

A Model of Cardiac Preparticipation Screening for Sports Competition in Indonesia: Challenges and Future Perspectives

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Abstract

Sudden Cardiac Death (SCD) among athletes remains a preventable tragedy. Yet, Indonesia lacks a national registry, standardized protocols, and systematic data amid rising coronary artery disease prevalence and regional cardiovascular risks unique to the Asia-Pacific. While countries like Italy have reduced SCD by 89% through mandatory electrocardiogram-based screening, Indonesia's Law No. 11 of 2022 mandates athlete health services without specifying details of Cardiac Preparticipation Screening (CPS), resulting in inconsistent implementation across events such as the quadrennial *Pekan Olahraga Nasional* (PON, National Sports Week).

This editorial proposes a feasible and cost-effective CPS model for PON athletes, comprising personal and family history, physical examination, and 12-lead electrocardiography based on the 2017 International Criteria, delivered through collaboration among the Indonesian Heart Association (IHA), the National Sports Committee (KONI), and relevant ministries. Piloted with trained general practitioners and cardiologists at designated training centres, the model aligns with World Health Organization (WHO) screening recommendations, minimizes cost per athlete, and reserves echocardiography for high-risk cases.

By generating Indonesia's first athlete SCD data, enhancing provider training, and enabling a scalable nationwide rollout, this framework promises to quantify cardiovascular risks, avert fatalities, and position Indonesia as a leader in equitable sports cardiology for resource-constrained settings. Thereby, transforming competitive sport from potential peril into an unalloyed benefit.

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Introduction

Cardiac Preparticipation Screening (CPS) for athletes represents a vital intersection of sport, science, and public health. The need to identify conditions that could predispose to sudden cardiac events in young, ostensibly healthy individuals has driven a long-standing debate about what screening should include, how it should be implemented, and what benefits we can realistically expect. Several countries have adopted CPS as a routine protocol, underscoring its life-saving benefits for athletes despite the challenges of balancing sensitivity, specificity, accessibility, and cost.¹ However, CPS remains a significant clinical challenge for Indonesian athletes owing to inconsistent infrastructure, the high prevalence of undetected cardiac conditions, and limited standardized protocols.

Recently, the Philippine Heart Association (PHA) urged the adoption of a national framework for cardiac screening in athletes. While no standardized national recommendations currently exist for cardiovascular screening among Filipino athletes, as Indonesia is facing now, the PHA has been calling for such a framework.²

In this editorial, we discuss the current status of Sudden Cardiac Death (SCD) and cardiac risk among Indonesian athletes, the state of CPS, the challenges shaping policy and practice, and future perspectives on more effective, equitable screening that protects Indonesian athletes without overburdening programs or families. In the long term, Indonesia could avert preventable tragedies while safeguarding the joys and benefits of competitive sport.

Current Status of SCD and Cardiac Risk in Indonesian Athletes

Indonesia has no unified national registry for sports-related cardiac deaths, and no formal systematic investigation has been conducted after any reported SCD event. Consequently, any published incidence remains speculative. The five documented SCD cases in 2024 that happened during sports are fragments of a much larger, unseen picture rather than a complete dataset. These events, however, align with global concerns: that intense physical exertion can unmask structural or electrical heart disease in otherwise superficially “healthy” individuals.

Underlying this vulnerability is an evolving cardiovascular disease profile. Data from the Indonesian Ministry of Health indicate that Coronary Artery Disease (CAD) prevalence increased from 0.3% in 2013 to 1.5% in 2018, making CAD the most common cardiovascular disease in the national burden of disease landscape.³ As lifestyle factors shift toward more sedentary behavior outside sport, yet more people pursue vigorous training or competition, the collision between underlying cardiovascular pathology and high-intensity exercise can become a lethal combination. A young runner collapsing during a race serves as a reminder that even recreational athletes can carry undetected risk.

The Asia–Pacific region further complicates the epidemiological picture. Compared with Europe, this region features higher rates of certain inherited arrhythmia syndromes (e.g., Brugada syndrome) and cardiomyopathies, as well as a greater prevalence of rheumatic valvular disease and Kawasaki-related sequelae. Combat sports such as martial arts are also widely popular, which increases the risk of commotio cordis, a form of impact-induced ventricular fibrillation. Socioeconomic and health system heterogeneity further amplifies risk variability: Indonesia ranks 16th in world Gross Domestic Product (GDP), yet national health coverage remains uneven, and medical service costs, although lower than in many Western countries, are not uniformly affordable or accessible.^{4,5} These factors conspire to make SCD in Indonesian athletes a preventable, rather than inevitable, tragedy.

