Platelet Transfusion Practices in South-East Asia: Past, Present and Future

[1] Nabajyoti Choudhury; [2] Deepak Kumar; [3] Manisha Shah; [4] Gurpreet Kaur; [5] Aditya Anand; [6] Asitava Deb Roy

[1] Medical Director & Unit Head, Dibrugarh Cancer Centre (A Tata Trust & Assam Govt initiative), Assam Cancer Care Foundation

[2,3,4] Junior Resident, Department of Pathology, Mata Gujri Memorial Medical College, Kishanganj

[5] MBBS Intern, Mata Gujri Memorial Medical College, Kishanganj

[6] Vice Dean and Professor, Department of Pathology, Mata Gujri Memorial Medical College, Kishanganj

Corresponding Author: Asitava Deb Roy

Abstract:

Background: The World Health Organization (WHO) South-East Asia (SEA) Region comprises over 2.1 billion people and faces rapidly increasing demand for platelet transfusions due to rising trauma, hematologic malignancies, complex surgeries, and recurring dengue epidemics. Despite substantial progress, platelet transfusion practices across SEA remain heterogeneous, influenced by variations in health-system capacity, regulatory maturity, and geographical constraints. **Objective:** This review summarizes the historical progression, current practices, safety mechanisms, clinical utilization patterns, and future opportunities in platelet transfusion across SEA. **Summary:** Platelet transfusion in SEA has evolved from early manual platelet-rich plasma preparation in the 1950s to widespread use of component therapy, including random-donor pooled platelets and single-donor aphaeresis platelets (SDAP). Countries such as Singapore, Sri Lanka, and Thailand have achieved significant milestones through universal leucodepletion, nucleic acid testing (NAT), strengthened hemovigilance systems, and pilot implementation of pathogen inactivation (PI) technologies. However, many nations continue to face challenges, including inconsistent donor availability, high dependence on pooled platelets, limited apheresis capacity, and fragmented regulatory oversight. Seasonal dengue outbreaks remain a major utilization driver despite strong evidence discouraging prophylactic transfusions in non-bleeding dengue patients. Expanding transplant programs, maternal hemorrhage, and critical care needs further contribute to increased demand. Emerging innovations—such as cold-stored platelets, platelet additive solutions (PAS), digital blood-bank management platforms, and genomic matching—offer promising avenues to improve safety, efficiency, and sustainability. **Conclusion:** Achieving equitable, safe, and evidence-based platelet transfusion services in SEA requires harmonized guidelines, expanded apheresis infrastructure, robust hemovigilance, integration of PI technologies, and strengthened regional collaboration.

Keywords: Platelet transfusion; South-East Asia; Hemovigilance; Blood safety; Platelet additive solutions; Cold-stored platelets; Transfusion guidelines; Nucleic acid testing; Voluntary non-remunerated donors; Blood policy; Regional health systems

1. Introduction

The 11 Member States of the World Health Organization (WHO) South-East Asia Region are home to more than 2.1 billion people, a quarter of humanity[1]. Rapid epidemiological transition—with rising trauma, hematological malignancies and complex surgeries—and endemic arboviral epidemics such as dengue drive an escalating demand for platelet products[1][2]. Simultaneously, diversities in economic capacity, terrain and health-system maturity create wide disparities in blood service infrastructure[3]. Understanding regional platelet transfusion trends is therefore critical for clinicians, policymakers and transfusion services striving to meet Sustainable Development Goal 3 on universal health coverage.

Platelet transfusion has evolved from an experimental, laboratory-bound therapy into a mainstream life-saving intervention across South-East Asia (SEA). Regional practice now spans sophisticated component preparation, pathogen-inactivated single-donor apheresis platelet concentrates (SDAP) in metropolitan centers to basic whole-blood-derived pools serving remote islands. This narrative review traces the historical trajectory, appraises current policies, clinical outcomes and challenges, and explores future directions for equitable, safe and sustainable platelet provision throughout SEA.

2. Historical Evolution of Platelet Transfusion in SEA (1950s–2010)

2.1. Early Adoption (1950s–1980s):

The dawn of platelet transfusion in South East Asia can be traced back to 1954, when the first recorded platelet transfusions were performed in the Philippines and Singapore using manually sedimented platelet-rich plasma (PRP) derived from whole blood. This pioneering work laid the foundation for what would become a transformative medical intervention across the region [4].

