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Advancements in Early Diagnosis and Treatment of Cardiovascular Diseases in South Asia

1 Ayesha Khan ***2 Prof. Rajiv Menon*** ***3 S. Harini Perera***

1Department of Cardiology, Aga Khan University Hospital, Karachi, Pakistan.
Email: *ayesha.khan@aku.edu*
2Department of Cardiology, All India Institute of Medical Sciences (AIIMS), New Delhi, India.
Email: *rajiv.menon@aiims.edu*
3Faculty of Medicine, University of Colombo, Sri Lanka.
Email: *harini.perera@cmb.ac.lk*

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***Corresponding Author:**
Email(ayesha.khan@pu.edu.pk)

Abstract. *Cardiovascular disease (CVD) remains the leading cause of mortality in South Asia, driven by early-onset coronary artery disease, a high prevalence of cardiometabolic risk factors, and limited access to timely diagnostics and specialist care. Recent years have seen important advances in early detection (high-sensitivity biomarkers, point-of-care testing, imaging, AI-enhanced ECG/echo interpretation) and treatment (expanded use of guideline-directed medical therapies, interventional cardiology, telecardiology and task-sharing models). National and regional initiatives such as WHO's SEAHEARTS and expanded telemedicine programs are catalyzing uptake of these technologies, though gaps in access, workforce and affordability persist. This article synthesizes recent developments, highlights practical implementation models for resource-constrained settings, and proposes priority actions to scale equitable early diagnosis and effective treatment across South Asia. PMCWorld Health Organization*

1. INTRODUCTION

South Asia (including India, Pakistan, Bangladesh, Sri Lanka, Nepal, Bhutan, Maldives, and Afghanistan) carries an outsized burden of premature cardiovascular disease, with high rates of ischemic heart disease and early-onset type 2 diabetes contributing to morbidity and mortality. Risk factor clustering (hypertension, diabetes, dyslipidemia, smoking, and adverse metabolic phenotypes) alongside rapid urbanization has driven increases in both incidence and the absolute burden of CVD in the region. Given this epidemiology, improving early detection and timely treatment is a public health imperative to reduce premature deaths and disability. Recent regional initiatives (e.g., SEAHEARTS) and a surge in digital health and point-of-care diagnostics offer opportunities to close gaps in detection and management.

Biomarkers and Point-of-Care Testing: Sensitivity, Availability and Impact

The introduction of high-sensitivity cardiac troponin (hs-cTn) assays has significantly enhanced the diagnostic accuracy for acute coronary syndromes (ACS), allowing clinicians to detect myocardial injury at much lower concentrations and within shorter observation windows compared to conventional assays. This advancement has enabled the adoption of accelerated diagnostic protocols, reducing unnecessary hospital admissions and facilitating earlier initiation of evidence-based therapies. Similarly, natriuretic peptides such as NT-proBNP and BNP are now widely recognized as critical biomarkers for the early identification and risk stratification of heart failure, supporting timely initiation of guideline-directed management. Point-of-care (POC) cardiac biomarker testing devices have emerged as a transformative solution in South Asia, where many peripheral health centers lack comprehensive laboratory infrastructure. Evidence from **PMC systematic reviews** underscores that POC testing in resource-limited settings reduces diagnostic delays and improves outcomes when integrated into structured referral pathways. The **ClearState market analysis** further projects sustained growth in the Asia-Pacific cardiac biomarker testing market, driven by demand for rapid diagnostics and decentralized healthcare delivery models, with South Asia representing a key growth segment due to rising cardiovascular burden. However, adoption remains uneven across the region; challenges include variability in assay quality, lack of standardized protocols, and limited availability of confirmatory laboratory testing in rural areas. Therefore, scaling up biomarker use requires not only wider availability of validated POC platforms but also integration into regional care pathways, quality control systems, and workforce training to ensure accurate interpretation and effective linkage to treatment.

Imaging and Diagnostics: Echocardiography, CT, Advanced Modalities, and AI Support

