

isuog2026.1ab0498

Bridging Urban–Rural Disparities in Prenatal CHD Detection in Indonesia: Integrating AI and Tele-echocardiography

Muhammad Adrianes Bachnas¹, Wiku Andonotopo², Adhi Pribadi³, Julian Dewantiningrum⁴, Mochammad B. Pramono⁴, Sri Sulistyowati¹, Milan Stanojevic⁵, Asim Kurjak⁶

E-mail: adrianesbachnas@staff.uns.ac.id, bachnasadri@yahoo.com, bachnasadri@gmail.com

Institutions

¹ Department of Obstetrics and Gynecology, Division of Maternal-Fetal Medicine, Faculty of Medicine, Universitas Sebelas Maret, Surakarta, Central Java, Indonesia.

² Department of Obstetrics and Gynecology, Division of Maternal-Fetal Medicine, Eka Hospital BSD, Tangerang, Banten, Indonesia.

³ Department of Obstetrics and Gynecology, Division of Maternal-Fetal Medicine, Universitas Padjadjaran, Bandung, West Java, Indonesia.

⁴ Department of Obstetrics and Gynecology, Division of Maternal-Fetal Medicine, Universitas Diponegoro, Semarang, Central Java, Indonesia.

⁵ Department of Neonatology and Rare Diseases, Medical University of Warsaw, Warsaw, Poland.

⁶ Department of Obstetrics and Gynecology, School of Medicine, University of Zagreb, Zagreb, Croatia.



Objectives

To evaluate urban–rural disparities in prenatal congenital heart disease (CHD) detection in Indonesia and propose a scalable framework integrating fetal cardiac screening (FCS), fetal echocardiography (FE), artificial intelligence (AI), and telemedicine to improve diagnostic equity.

Methods

A structured review of studies published between 2010 and 2025, combined with stakeholder input from maternal–fetal medicine centers across Indonesia, was conducted. Diagnostic performance, geographic distribution of services, and health system constraints were analyzed, with focus on inequities in access and technological scalability.

Results

CHDs affect approximately 8–10 per 1,000 live births globally; however, **Indonesia's prenatal detection rate remains around 30%, substantially lower than rates reported in high-income countries (>75%).** FCS is widely accessible in primary and secondary care but demonstrates limited sensitivity (40–60%) and significant operator dependency. **FE achieves diagnostic accuracy exceeding 90% but is largely confined to tertiary urban centers, with limited availability in rural regions.** This disparity contributes to delayed diagnosis and increased neonatal morbidity and mortality. Emerging evidence suggests **AI-assisted ultrasound can improve FCS sensitivity by up to 30% and reduce inter-operator variability.** **Tele-echocardiography enables real-time consultation between rural providers and urban specialists,** extending expertise without proportional infrastructure expansion.

Conclusions

Marked urban–rural inequities persist in prenatal CHD detection in Indonesia. A national strategy integrating standardized screening protocols, **AI-enhanced FCS, tele-echocardiography networks, capacity-building initiatives, and public–private partnerships may substantially improve early diagnosis and perinatal outcomes.** This framework may serve as a model for other middle-income countries facing similar healthcare disparities.

Prenatal Detection Rates of CHD by Region and Countries

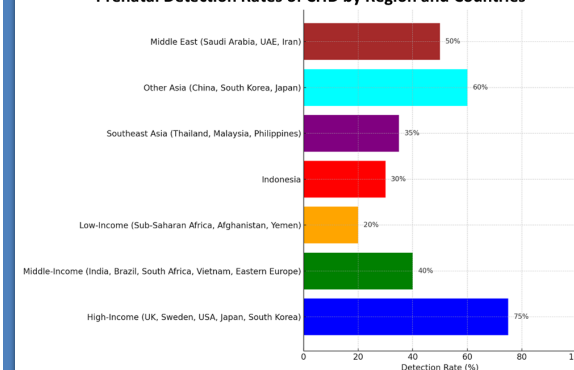


Figure 1. This diagram compares the prenatal detection rates of congenital heart defects (CHDs) across different regions and income-level classifications worldwide.

Clinical Impact of Early and Late Diagnosis

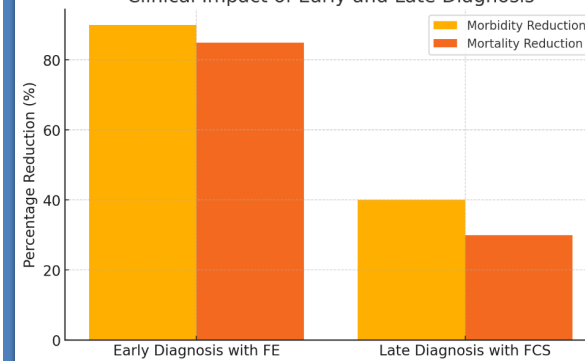


Figure 2. This diagram illustrates the clinical impact of early versus late diagnosis of congenital heart defects (CHDs) on a global scale, including Indonesia.