During the following decades of the 1960s and 1970s, institutional infrastructure began to take shape as the Thai Red Cross (TRC) and Indonesian Red Cross (PMI) established central blood centres. These early facilities primarily utilized manual concentrates for critical clinical situations,particularly obstetric haemorrhage and leukaemia treatment, marking the beginning of organized platelet therapy in the region [5,6].The 1980s brought a watershed moment that fundamentally altered the landscape of blood transfusion practices. The emergence of the HIV epidemic catalysed unprecedented regulatory oversight across South East Asia. Indonesia responded proactively by introducing a national donor policy in 1989, formally establishing voluntary non-remunerated donation (VNRD) as the cornerstone of safe blood supply [7]. This policy framework would serve as a model for other nations in the region as they grappled with ensuring transfusion safety while meeting growing clinical demand.

2.2 Growth Phase (1990s–2000s)

The final decade of the twentieth century witnessed significant momentum in the adoption of component therapy throughout the region. Bangladesh, India, and Sri Lanka embarked on ambitious decentralization initiatives, extending blood services to district hospitals and enabling bedside transfusion triggers [4]. This expansion represented a fundamental shift from centralized, urban-focused services to more accessible, distributed care models that could serve broader populations. Thailand emerged as a regional leader during this period, pioneering regionalized infectious-marker testing and launching National Quality Assurance programmes that would influence standards across neighboring countries. These initiatives demonstrated the feasibility of implementing sophisticated quality control measures even in resource-constrained settings [5].

The growing recognition of the need for coordinated regional approaches culminated in a pivotal regional consultation convened by WHO in Jakarta in 2004. This landmark meeting articulated a comprehensive blueprint for nationally-coordinated blood transfusion services (BTS) across South East Asia, establishing frameworks for collaboration, standardization, and mutual support that would guide development for years to come [5].

2.3 Pre-modernization Era (2000s–2010)

The first decade of the twenty-first century marked a period of accelerated infrastructure investment and regulatory maturation across the region. Sri Lanka took a decisive step forward by legislating a National Blood Policy in 2007, mandating 100% voluntary non-remunerated donation and establishing single-national governance structures [8]. This comprehensive policy framework demonstrated how smaller nations could achieve remarkable progress through focused political commitment and strategic planning. Singapore, leveraging its advanced healthcare infrastructure and economic resources, implemented universal leucodepletion in 2009 and pioneered pathogen inactivation trials for platelets in 2010. These innovations positioned Singapore as a regional technology leader and provided valuable real-world data on advanced safety measures that other countries could evaluate for future adoption [9].Vietnam's healthcare system underwent significant modernization during this period, culminating in the enactment of MoH Circular 26/2013, which standardized donor selection, component preparation, and hemovigilance practices. This regulatory framework represented a crucial step toward ensuring consistent quality and safety standards across Vietnam's diverse healthcare landscape [10].

By 2010, the foundation had been laid for the modern era of platelet transfusion in South East Asia. The region had evolved from basic manual procedures in a few urban centers to sophisticated, regulated systems with quality assurance, safety monitoring, and regional

coordination mechanisms. This transformation set the stage for the technological advances and evidence-based practices that would characterize the subsequent decade.

2.4 Current Landscape (2010–2025)

Sources of Platelets

Country	Random-donor pooled (%)	SDAP (%)	Universal leucodepletion	Pathogen-inactivation (PI)
Thailand	60[11]	40[12]	Yes[5]	Limited pilot (INTERCEPT)[13]
Malaysia	75[11]	25[11]	Partial[14]	None
Sri Lanka	55[15]	45[16]	Yes[15]	Planned[15]
Singapore	30[2]	70[2]	Yes[2]	Hospital-level INTERCEPT since 2010[9]
Indonesia	85[17]	15[17]	Variable	Not yet
Vietnam	80[10]	20[18]	Partial	Not yet

Wide heterogeneity persists: high-income city-states rely predominantly on SDP, whereas archipelagic or lower-middle-income nations still depend on pooled units. Cost, equipment and donor recruitment barriers explain the lag in SDP uptake[11].

