PROCUREMENT AND SUPPLY CHAIN MANAGEMENT CHALLENGES FOR MALARIA ELIMINATION IN INDIA, INDONESIA, AND PAPUA NEW GUINEA

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APLMA Case Study
About APLMA-APMEN

Asia Pacific Leaders Malaria Alliance (APLMA) is an alliance of heads of government committed to achieving a region free from malaria by 2030. APLMA is a distinctive platform facilitating collective regional leadership for malaria elimination and health security.

Asia Pacific Malaria Elimination Network (APMEN) is a network of 22 countries and 54 partner institutions. APMEN facilitates regional and multi-sectoral collaboration around evidence-based practices and fosters innovation. Jointly, APMEN and APLMA act as an ‘evidence-to policy’ vehicle that links directly to leadership levels across the region.

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Introduction

India, Indonesia, and Papua New Guinea (PNG) bear a significant burden of malaria – accounting for almost 62% of all cases in the Asia Pacific region \(^1\). These countries have diverse ecosystems and environments that favour the breeding of mosquitoes, combined with socio-economic challenges that impede malaria control.

The success of malaria elimination programmes heavily depends on the timely availability and distribution of essential commodities like diagnostic kits, antimalarial drugs, insecticide-treated nets (ITNs), and indoor residual sprays (IRS). Effective procurement and supply chain management play pivotal roles by preventing stock-outs of critical commodities which are imperative for the success of malaria elimination efforts in the region.

Procurement and supply chain management (PSM), while interconnected, serve distinct functions. *Procurement* is the process of identifying, selecting, and acquiring goods, services, or works from an external source. This can involve tendering or competitive bidding. The process usually begins with a need and ends with a contract or an order placement. *Supply chain management* refers to the comprehensive coordination of all processes involved in converting raw materials into final products and distributing these products to end users. It involves various stages: planning, design, production, assembly, distribution, and delivery (Figure 1).
This case study aims to shed light on the existing challenges in PSM for malaria elimination in the three high-burden geographies of India, Indonesia, and PNG along with some regional best practices. The principal source documents for the facts presented in this brief is the 2022 Mid Term Review (MTR) of malaria programme reports from India, Indonesia, and PNG, as well as a needs assessment undertaken by the Asia Pacific Leaders Malaria Alliance (APLMA) and Clinton Health Access Initiative (CHAI) in the Milne Bay province of PNG in 2021.

By understanding these challenges, stakeholders can inform their efforts to strengthen effectiveness of procurement and supply chain management systems, ensuring that everyone, regardless of location or socio-economic status, is protected against this perilous disease.
Components of procurement and supply chain management

Procurement and supply chains encompass a wide range of activities. Some common components include demand forecasting, supplier reliability, logistics and transportation, information systems, regulatory and compliance, quality control, and inventory management.\(^4\)\(^5\)

Figure 1: Factors affecting supply chain and procurement systems in health care

Challenges in procurement

LIMITED FINANCIAL RESOURCES AND CAPACITY FOR EFFICIENT PROCUREMENT OF MEDICAL SUPPLIES

The challenges plaguing PNG National Department of Health’s (NDoH) procurement and distribution functions are widely recognized and documented \(^6\)\(^7\). These challenges stem from various sources: leadership deficiencies, inadequate institutional frameworks, absence of administrative infrastructure, capacity constraints, fund and supply leakages, and resistance from certain officials and staff against positive change. As a result, the country witnessed doubling of the procurement costs of drugs and medical supplies from 2010 to 2014 \(^8\).

CHALLENGES IN ACCESSING AND PROCURING DIAGNOSTIC TOOLS AND ANTIMALARIAL DRUGS

In 2019, 2.6 million tablets of Sulphadoxine- Pyrimethamine (SP) were ordered for PNG, yet over half remained undelivered until 2021 -- leaving a 1.4 million tablet shortfall. Due to lack of appropriate oversight over NDoH procurement processes, there was an accidental introduction of BioCredit® rapid diagnostic tests (RDTs) to the programme. Additionally, many care points face stock shortages, particularly of injectable artemesunate \(^9\).