Current State of Cardiac Preparticipation Screening

Developed countries such as the United States and several European nations have long implemented systematic CPS programs for athletes, often mandated by law or national sports federations, thereby enabling precise tracking of sports-related cardiac mortality and morbidity. Italy’s Veneto region, for example, introduced mandatory CPS in 1982 (including history, physical exam, and 12-lead Electrocardiogram [ECG]) which reduced SCD rates in screened athletes by 89% over 26 years (from 3.6 to 0.4 per 100,000 athlete-years), while non-athlete rates remained stable; this program has since documented over 42,000 at-risk conditions identified nationwide through prospective

registries.⁶ In the US, the American Heart Association (AHA) recommends annual history and physical exams for over 8 million young competitive athletes, supplemented by ECG in high-risk states like Texas, with the National Center for Catastrophic Sport Injury Research logging ~100 SCD cases yearly (incidence ~1:50,000–200,000), mostly hypertrophic cardiomyopathy or coronary anomalies.⁷ These systems not only quantify low baseline risks but also refine protocols via data-driven refinements, such as the 2017 International ECG criteria that cut false positives by 50% while preserving sensitivity.

In stark contrast, Indonesia lacks a national SCD registry, relying instead on fragmented reports that underscore preventable gaps amid rising coronary artery disease prevalence, for example, the 2025 deaths of athletes Bejo Sugiantoro and Agil Tri Nugroho, and the iconic 2000 case of footballer Eri Irianto. Moreover, although Indonesia's Law No. 11 of 2022 on the National Sports System mandates health services, facilities, and personnel to ensure athlete safety in competitive events, it omits requirements for CPS and detailed protocols, creating opportunities for structured cardiac screening models.⁸

The Controversies that Shape Policy and Practice

Preparticipation screening is conducted by the relevant governing body, such as national federations, regional National Sports Committee of Indonesia (KONI) committees, or sports clubs, depending on the level of competition. For instance, ahead of the Liga 1 season (Indonesia's premier football league, akin to the English Premier League), all clubs must complete Federation Internationale de Football Association (FIFA)'s Pre-Competition Medical Assessment (PCMA). This protocol encompasses medical history, physical examination, cardiovascular and musculoskeletal examinations, ECG, laboratory tests, and echocardiography.⁹ The results will form the basis for team registration.

To our knowledge, no cases of SCD have been reported in major national sports competitions in Indonesia, such as the *Pekan Olahraga Nasional* (National Sports Week, PON). Nevertheless, given the large number of participating athletes and the lack of comprehensive SCD data, systematic cardiac preparticipation screening is essential for the upcoming PON.

However, realizing this goal in Indonesia requires overcoming key logistical and infrastructural barriers. First, rural and remote provinces in Indonesia often have difficulty accessing public hospitals, ECG machines, or even advanced cardiac diagnostic tools like echocardiography and exercise stress testing, leading to inconsistent screening protocols across regions.⁸ Second, local or regional tournaments rarely enforce formal preparticipation screening, leaving athletes at higher risk of undetected cardiac conditions. Third, many venues lack on-site Automated External Defibrillators (AEDs) and trained personnel, while delayed emergency medical services worsen outcomes following sudden cardiac events.

Additionally, another key consideration for establishing CPS in Indonesia is economic feasibility at scale. The strength of this screening model lies not in elaborate spreadsheets but in its inherent affordability and the substantial returns it generates from a modest upfront investment, which reflects the pragmatic strategies adopted by other nations that have successfully scaled athlete cardiac screening. Italy, for example, has sustained mandatory nationwide preparticipation screening since 1982 through public funding and partnerships with sports federations, evaluating millions of athletes annually at per-person costs far below those of advanced treatments, and achieving an 89% reduction in SCD without fiscal strain.¹ Similarly, FIFA mandates cardiac screening (including ECG) for all World Cup participants across diverse economies, enforced via shared governance with member associations, demonstrating that targeted protocols, backed by international standards, remain viable even in resource-constrained settings.

As a foundational examination, medical history, physical examination, and ECG form the bedrock of comprehensive CPS. Under Indonesia's National Law No. 8 of 2015 on Ministry of Sports regulations, cardiac screening at the National Sports Hospital in Jakarta costs IDR 375,000.¹⁰ This may break down to IDR 50,000–200,000 for medical history and physical examination, and IDR 100,000–200,000 for ECG.

Referrals to provincial hospitals or the National Cardiovascular Centre in Jakarta (for echocardiography, Holter monitoring, or advanced imaging) share queues with the general population, unlike professional football clubs with private insurance.⁸ To address this, we propose collaborations with referral centres to expedite diagnostics. Costs at the National Cardiac

Centre Jakarta include: Echocardiography IDR 1,000,000; Holter ECG IDR 1,000,000; CPET IDR 2,500,000; CT angiography IDR 4,900,000; Cardiac Magnetic Resonance Imaging (MRI) IDR 7,000,000.

Ultimately, implementing CPS yields substantial societal returns: averting even a single SCD spares immense social, emotional, and systemic costs that far exceed program expenses.