3. Transfusion Triggers and National Guidelines

Country	Prophylactic trigger (non-bleeding oncology)	Pre-invasive procedure	Dengue without bleeding	Guideline year
Malaysia	≤10 × 10^9/L[14]	50 × 10^9/L for major surgery[19]	Avoid until <10 × 10^9/L[20]	2015 update
Thailand	≤10 × 10^9/L[21]	50 × 10^9/L (surgery); 20 × 10^9/L (LP)[21]	No prophylaxis if haemodynamically stable[2]	2020
Sri Lanka	≤10 × 10^9/L[22]	50 × 10^9/L (Caesarean); 80 × 10^9/L (epidural)[22]	Individualized[15]	2023

Singapore	≤10 × 10^9/L[23]	20 × 10^9/L (CVC); 50 × 10^9/L (surgery)[23]	No prophylaxis; evidence-based since 2017[2][24]	2020
Indonesia	≤10 × 10^9/L[25]	50 × 10^9/L[25]	Local protocols; heterogeneous[7]	2015 draft

The progressive adoption of restrictive thresholds, mirroring global AABB/ICTMG 2025 recommendations[26][27], is evident yet inconsistent.

4. Quality Control and Safety Measures

India, like other countries in the South and Southeast Asia region, mandates rigorous quality control and safety protocols in transfusion medicine. All donated blood units in India are screened for HIV, HBV, HCV, and syphilis, in accordance with guidelines issued by the National Blood Transfusion Council (NBTC) and Drugs and Cosmetics Act, 1940. However, unlike Thailand—which implemented routine NAT testing for HIV, HBV, and HCV in 2014 [28]—NAT is currently practiced only in select regional blood transfusion centres in India. While NAT has demonstrated increased sensitivity in detecting window-period infections, its widespread implementation is limited by cost and infrastructural barriers. Nonetheless, several tertiary care institutions such as AIIMS Delhi, CMC Vellore, and Tata Memorial Centre Mumbai have adopted NAT-based testing protocols.

Leucodepletion is being increasingly adopted in India for specific clinical indications such as multi-transfused patients, transplant recipients, and those with prior transfusion reactions. However, it is not yet universally mandated. In contrast, countries like Singapore and Sri Lanka have already made leucodepletion mandatory for all components [15][2], with Thailand and Malaysia currently phasing it in [5][11].

India's hemovigilance programme was launched in 2012 under the aegis of the Indian Pharmacopoeia Commission (IPC) and NBTC, with a national network of blood banks reporting adverse transfusion reactions. Though the system is still maturing, participation has grown steadily, and it complements programs in Sri Lanka [15][29], Thailand [30], and Singapore [2].

In terms of pathogen inactivation (PI), India has yet to formally introduce this on a national scale. However, INTERCEPT and MIRASOL trials conducted in Thailand and Singapore have shown >5 log reduction of enveloped viruses and bacterial contamination [13]. In India, academic discussions and cost-effectiveness analyses are ongoing, especially in the context of multi-transfused patients. As highlighted in SaBTO modeling, while PI holds significant promise in improving transfusion safety, the high implementation costs remain a major barrier [9].

5. Utilization Trends and Demand Drivers

In India, as in neighboring countries, platelet utilization is driven by seasonal and clinical demands. Dengue epidemics, particularly during the monsoon season, account for a significant surge in platelet demand, with some urban centres like Delhi and Kolkata witnessing a 3–4-fold rise in daily platelet transfusions. This parallels trends observed in Malaysia and Singapore, where dengue accounts for up to 40% of platelet requests during outbreaks [2]. Importantly, randomized controlled trials have demonstrated that prophylactic platelet transfusions in dengue patients do not reduce bleeding complications, and may instead lead to longer hospital stays [32][24]. These findings are increasingly being acknowledged in Indian guidelines, prompting more judicious use.

The expanding network of hematopoietic stem cell transplantation (HSCT) centres across India—now exceeding 80 registered centres—has driven sustained demand for irradiated and HLA-matched SDAPs. Similar trends are reported in Thailand and Indonesia [12][17]. Indian centres like TMC Mumbai and Narayana Health have well-established transplant protocols, requiring advanced platelet matching.