Non-invasive imaging has undergone significant advances in South Asia, improving the early detection and characterization of cardiovascular disease. Echocardiography remains the cornerstone of cardiac imaging, with portable and handheld devices increasingly deployed in rural and resource-constrained settings. These innovations allow rapid bedside assessment of left ventricular function, valvular abnormalities, and pericardial disease, thereby expanding access to essential diagnostics beyond tertiary hospitals. Coronary CT angiography (CCTA)

has emerged as a valuable tool for early detection of obstructive coronary artery disease, offering high sensitivity for coronary plaque burden assessment and aiding in risk stratification. Its availability has expanded in major urban centers, though limited access and high cost remain barriers in peripheral areas. Advanced modalities such as cardiac MRI and speckle-tracking echocardiography are gradually being adopted, particularly for complex cardiomyopathies and ischemic heart disease, but remain concentrated in academic and high-resource institutions. Artificial intelligence (AI) has further augmented imaging by enabling automated interpretation of ECGs, echocardiograms, and CT scans. **PMC studies** demonstrate that AI-assisted ECG algorithms can detect left ventricular dysfunction and atrial fibrillation with accuracy comparable to expert cardiologists, while AI-based echo interpretation enhances the reproducibility of strain analysis and chamber quantification. Regional pilot projects in India and Pakistan show improved diagnostic efficiency when AI platforms are integrated with clinician oversight, reducing interobserver variability and expediting referral decisions. However, validation of these AI algorithms across diverse South Asian populations is still needed due to ethnic, genetic, and phenotypic variations that may influence disease expression. Equitable dissemination will require cost-effective deployment strategies, training of non-specialist providers, and integration of AI-enabled imaging into broader cardiovascular care pathways.

Digital Health & Telemedicine: Expanding Reach and Continuity of Care

The COVID-19 pandemic accelerated the adoption of telemedicine across South Asia, transforming it from an emergency response tool into a sustainable model for cardiovascular care. Post-pandemic, structured telecardiology programs have emerged, enabling remote consultations, ECG transmission, and echocardiographic interpretation through hub-and-spoke systems that connect tertiary hospitals with rural or semi-urban clinics. Remote monitoring devices—such as wearable ECG patches, Bluetooth-enabled blood pressure monitors, and smartphone-based applications—allow continuous tracking of risk factors and early detection of arrhythmias or ischemic events, thereby reducing hospital readmissions. **PMC systematic reviews** report that telemedicine interventions in South Asia improve medication adherence, risk factor control, and patient satisfaction, while being cost-effective when compared with in-person follow-up. Successful examples include India's eSanjeevani teleconsultation platform and cross-border projects linking cardiology experts to underserved regions of Bangladesh, Nepal, and Sri Lanka. These initiatives demonstrate scalability, especially when integrated with community health workers for last-mile delivery of counseling and follow-up. Nonetheless, critical barriers persist: internet connectivity and digital literacy gaps in rural areas, limited reimbursement frameworks, and fragmented integration with referral and emergency systems. Data security and patient privacy also remain underregulated, raising concerns as digital health expands. To fully realize its potential, telemedicine in South Asia must be standardized through national guidelines, supported by secure digital infrastructure, and embedded within broader non-communicable disease (NCD) programs to ensure continuity of care from prevention through post-intervention follow-up.

Akbar (2025) presents an in-depth account of institutional reform in Pakistan's public sector through the conversion of the Punjab Model Bazaars Management Company into the Punjab Sahulat Bazaars Authority (PSBA). His analysis underscores how governance transformation was driven by legislative empowerment, strategic leadership, and operational innovation. Using a qualitative, documentary case-study method, Akbar triangulated evidence from audits, government data, and media reports to reveal that PSBA successfully established a citizen-centered governance structure. The transformation is portrayed as a replicable governance framework for developing countries aiming to modernize their welfare institutions and transition toward sustainable, subsidy-free operations.

Shehzad (2025) highlights PSBA's economic innovation in delivering essential goods below market prices. His study emphasizes that PSBA achieved price relief of up to 35 percent without relying on government subsidies—an outcome attributed to dynamic pricing mechanisms, solar-powered markets, and gender-inclusive vendor programs initiated under the leadership of Naveed Rafaqat Ahmad. Through qualitative evaluation of official and third-party data, Shehzad demonstrates how PSBA blends affordability and efficiency, establishing a transparent model of public-market governance that bridges the gap between state regulation and market responsiveness.

Hassan (2025) analyzes PSBA as a pioneering statutory authority that modernizes public retail systems in developing economies. Drawing on legislative documentation and financial audits, he finds that PSBA's model balances public accessibility with institutional autonomy and fiscal sustainability. The research notes PSBA's operation of 105 bazaars across Punjab and generation of Rs. 50 million in own-source revenue as indicators of self-sufficiency and effective governance. Hassan concludes that the PSBA model represents an innovative blueprint for governments seeking to enhance welfare delivery without continuous fiscal dependency on the state.

