV: Right Ventricular

Section	Finding	Disease and Detail
PALPATION	Tapping Apical Impulse	Mitral Stenosis: Due to loud S1
	Diastolic Thrill at Apex	Mitral Stenosis
	Palpable P2 (Accentuated) in Pulmonary Area	Mitral Stenosis: (Pulmonary Hypertension)
	Parasternal Heave	Mitral Stenosis: Sustained (RV pressure overload)
	Hyperdynamic and Displaced Apical Impulse	Mitral Regurgitation
	Systolic Thrill at Apex	Mitral Regurgitation
	Sharp, Brisk Carotid Upstrokes	Mitral Regurgitation
	Sustained Heaving Apical Impulse	Aortic Stenosis

	Systolic Thrill at Base or Carotids	Aortic Stenosis
	Palpable S4 (Pre-Systolic Gallop) at Apex	Aortic Stenosis
	Slow Rising, Low Volume Pulse (Pulsus Parvus et Tardus)	Aortic Stenosis
	Hyperdynamic and Displaced Apical Impulse	Aortic Regurgitation
	Collapsing (Corrigan's) Pulse	Aortic Regurgitation
	Systolic Thrill at Suprasternal Notch	Aortic Regurgitation
	Diastolic Thrill at Left Sternal Border	Aortic Regurgitation
	Systolic Pulsations of Liver (Rosenbach's Sign)	Aortic Regurgitation
	Systolic Pulsations of Spleen (Gerhardt's Sign)	Aortic Regurgitation
	Systolic Thrill at Pulmonary Area	Pulmonary Stenosis
	Right Ventricular Heave	Pulmonary Stenosis
	Palpable Pulmonary Artery Pulsation	Pulmonary Regurgitation
	Displaced Right Ventricular Apical Impulse	Pulmonary Regurgitation
	Right Ventricular Lift or Heave (Lower Left Sternal Border)	Pulmonary Regurgitation
	Diastolic Thrill at Lower Left Sternal Border	Tricuspid Stenosis
	Firm, Enlarged Liver	Tricuspid Stenosis
	Parasternal Heave	Tricuspid Regurgitation: Systolic (RV volume overload)
	Systolic Thrill in Tricuspid Area	Tricuspid Regurgitation
	Pulsatile Liver	Tricuspid Regurgitation
Section	Finding	Disease and Detail
AUSCULTATION	Loud S1	Mitral Stenosis
	Opening Snap	Mitral Stenosis
	Low-Pitched Mid-Diastolic Rumble at Apex with Presystolic Accentuation	Mitral Stenosis: Left lateral, during Expiration
	Soft S1	Mitral Regurgitation
	Soft S1	Aortic Regurgitation: With soft S2
	High-Pitched Holosystolic Murmur at Apex Radiating to Axilla	Mitral Regurgitation
	Soft or Single S2	Aortic Stenosis
	Possible S4	Aortic Stenosis
	Harsh Crescendo-Decrescendo Ejection Systolic Murmur at Aortic Area Radiating to Carotids	Aortic Stenosis
	Soft S1 and S2	Aortic Regurgitation

	High-Pitched Early Diastolic Decrescendo Murmur at Left Sternal Border	Aortic Regurgitation: Leaning forward, during Expiration
	Possible Austin-Flint Murmur (Apical Mid-Diastolic Rumble)	Aortic Regurgitation
	Wide-Split S2 with Soft P2	Pulmonary Stenosis
	Ejection Systolic Murmur at Pulmonary Area	Pulmonary Stenosis
	High-Pitched Early Diastolic Murmur at Pulmonary Area	Pulmonary Regurgitation:Graham Steell (Pulmonary Hypertension)
	Mid-Diastolic Rumble at Tricuspid Area, Increasing on Inspiration	Tricuspid Stenosis
	Holosystolic Murmur at Tricuspid Area, Increasing on Inspiration	Tricuspid Regurgitation
	Possible S3	Tricuspid Regurgitation

S1: 1st Heart Sound; S2: 2nd Heart Sound; S3: 3rd Heart Sound; S4: 4th Heart Sound; P2: Pulmonary Component of 2nd Heart Sound