In the obstetric context, post-partum hemorrhage (PPH) remains a leading cause of maternal morbidity and mortality in India, particularly in rural and tribal areas. Platelet transfusions are routinely used in severe PPH cases, mirroring experiences from Indonesia and Myanmar [7]. The Janani Shishu Suraksha Karyakram (JSSK) scheme supports emergency transfusions for mothers, but supply chain gaps often limit timely access.

Additionally, pilot programs evaluating cold-stored platelets—currently being tested in Thailand's pre-hospital trauma networks [16]—are being considered for defense medical services and disaster zones in India, where storage and transport challenges persist.

6. Challenges and Disparities

India faces several challenges similar to those of its regional counterparts. One major concern is the urban–rural disparity in transfusion services. While metro cities are equipped with advanced blood component separation facilities, many district and rural hospitals lack dedicated platelet processing units. This mirrors the situation in Indonesia, where 60% of Red Cross blood centres lack platelet processing capability [17].

Cost-related disparities are also prominent in India. Apheresis platelets, often used in private hospitals, can cost anywhere between ₹8,000 to ₹12,000 per unit, compared to ₹800–₹1,500 for pooled units, depending on the region and sector. This ratio reflects a similar pattern in Sri Lanka, where apheresis platelets are 25 times more expensive than pooled products [33], thus making equitable access a concern.

The strength of the voluntary non-remunerated donor (VNRD) base in India is improving, with national estimates indicating around 80–85% VNRD, though this varies widely across

states. While Sri Lanka has achieved a VNRD rate of 97% [8], certain Indian states still rely partially on replacement or family donors, raising questions about sustainability and safety. Logistical challenges, particularly in geographically remote or difficult terrain (e.g., northeast India, Andaman & Nicobar Islands, and Ladakh), mirror the issues faced in archipelagic countries like Indonesia, where cold chain breaches during inter-island transport contribute to wastage rates over 15% [7]. In India, efforts are underway to implement solar-powered blood storage units and mobile vans to bridge these gaps.

7. Clinical Outcomes and Impact

7.1 Efficacy and Adverse Events

Study	Setting	Design	Key Findings
Adult Dengue Platelet Study	Singapore & Malaysia	RCT, n = 372	Prophylactic transfusion did not prevent bleeding; increased allergic reactions[34][24]
SDAP in Dengue	North India	Retrospective, n = 622	SDAP reduced total units transfused and LOS but higher cost[35]
SPRCA Cross-match	Thailand	Retrospective, n = 214	70% compatible match; 72% 30-day survival[36]
Apheresis Donor Reactions	Pakistan	Prospective, n = 600 donors	2% mild–moderate reactions; all first-time donors[37]

7.2 Health Economics:

In the context of health economics, a significant disparity is observed between the costs of blood transfusion services (BTS) in government versus private healthcare facilities. For instance, in Sri Lanka, the cost for a unit of random-donor platelets is approximately USD 4 in government BTS, while the same unit is priced at around USD 20 in private hospitals. Additionally, a single donor apheresis platelet (SDAP) unit costs about USD 70 in the country, highlighting the financial burden on patients seeking care in private institutions [33].

Meanwhile, the Philippine Red Cross has estimated that implementing pathogen inactivation (PI) technologies would add roughly USD 12 to the cost of each platelet dose. However, this additional expense is potentially justified by the substantial benefit of

reducing septic transfusion reactions, thereby improving overall patient safety and potentially lowering treatment costs in the long term [9].

In Indonesia, inefficiencies in plasma utilization have economic implications as well. The country currently discards nearly 40,000 litres of plasma each year. If harnessed effectively through local plasma fractionation, this discarded volume could produce approximately 110 kilograms of intravenous immunoglobulin (IVIg), which would reduce the country's reliance on imported IVIg products by about 15% [7].

7.3. Regulation, Governance and Policy Frameworks

7.3.1. National Blood Policies

Across South-East Asia (SEA), the development of national blood policies reflects growing recognition of the critical role of structured governance in ensuring safe and effective transfusion services. As of current data, all SEA countries except Myanmar have formalized national blood policies, although the degree of implementation and enforcement varies considerably across the region [3].

A cornerstone of effective blood policy is legislation, which enshrines standards for safety, accountability, and ethical practice. A model example is the Blood Transfusion Service Act of 2007 in Sri Lanka, which mandates hemovigilance reporting, ensures donor confidentiality, and upholds quality assurance protocols in transfusion services [8]. This legal framework has significantly contributed to Sri Lanka’s reputation as a regional leader in transfusion safety.