Drawing parallels from Indonesia, a significant logistic issue emerged in 2022. During March and April, a lapse in artemisinin-based combination therapies (ACTs)
procurement from China led to stock-outs in multiple districts, causing programmatic disruption and demotivating healthcare workers. Although this was partially attributed to supply chain issues originating in China, internal estimation errors in Papua province and intra-Indonesia transportation delays further exacerbated the situation. Incidentally, it was noticed that high-burden provinces were more likely to suffer from stockouts of ACTs. For example, almost half of all health facilities in Papua experienced stockouts of malaria commodities. This finding is concerning as the Papua province accounts for majority of cases in Indonesia and controlling malaria from high-burden provinces is the backbone of malaria elimination initiatives.

This predicament underscores every global malaria programme’s reliance on singular supply chains. It is a necessity for central authorities to anticipate potential supply snags and maintain multiple suppliers by distributing 70-80% of share to primary suppliers (L1) and 20-30% share to secondary suppliers (L2) with possibility of shifting to L2 suppliers in case of L1 failures 10.

**INADEQUATE CONTROL OF PRIVATE SECTOR**

PNG’s public sector struggles with inefficient procurement processes for malaria commodities. This compels health facilities and patients to seek alternatives in the private sector. However, the commodities available in the private sector often come with exorbitant pricing and are of questionable quality. The risk is not just financial; these dubious-quality drugs can lead to drug resistance and incomplete or incorrect radical treatment of malaria, which can result in relapses. Another alarming trend is the unauthorized sale of drugs from public health facilities in local markets. Even though this activity is well-known, enforcement against it remains minimal. This not only underscores the inadequate control of the private sector but also demonstrates how inefficiencies in the public sector can bleed into and bolster these unauthorized, potentially dangerous private channels.

A notable effort to combat this issue can be seen in the district of Alotau, where collaboration between the pharmacy inspector and the police actively targets illegal sellers. Yet, to genuinely mitigate this problem, an extensive investigation across provinces is crucial to identify and plug these leaks 11.
Challenges in supply chain management

LIMITED STORAGE AND TRANSPORTATION FACILITIES

ITNs require substantial storage space and IRS chemicals should be stored separately from medicines. Even as malaria cases decrease, the need for preventive measures like ITNs and IRS remains and ensuring compliance with proper storage requirements can cause complications. For example, a city in the state of Karnataka, India, rented a warehouse exclusively for ITN storage for six months, and in the same municipal area, an external primary health centre (PHC) room was used for ad-hoc IRS storage. Insufficient storage forced early supply chain movement of LLINs, pressuring the state programme for immediate distribution. In PNG, during an assessment of malaria elimination in Milne Bay province, it was reported that some stores were overcrowded, had poor infrastructure, and were rodent-infested. This may lead to insufficient vector-control tool coverage for communities, and hinder prompt diagnosis and treatment.

POOR ROAD NETWORKS AND ACCESSIBILITY

In PNG, where 86% of the population resides in remote villages, accessing health services is a significant challenge. About 25% of health facilities are not accessible by standard roads or boats. While the average travel time to reach Milne Bay health facilities is under one hour, some remote areas require much longer travel durations. Given Milne Bay’s numerous islands, dinghies serve as a primary transport mode to health centres. Rotarians Against Malaria’s (RAM) Regional Malaria Coordinators (RMCs) and Provincial Malaria Supervisors (PMS) routinely visit all reachable health
facilities to restock supplies, however some hard-to-reach areas are only able to be visited as infrequently as once per year\textsuperscript{9}.