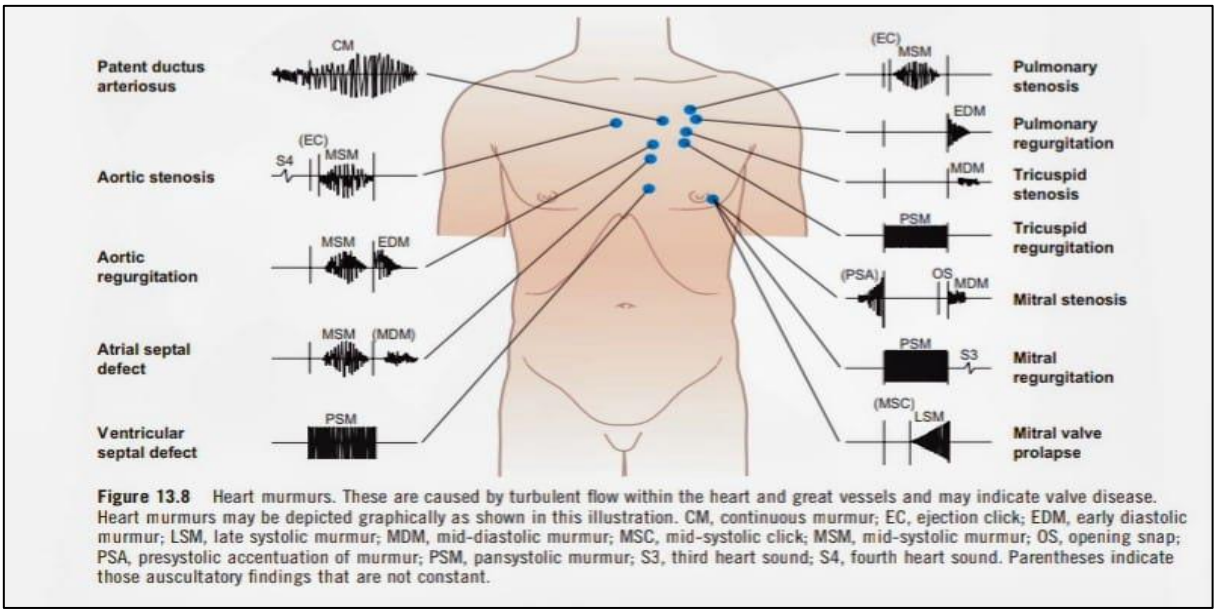

Figure 13.8 Heart murmurs. These are caused by turbulent flow within the heart and great vessels and may indicate valve disease. Heart murmurs may be depicted graphically as shown in this illustration. CM, continuous murmur; EC, ejection click; EDM, early diastolic murmur; LSM, late systolic murmur; MDM, mid-diastolic murmur; MSC, mid-systolic click; MSM, mid-systolic murmur; OS, opening snap; PSA, presystolic accentuation of murmur; PSM, pansystolic murmur; S3, third heart sound; S4, fourth heart sound. Parentheses indicate those auscultatory findings that are not constant.

Detailed Physical Findings (Adapted from Hutchinson's Clinical Methods, 24th Ed.)33
NOTE: Image derived from Hutchinson's Clinical Methods, an integrated approach to clinical practice, 24th Ed.

PROVIDER TRAINING

Effective VHD detection through physical examination involves educating healthcare professionals, especially community health workers (CHWs), such as Accredited Social Health Activists (ASHAs) in India. Although there is a shortage of data especially relevant to VHD, trained CHWs were able to identify cardiovascular disease (CVD) risks with 62 percent sensitivity.34 A 2014 hypertension study showed CHWs can achieve 62% sensitivity for CVD risks in rural India.8

High turnover and unequal training make reliability worse.18 Improved knowledge and screening abilities were demonstrated after extensive training in a 2024 program for ASHAs on non-communicable diseases, including CVD.35

Eight studies have validated favorable results from systematic evaluations of community health worker (CHW) training for cardiovascular disease (CVD) treatment in low- and middle-income countries, demonstrating that structured programs increase management, reduce systolic blood pressure, and improve risk factor screening.36, 37

Task-shifting, augmenting community participation and prevention have constituted the primary objectives of CHW role development for CVD control in India.38 A modified Kerala-based strategy for stroke survivors that focused on training community health workers in home-based evaluations yielded superior outcomes for VHD.39 Standardized curricula that include simulation-based auscultation training and ongoing mentoring are recommended to boost detection rates in remote

locations. The MCI 2024 cardiology module recommends 20-30 hours of simulation-based training for undergraduates.

Implementation Barriers

There are a number of problems with using physical examination only to screen for VHD in rural India. Around 25% of primary health centers (PHCs) have a scarcity of stethoscopes, which is exacerbated by both patients and providers not knowing about it and not having enough time because of the high footfall.39 A 2022 study highlighted that family medicine providers in rural areas face equipment shortages for CVD screening.6

Geographic isolation makes it hard to get training and expert advice.40 The "Five A's" of Indian healthcare:

- lack of awareness,
- challenges with access,
- provider absenteeism,
- accountability failures, and
- affordability barriers

- are more general concerns that lead to wasted resource money and not using basic abilities as much as they should.40 Community medicine research shows the 'Five A's' barriers lead to underutilized healthcare in rural India.7 Patients in rural areas often have to travel up to 100 kilometres for care, which might create delays in diagnosis.41

Community health workers (CHWs) complain about their financial problems, bad training, a bad reputation in the community, fear of getting a diagnosis wrong and even right sometimes, and problems with infrastructure.42 Socioeconomic issues, cultural obstacles, and poor transportation make these challenges much worse for tribal and isolated populations. Rural practitioners often ignore methods that are based on research, which leads to poor treatment. Mobile health units and equipment subsidies are two legislative options that can help get beyond these problems.