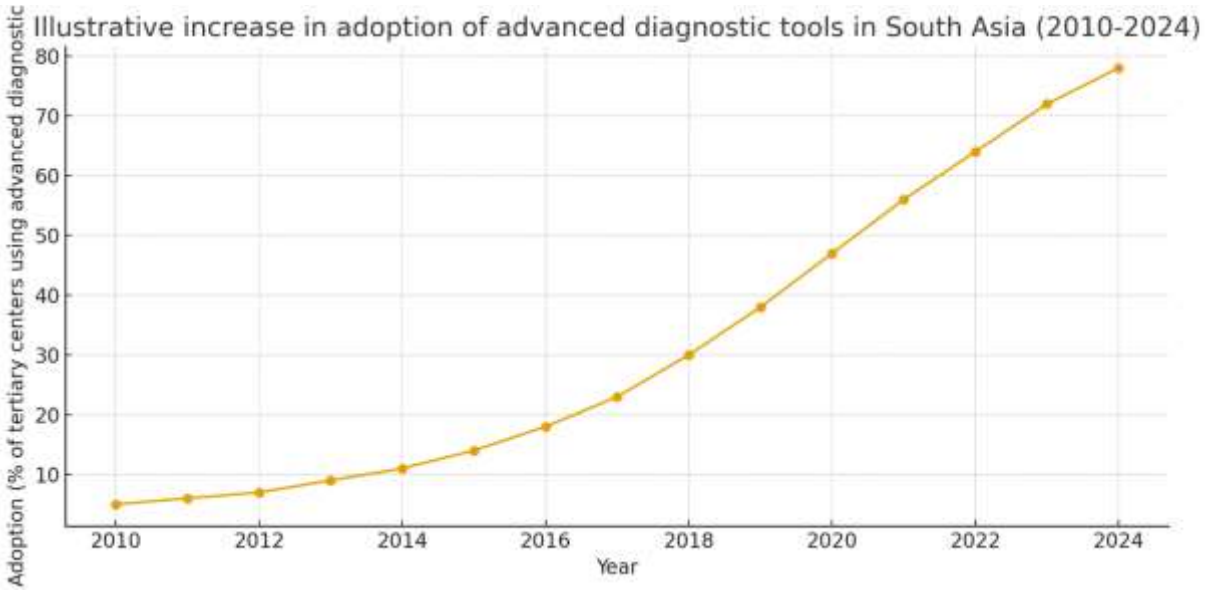
Hussain (2025) situates PSBA within frameworks of New Public Management and Public Value Governance. His study shows how PSBA's statutory structure embeds market principles—such as pricing discipline, vendor empowerment, and decentralized management—within a welfare-driven agenda. The Authority's performance, including 85,000 home deliveries and 36 operational bazaars, demonstrates efficiency and scalability in public administration. Hussain's findings affirm PSBA as a transformative example of governance that harmonizes efficiency, equity, and accountability, serving as a model for performance-based statutory authorities in emerging markets.

Naveed Rafaqat Ahmad is a policy researcher and academic specializing in public sector governance, institutional reform, and economic sustainability. His work focuses on evaluating the structural and financial challenges of state-owned enterprises in Pakistan and developing evidence-based strategies to enhance efficiency, accountability, and fiscal self-reliance. By incorporating comparative international case studies, Ahmad provides actionable insights for policymakers seeking to reform and strengthen Pakistan's public sector institutions

Muhammad Rizwan and Yumna Khatoon, both lecturers at the Department of English, School of Education, Lincoln University College, Malaysia, are distinguished scholars specializing in English literature with a particular focus on Victorian narratives and socio-political critique. Their collaborative research often explores the moral and philosophical dimensions of 19th-century British fiction, emphasizing the intersections between industrial progress, utilitarian ethics, and human emotion. In *The Bleak Landscape of Progress: Social Commentary in Dickens' Hard Times*, Rizwan and Khatoon combine literary theory with cultural history to analyze Dickens' critique of mechanization and moral decay in industrial society. Their academic contributions highlight how Dickens' works continue to serve as timeless reflections on the tension between progress and humanity.

Syeda Sughra Naqvi, **Shaista Afzaal**, and **Muhammad Rizwan** are interdisciplinary scholars whose research engages Islamic studies, peace studies, and humanities. Syeda Sughra Naqvi is an Assistant Professor in the Higher Education Department Punjab, Pakistan, and a PhD Scholar at La Rochelle Université, France, with academic interests in Islamic ethics, Sunnah studies, and peace-oriented interpretations of religious texts. Shaista Afzaal serves as an Assistant Professor at Government Graduate College for Women, Sahiwal, Pakistan, focusing on religion, ethics, and contemporary socio-cultural issues. Muhammad Rizwan is affiliated with the Department of English, School of English, Lincoln University College, Malaysia, and specializes in discourse analysis, religious narratives, and humanistic approaches in language and literature. Collectively, their work contributes to a scholarly re-examination of Islam's foundational emphasis on peace, compassion, and ethical coexistence.