**HUMAN RESOURCE STAFFING AND CAPACITY ISSUES**

During the MTR visit in the state of Karnataka, India, challenges in staffing were evident from sub-district to state levels, with over 1,000 pharmacist vacancies statewide. In a specific case, a Bangalore urban primary health centre had an unfulfilled pharmacist role for over a year, relying on nurses to fill the gap. This shortage affected physical stock management, with instances of mislabelled shelves or incorrectly arranged stocks. Moreover, non-pharmacist staff, preoccupied with primary duties, struggle to update stock registers and manage the logistics of management information systems (MIS).

In the PNG Milne Bay assessment, lack of skills at the facility level for stock management and mSupply\textsuperscript{1} usage at provincial transit stores were identified. Furthermore, the lack of quick communication from facilities to the provincial transit stores in case of stock-out was also noted.

**INEFFICIENT FORECASTING AND STOCK MANAGEMENT**

Facilities typically base stock indents on the previous year’s consumption, adjusted for growth and current stock. However, this method leads to gaps: as malaria cases decrease, the stock management formula can result in no stock orders, as has happened with ACTs and Primaquine\textsuperscript{12}. During an MTR in India, it was found that a leading hospital in a state capital, despite a non-zero caseload, resorted to using private pharmacies due to lack of stock\textsuperscript{12}. With the dwindling availability of malaria commodities in public pharmacies, any outbreak can pose serious supply delays, risking patient health and compromising treatment quality. Additionally, limited budgets can lead facilities to prioritizing other diseases, expecting no malaria cases.

\textsuperscript{1}mSupply is a system introduced centrally in Papua New Guinea in 2017. It reports medical supply procurement, warehousing, and distribution functions.
Another finding from the India MTR suggested that an average health centre juggles 300-400 products, complicating inventory management. In the state of Karnataka, the Aushada software, aiding electronic inventory control, is deployed in 2,889 locations. However, the adoption of this software was minimal despite training. Overwhelmed staff, due to additional duties and multiple concurrent systems like eVIN\textsuperscript{11} found it challenging to adopt \textsuperscript{12}.

Further evidence from PNG showed that RDT and ACT quantification at the national level was based on the highest case numbers from the past four years plus a 30\% buffer. This simplistic approach exists due to (a) stock data only being available at provincial stores via mSupply, (b) sluggish data reporting to the national health information system, and (c) inaccurate reporting. The gap in recording clinically diagnosed cases makes it difficult to reconcile ACT use with the reported cases \textsuperscript{9}. Additionally, stock forecasting does not adequately take aid posts or home malaria management (HMM) programme into account, which would further increase the gap if the HMM is expanded across the country \textsuperscript{11}.

\textsuperscript{8} The Electronic Vaccine Intelligence Network (eVIN) is a smartphone and cloud technology-based app that digitizes information on vaccine stocks and temperatures across the country.
Best practices towards procurement and supply chain management

INDIA

Innovative approaches for supply chain management

Drone deliveries: The 'Medicines from the Sky' project in Telangana, and similar pilots in Meghalaya and Arunachal Pradesh, have proven drones' efficiency in reducing delivery time for crucial medical supplies. In West Khasi Hills, for instance, delivery times plummeted from three hours to just 25 minutes over a 25-kilometer stretch.

Passbook system: Adopted by states like Tamil Nadu and Rajasthan, this record-keeping tool allocates specific budgets to health facilities based on patient load and other metrics. It not only provides insights into drug consumption patterns but also curtails pilferage.

Blockchain in drug logistics: Karnataka's Drug Logistic Chain, backed by blockchain technology, centralizes procurement and storage, ensures product quality, and tracks the entire supply chain in real-time.

Tried and tested methods for supply chain management

Solutions for community health workers (SOCH): The Malaria Elimination Demonstration Project’s (MEDP) indigenous surveillance cum supply chain mobile
application resulted in a 60% improvement in supply chain management by providing real-time functionalities from the grassroot level to district warehouses.