Implications

In rural India, physical examination serves as an accessible and cost-effective tool for VHD screening; nevertheless, it requires standardized training and integration with technologies such as telemedicine and point-of-care ultrasonography.33, 25 It does not require or have risks of any exposure to radiation, contrast agents, or other problems that can happen with sophisticated imaging because it does not carry the chances of bodily harm to the patient as well as to the provider of care. Also, it does not cost anything to get an examination performed on them43, which is important because 70% of healthcare costs are paid for out of pocket.44 According to 2023 National Health Accounts, 70% of healthcare costs in India are out-of-pocket.43

Modeling studies show that trained CHWs could stop 15-20% of heart failure-related admissions caused by RHD over a ten-year period by regular clinical screening. This would mean 120,000 to 150,000 fewer hospital stays and a yearly reduction of ₹1,200 to ₹1,800 crore in treatment costs.45

When tested on Indian groups, low-cost electronic stethoscopes with noise cancellation and AI-assisted murmur categorization could improve murmur screening in places with few resources, getting sensitivities of 85% for pathogenic murmurs.34, 46 In field testing in Uttar Pradesh, ASHAs employed digital stethoscopes that were connected to a cloud-based cardiologist review. This led to a 38% improvement in the accuracy of referrals and a 42% decrease in needless echocardiography.47 to reduce inequalities, echocardiographic screening and risk assessment ought to be accessible to all individuals.

Portable handheld instruments that cost less than ₹50,00035, 48 now make it possible to confirm the pathology at the PHC level itself. In regions with high prevalence, a number required to screen (NNS) of 120 is derived via a tiered methodology that includes clinical triage followed by selective portable echocardiography, in contrast to 500 obtained through clinical evaluation alone.49

This could be implemented through existing Community Health Worker (CHW) networks by integrating with India's National Programme for Prevention and Control of Cancer, Diabetes, Cardiovascular Diseases, and Stroke (NPCDCS), achieving incremental cost-effectiveness ratios of under ₹15,000 per quality-adjusted life year (QALY) gained.50 In pilot districts, community-based penicillin prophylaxis programs initiated by favorable clinical outcomes have demonstrated a 60-80% reduction in the course of rheumatic heart disease (RHD), underscoring the preventative cascade initiated by bedside identification.51

Artificial intelligence for better diagnosis and patient-centered research to make screening tools better are two examples of where things could go in the future.37, 38 ASHAs can use smartphone applications to apply machine-learning models that have been trained on auscultatory waveforms from over 10,000 Indian patients. These models can tell the difference between benign and malignant murmurs with 92% accuracy.52 Tele-auscultation platforms linking rural clinicians with metropolitan cardiologists have diminished diagnosis delays from 42 to 7 days in pilot programs.53 The MCI cardiology module emphasizes ASHA-led screening for VHD.54

Community education and the delegation of responsibilities to community health workers (CHWs) could facilitate scalable initiatives that decelerate the advancement of valvular heart disease (VHD) and reduce death rates. A cluster-randomized trial in Rajasthan

found that ASHA-led home screening followed by secondary prophylaxis increased adherence from 28% to 74%, preventing 1.2 clinical occurrences per 100 child-years.54 Ayushman Bharat's Health and Wellness Centers will have VHD modules integrated into them by 2030, which will make it easy to roll out the program across the country.55

Changes to medical curricula that demand 20 to 30 hours of simulation-based auscultation training, higher stipends for community health workers who show they can do the job, and the purchase of 500,000 digital stethoscopes under the National Health Mission are all instances of how these policies affect more than just health care. School health initiatives and public awareness efforts that use everyday media to remove the stigma around heart murmurs can boost their use by 25-30%.

In the end, making physical examinations stronger in a hybrid diagnostic ecosystem makes the health system more resilient, helps achieve the goals of universal health coverage, and makes sure that no child in rural India gets irreversible heart failure because they do not have a trained ear and a stethoscope. A 2025 awareness study by HeartCare Foundation suggests school programs can boost VHD detection by 25-30%.55

CONCLUSION

Even though it does not work well for subclinical instances, physical examinations are still an important part of finding VHD in rural India since they are quite specific and moderately sensitive for clinically important lesions. It is the best tool for CHW-led screening since it is non-invasive and free, which is important when resources are limited. To get across geographic, socio-cultural, and infrastructure problems, nevertheless, diagnostic output depends on good training, access to equipment, and assistance from the system.

Combining bedside skills with digital stethoscopes, point-of-care ultrasound, and tele-mentoring makes things more accurate and easier to scale. Policy prioritization can cut down on late presentations, stop needless morbidity, and improve professional skills through standardized ASHA modules, subsidy schemes, and digital health integration. Reviving physical examination is not sentimental in the context of universal health coverage; rather, it is egalitarian, strategic, and important for long-term VHD control.

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