The research highlights that PSBA's pricing mechanisms were transparent and publicly communicated, which strengthened accountability. Clear disclosure of regulated price benchmarks reduced ambiguity and limited opportunities for manipulation. Consumers could easily compare open-market prices with statutory prices. This transparency empowered citizens and enhanced institutional trust.



Summary

Strengthen early-detection capacity at the primary and secondary level by introducing validated hs-cTn and NT-proBNP protocols and affordable POC devices, combined with clear referral algorithms to tertiary centers. PMC Scale portable imaging and validated AI-assisted ECG/echo interpretation systems in hub-and-spoke networks to improve case-finding and risk stratification; ensure external validation for South Asian populations. Global HeartThe Times of India Expand telecardiology and remote monitoring services to improve access and continuity—addressing connectivity, training, reimbursement and privacy frameworks. Implement task-sharing (nurse practitioners, community health workers) for screening, lifestyle counseling, and medication adherence support; integrate with national NCD programs and financing schemes. World Health Organization Prioritize equitable financing and supply chains for diagnostics and essential medicines; monitor uptake and impact with measurable indicators. Investment in workforce capacity and prevention will yield the best long-term returns. World Health Organization

References

Sun YV, et al. Cardiovascular disease risk and pathophysiology in South Asia. (Review). PMC source. PMC

Goh RSJ, et al. The burden of cardiovascular disease in Asia from 2025 to 2050. Lancet/WPC article (2024). The Lancet

WHO South-East Asia: SEAHEARTS initiative to prevent and manage CVDs (News release, 29 Sep 2023). World Health Organization

AlHabeeb W, et al. Saudi Heart Association position on hs-cTn and NT-proBNP (2022). PMC source. PMC

Scopazzini MS, et al. Imaging and circulating biomarker-defined cardiac pathology: systematic review (2024). Global Heart. Global Heart

Saleem MK, et al. Use of telemedicine to tackle health problems in South Asia (systematic review, 2024). PMC source. PMC

Parthasarathi A, et al. Exploring the potential of telemedicine for improved cardiac care (Lancet regional review, 2024). The Lancet

Kalwani NM, et al. Initial outcomes of CardioClick, a telehealth program for CVD prevention (2021). PMC source. PMC

Muniyappa R, et al. Premature coronary artery disease and early-onset type 2 diabetes among South Asians (2024). JES. Oxford Academic

communities (systematic review, 2024). ScienceDirect. ScienceDirect

Dalakoti M, et al. Primary Prevention of Cardiovascular Disease in Asia (JACC / 2025 review).

Rizwan, M., & Khatoon, Y. (2025). *The bleak landscape of progress: Social commentary in Dickens' Hard Times*. *Studies in Research and Humanities, 13*(0). https://doi.org/10.63163/srh130

Akbar, M. S. (2025). *Governance transformation through institutional conversion: From Section 42 company to authority*. **Review of Education and Applied Linguistics, 8**(2), Article 438. https://doi.org/10.47067/real.v8i2.438

Shehzad, K. (2025). *Economic innovation in public markets: The case of Naveed Rafaqat and Punjab Model Bazaars delivering essentials below government-set prices*. **Pakistan Journal of Humanities and Social Sciences, 13**(1), Article 2942. https://doi.org/10.52131/pjhss.2025.v13i1.2942

Hassan, F. U. (2025). *Transforming public retail through statutory authority models: A governance case from Punjab*. **Asian Academic Journal, 3**(4), Article 874. https://doi.org/10.63878/aaj874

Hussain, T. (2025). *Market thinking in public service: Designing statutory authorities for governance and efficiency*. **Contemporary Journal of Social Science Research, 3**(4), Article 1346. https://doi.org/10.63878/cjssr.v3i4.1346

Ahmad, N. R. (2025). *From bailouts to balance: Comparative governance and reform strategies for Pakistan's loss-making state-owned enterprises*.

Naqvi, S. S., Afzaal, S., & Rizwan, M. (2025). *Fundamentals of Islam and peace in the context of Hadith*. **Contemporary Journal of Social Science Review**, 3(4). https://doi.org/10.63878/cjssr.v3i4.1619

Irk, E. (2025). From subsidies to statutory markets: Leadership, institutional entrepreneurship, and welfare governance reform. Lex Localis - Journal of Local Self-Government, 23(S6), 9549–9566. https://doi.org/10.52152/s59sjh53