Comprehensive case management programme (CCMP): The supply chain management was fortified to the village level, ensuring consistent drug and diagnostic supplies. RDTs and drug quantities were determined based on caseload, service providers, and stock levels -- unlike the conventional system which only considered caseload. Buffer stocks were kept at block level in CCMP areas instead of the usual district level. Before the rainy season, which exacerbates malaria transmission and hinders road access, extra care was taken to stock remote areas.

INDONESIA

Adaptive procurement planning: The malaria programme has successfully implemented a dynamic method for calculating programme needs. This approach incorporates various factors like intensity of case finding, area coverage, health facility counts, and past procurement experiences. Consequently, this has optimized the procurement of essentials such as LLINs, Antimalarial Drugs, RDT, reagents, and insecticides.

Enhanced surveillance information system: Progress has been marked in the domain of malaria surveillance with the advancements to SISMAL V2. Further developments are underway with SISMAL V3, which promises real-time updates in both offline and online capacities including logistics tracking.

Integrated district storage management: A shift to a one-gate system for the storage and distribution of antimalarial drugs and related logistics has been observed. This centralized approach, overseen by the Director General for Pharmaceutical & Medical

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ii SISMAL is an individual data-based malaria surveillance recording and reporting system with web, desktop and mobile bases in Indonesia. Source: National Malaria Midterm Review, Republic of Indonesia, 2022.
Devices and regional pharmacy warehouses, ensures a consistent quality of drug storage across regions.

**PAPUA NEW GUINEA**

**Effective buffer stock management:** The MTR noted that in Milne Bay, the Provincial Health Authority has maintained a buffer stock, effectively preventing stock-outs.

**Crackdown on illegal drug sales:** Alotau district in Milne Bay, stands out for its collaborative approach where the pharmacy inspector partners with the police to tackle illegal drug sellers.
Recommendations

Streamlined procurement and financial oversight: Establish a transparent, centralized procurement process with multiple approved suppliers and implement rigorous auditing to ensure financial efficiency and prevent leakages. This ensures timely access to essential commodities and reduces stock-outs.

Integration of interoperable digital systems for supply chain management: Given the limitations of electronic Logistics Management Information Systems like mSupply or eVIN, which excel in logistics functions such as inventory management and distribution but lack in forecasting, procurement, and planning capabilities, there is a need to explore interoperable digital systems. These systems should encompass all key supply chain functions including procurement and planning. Collaborate with the private sector to bolster storage infrastructure and consider the adoption of alternative transportation means, such as drones for hard-to-reach areas, when feasible and appropriate.

Human resource development and capacity building: Prioritize filling key vacancies and conduct regular training at all levels. This includes promoting understanding and adoption of modern supply chain tools and electronic inventory systems, and retention of these personnel through motivation and non-monetary incentives such as performance recognitions, career advancement, job rotation etc.

Enhanced quality control, transparency, and accountability: Set national quality control standards which should be on par with regional standards, create a transparent supply chain dashboard for stakeholders, adopt verification and traceability solutions
using serialized barcodes, and enforce strict measures against unauthorized sales and leakages.

**Community engagement and cross-border collaborations:** Engage local communities for better understanding and efficacy of the supply chain in remote areas. Foster collaboration between regions, like Papua province and Papua New Guinea, to leverage shared resources and knowledge in combating malaria.
Conclusion

The supply chain and procurement processes for malaria elimination in countries like India, Indonesia, and Papua New Guinea are riddled with significant challenges, from limited storage and transportation facilities to fragmented distribution systems and inadequate transparency.

Addressing these issues is paramount, as the successful elimination of malaria heavily depends on the consistent and timely availability of essential commodities like diagnostic kits, antimalarial drugs, and preventive measures.

It is crucial for policymakers and stakeholders to recognize the urgency of these challenges and to implement the recommended strategies proactively. A coordinated, transparent, and efficient supply chain is not just an operational necessity; it is a lifesaving imperative. The time to act is now, ensuring a malaria-free future for the Asia Pacific region.
References


12. Primary findings from APLMA. Malaria Programme Review for India. 2022.