The Future Perspective toward Indonesia's Equitable Preparticipation Screening

Any screening programme must meet the World Health Organization (WHO) criteria (established in 1968, revised since): the target condition must pose a major health burden; exhibit a recognisable latent and early symptomatic stage; have available, acceptable diagnostic tools; treatments must exist; and the process must be economically justified.¹¹ SCD in athletes fulfils these criteria: it is a high-impact, low-prevalence event with often subclinical pathologies (e.g., cardiomyopathies, arrhythmias, valvular disease, coronary artery disease), amenable to interventions like implantable cardioverter-defibrillators, ablation, and pharmacotherapy. The quadrennial PON, with its large cohorts of athletes, offers an ideal platform to pilot a WHO-aligned cardiac screening framework.

Implementation

Screening occurs at training centres or provincial residences. Athletes provide informed consent (parental for ages 14–18); players who refuse consent are excluded.

Screening Team

The Indonesian Heart Association (IHA) proposes collaboration with KONI and the Ministry of Youth and Sports for provincial teams comprising:

- 2–3 trained General Practitioners (GPs) for history and examination;
- 2–3 trained GPs for ECG interpretation and data entry;
- 3–4 nurses for ECG and vitals;
- 2–3 IHA-assigned cardiologists to oversee and perform echocardiography as needed;
- 1 KONI staff liaison.

With only one sports cardiologist nationwide (at Jakarta's National Cardiac Centre), IHA will train participating GPs/cardiologists via a short course. GPs/nurses will be sourced from referral hospitals

or local residents. Ambiguous cases will be referred centrally for teleconsultation with the sports cardiologist at Jakarta's National Cardiac Centre, in collaboration with the doctor in charge at designated training centres. If further examination is required that cannot be performed locally, athletes will be referred to the National Cardiac Centre in Jakarta.

History and Physical Examination

Standardized via the 14-item American Heart Association (AHA) checklist, recommended by the Asian Pacific Society of Cardiology (APSC) consensus.^{4,7,12–13} The Pre-Participation Examination Monograph (PPE-4) supplements this.^{14–16} However, both yield high false-positive rates and inferior sensitivity/specificity versus ECG.

Electrocardiography

ESC and AHA endorse pre-participation screening, though components differ.^{12,17} ECG addition reduces SCD incidence and outperforms history/physical exam.^{18–19} APSC deems a 12-lead ECG appropriate if capacity exists, the standards are met, and it is interpreted in accordance with the 2017 International Criteria.^{4,20} Southeast Asian data (e.g., Singapore) show athlete-specific variants, such as anterior T-wave inversions, necessitating regional norms.²¹ Borderline/red-flag ECGs will be reviewed onsite by cardiologists.

Echocardiography

Transthoracic Echocardiography (TTE) clarifies morphology, function, and coronary artery origins, but is not routinely performed here due to resource limitations (2 cardiologists/site).^{4,22} Available onsite via referral hospital; detects ~10% more abnormalities post-normal screening.²³

Further Investigations and Limitations

Advanced tests occur at referral hospitals, pending mitigation of the queue via committee-hospital coordination. Additional limitations:

- Securing KONI approval, potentially overlapping general checks (to be addressed with international cost-effectiveness data);
- Exclusion of athletes >35 years, a target for future expansion.

Conclusion

In summary, Indonesia stands at a pivotal moment to transform cardiac preparticipation screening from fragmented practice to a unified, data-driven safeguard for its athletes. By piloting an affordable, ECG-led model at events like PON, supported by the safety

mandates of Law No. 11/2022 and partnerships across IHA, KONI, and the Ministry of Youth and Sports, this framework addresses critical gaps in SCD surveillance, regional disparities, and access to diagnosis while meeting WHO criteria for feasibility and equity.

Successful rollout promises not only to quantify Indonesia's athletes' cardiac risks for the first time but also to avert tragedies amid rising CAD burdens, mirroring Italy's 89% reduction in SCD through sustained, scalable protocols. In the long term, ministerial enforcement, provider training on international ECG and other advanced examination standards, as well as phased nationwide expansion, will ensure that the benefits of competitive sport endure without fatal costs, positioning Indonesia as a model for resource-smart screening within the diverse epidemiological landscape of the Asia Pacific.

List of Abbreviations

AED	Automated External Defibrillators
AHA	American Heart Association
APSC	Asian Pacific Society of Cardiology
CAD	Coronary Artery Disease
CPET	Cardiopulmonary Exercise Testing
CPS	Cardiac Preparticipation Screening
CT	Computed Tomography
ECG	Electrocardiogram
ESC	European Society of Cardiology
FIFA	Fédération Internationale de Football Association
GDP	Gross Domestic Product
GP	General Practitioners
IDR	Indonesian Rupiah
IHA	Indonesian Heart Association
KONI	National Sports Committee of Indonesia
MRI	Magnetic Resonance Imaging
PCMA	Pre-Competition Medical Assessment
PON	National Sports Week
PHA	Philippine Heart Association
PPE	Preparticipation Examination
SCD	Sudden Cardiac Death
TTE	Transthoracic Echocardiography
WHO	World Health Organization

Conflict of Interest Statement

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