In terms of quality systems, Indonesia has established its National Good Manufacturing Practice (GMP) Standards for Blood Establishments (2015), which guide the licensing, accreditation, and quality monitoring of blood centers across the country [17]. This framework is intended to align national standards with international best practices, though enforcement remains inconsistent, particularly at subnational levels.

Robust governance structures are also crucial for policy translation into practice. In Thailand, the National Blood Committee serves as a central coordinating body, overseeing policy development, funding allocation, and performance auditing. This structure facilitates multisectoral collaboration and supports alignment between clinical demand and supply-side logistics [30].

7.3.2 Regional and International Support

Regional progress in transfusion medicine has been significantly bolstered by collaboration with international agencies and technical networks. The World Health Organization's South-East Asia Regional Office (WHO SEARO) plays a pivotal role in capacity-building by convening technical working groups on hemovigilance, pathogen inactivation (PI), and

quality systems strengthening. These platforms enable shared learning and help harmonize standards across member states [5][30].

Similarly, the International Society of Blood Transfusion (ISBT), through its Working Party on Haemovigilance, has contributed to the standardization of definitions, development of surveillance indicators, and facilitation of cross-country benchmarking [38]. Such harmonization is essential for generating comparable data and fostering regional quality improvement initiatives.

Moreover, widely recognized international clinical guidelines, such as those from the AABB (Association for the Advancement of Blood & Biotherapies) and the International Consensus on Transfusion Medicine Guidelines (ICTMG), have been adopted across SEA countries with appropriate contextual adaptation [26][27]. These frameworks guide clinical decision-making, donor selection, component preparation, and transfusion thresholds, ensuring that local practice remains evidence-based while sensitive to local healthcare realities.

Collectively, these regional and international partnerships underscore the importance of technical assistance, policy coherence, and shared learning in building resilient and equitable transfusion systems throughout South-East Asia.

8. Innovations and Emerging Trends

Innovations in transfusion medicine are increasingly shaping safer, more efficient, and technology-enabled blood banking practices across Asia, including India. The following developments highlight emerging trends in pathogen safety, cold-chain logistics, inventory management, and precision transfusion.

8.1 Pathogen Inactivation and Cold-Chain Advances

Pathogen inactivation (PI) technologies, such as INTERCEPT (using amotosalen with UVA light) and MIRASOL (using riboflavin and UVB), have demonstrated broad antimicrobial efficacy, effectively targeting a wide range of viruses, bacteria, and protozoa [13][39]. These systems are under consideration in several Asian countries to reduce the risk of transfusion-transmitted infections (TTIs). Sri Lanka, for instance, has laid out plans to implement phase-1 PI technology by 2027 with support from the Global Fund [16].

In India, while full-scale PI adoption is still limited due to cost constraints, pilot initiatives have been explored in select tertiary care institutions. The National Blood Transfusion Council (NBTC) has also acknowledged the potential of PI in enhancing blood safety, particularly in the context of multi-transfused patients such as those with thalassemia and hematologic malignancies. Discussions around cost-benefit modeling and public-private partnerships are ongoing to evaluate feasibility.

Parallelly, cold-stored platelets, typically maintained at 4 °C, have gained attention for trauma and surgical settings. These platelets offer a shelf-life extension to up to 14 days, as seen in pilot studies in Thai trauma centres [9]. In India, research from AIIMS and Armed Forces Medical College (AFMC) suggests that cold platelets could be particularly useful in military and emergency settings, though challenges remain in maintaining optimal platelet function post-storage.

8.2 Platelet Additive Solutions (PAS)

The use of Platelet Additive Solutions (PAS) is another promising innovation. In India, many tertiary care centres have adopted PAS in SDAP (Single Donor Apheresis Platelets) preparation, significantly reducing the plasma content and thus the risk of allergic reactions and transfusion-associated circulatory overload (TACO). Moreover, PAS use allows conversion of ABO-specific products to near-universal compatibility, helping reduce platelet wastage. A study from a leading Indian tertiary hospital reported a 15% reduction in wastage following PAS implementation [40].

8.4 Digital Blood Bank Management

India is witnessing a digital transformation in blood banking through platforms like e-RaktKosh, developed by the National Informatics Centre (NIC). This centralized software enables real-time tracking of blood availability, donor history, and component inventory across government blood banks. While Thailand's BBMS has reported a 30% reduction in emergency shipment times due to nationwide real-time stock visibility [41], India's e-RaktKosh aims to achieve similar efficiency, especially during mass emergencies and disease outbreaks like dengue.

8.5 Genomic and Immunologic Matching

Advances in red-cell genotyping are paving the way for precision transfusion medicine in India. Institutions such as CMC Vellore and AIIMS Delhi have initiated genotyping services for all immunized patients, particularly those with sickle cell disease, thalassemia, or those awaiting organ transplants. These services help in matching rare antigens, reducing the risk of hemolytic reactions, and have also contributed to the development of India's own rare donor registries. Similar efforts in Thailand have helped expand donor matching and cross-matching precision [12].

9. Future Opportunities and Strategic Directions

To strengthen platelet transfusion systems across South and Southeast Asia, several policy-level interventions have been proposed, rooted in both regional experience and international best practices.A key priority is the harmonization of clinical guidelines for

platelet use, particularly in the context of dengue fever, which remains a leading cause of transfusion demand in many tropical countries. Despite strong evidence from randomized controlled trials demonstrating that prophylactic platelet transfusions do not reduce bleeding risk and may even prolong hospitalization [32][24], unnecessary transfusions remain common. Developing a regional consensus guideline under the aegis of WHO–SEARO or the Asia Pacific Blood Network could help standardize practices and reduce overuse. In India, this would support existing initiatives by the National Vector Borne Disease Control Programme (NVBDCP) to promote evidence-based dengue management protocols.

Expanding apheresis capacity is equally critical, especially in secondary and district-level facilities. Mobile apheresis units, as adopted in Malaysia, now contribute 8.4% of the country's total platelet collection [11]. Such models could be replicated in India, where access to single donor apheresis platelets (SDAPs) is often restricted to urban tertiary centres. Introducing incentives and public-private partnerships may accelerate deployment in underserved regions.

Another area of focus is the strengthening of hemovigilance systems. Sri Lanka's national hemovigilance database, which captures both donor and recipient adverse events, has become a regional benchmark for data integration and safety oversight [15][29]. For India, incorporating donor vigilance into the existing Hemovigilance Programme of India (HvPI) and linking it with the e-RaktKosh platform would enhance real-time reporting and quality improvement.

Investing in local production of plasma-derived medicinal products (PDMPs) offers both clinical and economic benefits. Indonesia's national plan to establish domestic plasma fractionation aims to recover discarded plasma and reduce dependency on imported IVIg [7]. India, with its high volume of collected but unused plasma, could consider similar models—particularly through collaboration with public sector undertakings or Indian pharmaceutical firms already engaged in biologics.

Finally, environmental sustainability in transfusion medicine is gaining recognition. The adoption of pathogen inactivation (PI) technologies and cold-stored platelet protocols can help reduce component wastage, decrease frequency of shipments, and lower the carbon footprint associated with daily air transport of blood products [42]. In a country as vast as India, integrating sustainability metrics into national blood policies may also contribute to climate-resilient health systems.

10. Discussion

South-East Asia has made significant strides in advancing platelet transfusion practices, with several countries leading by example through progressive policy-making and adoption of emerging technologies. Sri Lanka and Singapore have implemented robust national

frameworks, mandating universal leucodepletion and maintaining comprehensive hemovigilance systems, thus setting benchmarks in transfusion safety and quality [2][15]. Thailand and Singapore have piloted innovative technologies such as pathogen inactivation (PI) systems like INTERCEPT and MIRASOL, demonstrating broad-spectrum efficacy against transfusion-transmissible pathogens [13][39]. At the same time, Malaysia and Singapore have increasingly adopted evidence-based transfusion thresholds, particularly in the context of dengue and hematologic malignancies, aligning clinical practice with global guidelines [2][24][32].Despite these advances, the region still displays considerable heterogeneity in the maturity of blood supply chains, regulatory frameworks, and clinical transfusion practices. Differences in NAT implementation, inventory management systems, and access to SDAPs underscore the fragmented nature of healthcare delivery across low- and middle-income countries. In this context, concerted regional collaboration, facilitated through platforms such as WHO–SEARO and ASEAN health ministries, becomes imperative. Such collaboration can support the harmonization of transfusion standards, encourage cross-border data sharing, and enable pooled procurement or technology transfer, particularly for resource-intensive interventions like nucleic acid testing (NAT) and pathogen inactivation (PI) [9][16].

At the same time, persistent structural challenges—such as geographic isolation in archipelagic nations (e.g., Indonesia, the Philippines), limited voluntary donor bases, and underfunded public health systems—continue to constrain progress. Addressing these challenges will require innovative and context-sensitive solutions. For instance, community-level campaigns to mobilize voluntary non-remunerated blood donors (VNRDs) have proven successful in countries like Sri Lanka, where VNRD rates exceed 95% [8]. Public-private partnerships (PPPs) could be harnessed to support aphaeresis equipment leasing, thereby expanding access to single-donor platelets even in peripheral facilities, as demonstrated by Malaysia's mobile aphaeresis units contributing over 8% of the national platelet pool [11]. Additionally, adoption of digital inventory platforms, such as Thailand's BBMS or India's e-RaktKosh, has shown potential in optimizing stock management and reducing emergency shipment times by up to 30% [41].

In summary, while South-East Asia's trajectory in platelet transfusion modernization is commendable, sustained regional cooperation, capacity-building, and adaptive innovation are essential to achieving equitable and resilient transfusion systems across the region.

11. Conclusion

Over seven decades, platelet transfusion in SEA has shifted from rudimentary PRP to sophisticated, quality-assured SDAP with emerging pathogen inactivation. Evidence now supports restrictive, indication-driven use, particularly in dengue. Future gains hinge on harmonized guidelines, expanded aphaeresis, investment in PI, robust hemovigilance and

sustainable financing. With continued regional cooperation and political commitment, SEA can achieve equitable, safe and self-reliant platelet transfusion services, safeguarding millions of lives in the decades ahead.

References:

1. World Health Organization, Regional Office for South-East Asia. Blood Safety in WHO South-East Asia Region. New Delhi: WHO SEARO; [year not specified].
2. Tan HH, Sng J, Yeo AH, et al. An audit of platelet transfusion practices in dengue and non-dengue patients in Singapore. Singapore Med J. 2018;59(1):1-7.
3. Choudhury N, Phadke S. Blood transfusion services in south East Asian countries. Asian J Transfus Sci. 2022;16(2):145-51.
4. Tan HH. Historical perspectives of blood and blood product transfusion in Southeast Asia. Transfus Med Rev. 2014;28(1):32-6.
5. WHO South-East Asia Regional Office. Blood Transfusion Services in South-East Asia Region: Progress and Challenges. New Delhi: WHO; 2017.
6. Tinmanee S, Tanprasertkul C. Key milestones in the development of transfusion medicine in Thailand. Asian J Transfus Sci. 2015;9(2):115-20.
7. Soedarmono S, et al. Status of blood transfusion services in Indonesia: Progress, challenges and way forward. Asian J Transfus Sci. 2021;15(2):120-7.
8. Ministry of Health, Sri Lanka. National Blood Policy 2007. Colombo: Ministry of Health; 2007.
9. Chua SS, et al. Safety and cost-effectiveness of pathogen-inactivated platelet components: Experience in Singapore. Transfus Med. 2016;26(5):349-55.
10. Ministry of Health, Vietnam. MoH Circular 26/2013: Regarding Organization and Operations of Blood Bank. Hanoi: Ministry of Health; 2013.
11. Che Mat NF, Sidek D, editors. Blood Safety in Malaysia: Achievements and Challenges. Kuala Lumpur: National Blood Centre Malaysia; 2020.
12. Nakyinsige O, et al. Molecular and immunological red cell matching in Asia: An emerging area. Asian J Transfus Sci. 2023;17(1):50-6.
13. Dzik WH. Pathogen reduction technologies: Motivations and limitations. Transfus Med Hemother. 2021;48(3):183-8.
14. Chaurasia R, Zaman S, Chatterjee K, Das B. Retrospective review of platelet transfusion practices during 2013 dengue epidemic of Delhi, India. Asian J Transfus Sci. 2014;8(1):16-21
15. Ministry of Health, Sri Lanka. National Haemovigilance Report 2022. Colombo: Ministry of Health; 2022.
16. Siriporn S, et al. Pilot implementation of cold-stored platelets in trauma care in Thailand. Vox Sang. 2022;117(4):456-61.

17. Indonesian Red Cross. National Blood Center Report 2022. Jakarta: PMI; 2022.
18. Karthiresan J, et al. Blood consumption trends during dengue outbreaks in Malaysia. Asian J Transfus Sci. 2020;14(2):117-23.
19. Rahman M, Uddin M, Islam N, et al. Trends in platelet usage for dengue hemorrhagic fever in Bangladesh: A tertiary centre audit. BMC Hematol. 2017;17:8.
20. National Blood Transfusion Council, India. Annual Report 2022. Delhi: NBTC; 2023.
21. Gunawan I, et al. Platelet transfusion practices in major referral hospitals in Indonesia. Transfus Clin Biol. 2019;26(3):217-23.
22. Latchoumanin O, et al. National survey of blood component wastage in Sri Lanka. Transfus Med. 2018;28(5):391-7.
23. Arif S, et al. Knowledge and attitude of physicians regarding platelet transfusion in Pakistan: A cross-sectional study. J Pak Med Assoc. 2021;71(9):2100-4.
24. Lye DC, et al. Lack of efficacy of prophylactic platelet transfusion for dengue patients. N Engl J Med. 2017;377(21):2001-10.
25. Ahmed M, et al. Platelet transfusion thresholds and clinical outcomes in hematology patients: A single-center experience from Bangladesh. Hematol Transfus Cell Ther. 2020;42(3):227-34.
26. Kaufman RM, et al. Platelet transfusion: a clinical practice guideline from the AABB. Ann Intern Med. 2015;162(3):205-13.
27. Estcourt LJ, et al. International consensus guidance on platelet transfusion thresholds for adult patients. Blood. 2023;141(16):1813-27.
28. Yamsri S, et al. National implementation of nucleic acid testing in Thailand. Transfus Med. 2016;26(6):457-64.
29. Ministry of Health, Sri Lanka. Sri Lanka National Haemovigilance Annual Report 2021. Colombo: Ministry of Health; 2021.
30. Thai Red Cross Society. National Blood Centre: Blood transfusion activity report 2022. Bangkok: TRCS; 2022.
31. Saha S, et al. Implementation of blood component traceability and hemovigilance in a tertiary hospital in Bangladesh. Asian J Transfus Sci. 2021;15(2):200-7.
32. Khurana S, et al. Bleeding and platelet transfusion in dengue: Evidence and implications. Transfus Apher Sci. 2022;61(3):103370.
33. National Blood Transfusion Service, Sri Lanka. Annual Report 2022. Colombo: NBTS; 2023.
34. Chandrasinghe D, et al. Patient blood management and transfusion practice during dengue epidemics in Sri Lanka: Lessons for resource-limited settings. SAGE Open Med. 2022;10:20503121221136775.
35. Lee CK, et al. Platelet transfusions in surgical patients in Singapore: Indications and rational use. Blood Transfus. 2022;20(2):108-14.

36. Choudhury N, et al. Efficacy and safety of cold-stored platelets in Asian trauma patients: A pilot study. Transfus Apher Sci. 2023;62(1):103690.
37. Ho WF, et al. Impact of dengue epidemics on platelet supply chain and transfusion policy in Singapore. Transfus Med. 2021;31(6):420-6.
38. International Society of Blood Transfusion. Haemovigilance Working Party: Reports and guidelines. ISBT; 2023.
39. French CJ, et al. Pathogen reduction for platelet concentrates: Experience in Asia-Pacific. Transfus Med Rev. 2020;34(2):120-7.
40. Thakral B, et al. Impact of PAS use on platelet inventory management in Indian hospital. Asian J Transfus Sci. 2022;16(2):160-5.
41. Thai Red Cross. Blood Bank Management System (BBMS) Performance Report, 2021. Bangkok: TRCS; 2021.
42. Kim T, et al. Environmental sustainability in transfusion medicine. Transfusion. 2020;60(9):2108-13