

Costing malaria surveillance systems and mobile reporting for private sector providers in Cambodia, Lao PDR and Myanmar: Is it affordable?

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BACKGROUND

National Malaria Control Programs (NMCPs) in the Greater Mekong Subregion (GMS) are strengthening malaria surveillance systems to achieve malaria elimination targets by 2030. NMCPs are considering whether and how to transition aggregate, paper-based reporting systems to real-time, case-based electronic systems. The exponential growth of smartphone ownership and mobile coverage in the GMS is also prompting NMCPs and malaria partners to integrate mobile reporting solutions into surveillance systems to increase the timeliness and granularity of case reporting. The affordability and sustainability of private sector surveillance interventions in malaria elimination settings, however, is largely unknown.

PSI's Greater Mekong Subregion Elimination of Malaria through Surveillance (GEMS) program supports NMCP strategies in Cambodia, Lao PDR, Myanmar and Vietnam by improving private sector case management and generating robust surveillance data from the private sector. In response to increasing demand for real-time case-based reporting and analysis, GEMS configured an electronic surveillance platform in DHIS2, developed open-source mobile applications for real-time reporting, and scaled mobile reporting tools across private sector networks. Case data generated by PSI-supported providers and captured through the GEMS surveillance platform were integrated into national systems at varying degrees of frequency and granularity, in accordance to NMCP reporting protocols.

- **Cambodia:** PSI Cambodia developed an Android-based Malaria Case Surveillance App for providers to report cases to DHIS2 in real-time. PSI procured and provided smartphone devices for 585 private providers and worksite-based providers, representing 82% mobile reporting coverage of a total network of 710 providers.
- **Lao PDR:** PSI Laos adapted the Android Malaria Case Surveillance App from Cambodia for the Lao context. PSI staff installed the app on the compatible personal smartphone devices of 240 providers, representing 55% coverage mobile reporting coverage of a total network of 432 providers.
- **Myanmar:** PSI Myanmar trained 200 field officers to use a generic, open-source DHIS2 reporting app (released by the University of Oslo) on tablets to report surveillance electronically during supervisory visits to providers. This model did not enable real-time reporting from providers; however, it did reduce the time lag associated with traditional paper-based reporting by approximately two months.

METHODS

Cost analyses were conducted in parallel with program implementation to provide information on the key cost drivers and affordability of electronic surveillance approaches, as well as estimate the comparative costs of approaches in different settings.

The objectives of the study were to:

1. Estimate the costs of introducing and maintaining electronic case-based reporting and surveillance interventions in the target countries
2. Assess the affordability of the introduction and support of electronic surveillance activities for malaria elimination

Costing of the GEMS electronic surveillance system is based on economic evaluation approach methods. Data were extracted from PSI's financial and operational records and supplemented by discussions with key informants in each setting. An ingredients-based approach was used to estimate financial costs in three country settings. The study was conducted in Cambodia, Lao PDR and Myanmar, where PSI has implemented electronic surveillance interventions under the GEMS program since 2016.

DISCUSSION

The cost of setting up and maintaining an electronic surveillance system likely has more to do with the complexity of the system and the country's stage of maturity with technology (i.e. DHIS2) than scale (i.e. number of providers covered). However, the capital and recurrent costs of introducing and maintaining mobile reporting increase with the number of providers covered due to the number of mobile devices purchased and data packages. On the other hand, the costs of start-up per provider decrease as these are spread among more providers. Procurement of mobile devices for reporting and purchasing of monthly mobile data top-ups are major cost drivers in some electronic surveillance interventions.

CONCLUSION

The study found that:

1. The cost of setting up and maintaining an electronic surveillance system varies across countries and is largely based on what has previously been developed and the decision of whether or not to purchase mobile devices and plans.
2. Cost efficiencies for mobile reporting can be achieved by using providers' personal smartphone devices rather than procuring smartphones for providers, but this may limit coverage.
3. Electronic surveillance systems can be financially affordable in comparison to paper-based systems over time assuming mobile devices do not need to be purchased each year and by utilizing personal mobile devices of providers.
4. Electronic surveillance system cost efficiencies include decreased cost for travel time and data entry.
5. Benefits of real time data, such as more rapid use in public health decision making, should be considered against the financial cost of an electronic surveillance system.

RESULTS

Annual financial costs of introducing and maintaining an electronic surveillance system varied across study settings. The main cost drivers were supervision in Myanmar and Lao PDR; and smartphone devices and monthly mobile data packages in Cambodia.

Annual Financial Cost and Cost Per Provider of an Electronic Surveillance System with a Mobile Reporting Component

	Cambodia	Lao PDR	Myanmar
Annual Financial Cost	\$ 144,989	\$ 50,959	\$ 437,954
Annual Per Provider Cost	\$ 207	\$ 118	\$ 27
Number of Providers Covered by Electronic Surveillance System	710	432	16,010

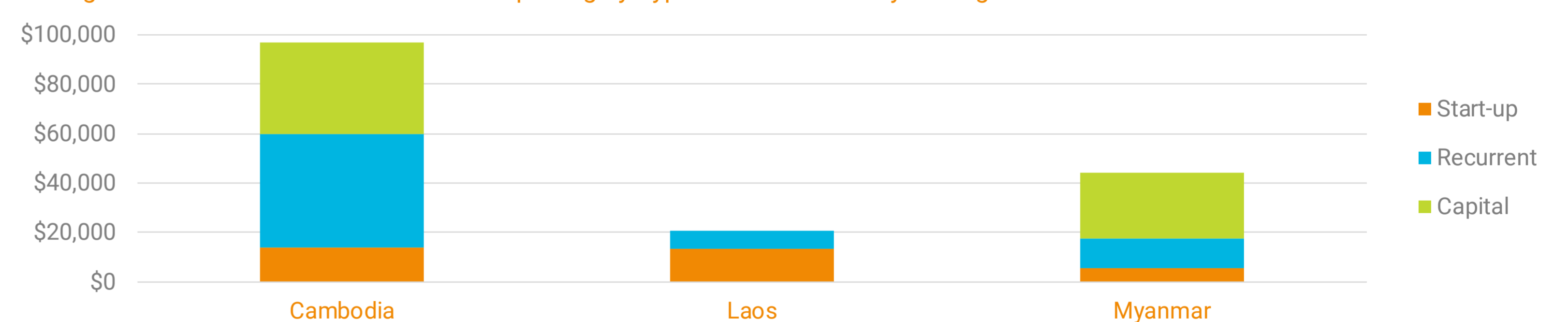
Annual Financial Costs of Introducing and Maintaining an Electronic Surveillance System

	Cambodia	Lao PDR	Myanmar
START-UP COSTS			
System Design (DHIS2)	\$ 3,967	\$ 1,923	\$ 5,993
System Config (DHIS2)	\$ 13,377	\$ 1,026	\$ 7,128
Piloting (DHIS2)	\$ 3,595	\$ 198	\$ 1,611
Training (DHIS2)	\$ 2,598	\$ 2,491	\$ 3,120
Surveillance Bulletin Design	\$ 789	\$ 1,702	\$ 814
Server Set-up	\$ 50	\$ 50	\$ 100
Sub-Total Start-up Costs	\$ 24,375	\$ 7,390	\$ 18,766
RECURRENT COSTS			
DHIS2 Maintenance & Routine Upgrades	\$ 7,531	\$ 2,748	\$ 2,517
Server Hosting	\$ 2,490	\$ 1,992	\$ 4,560
Monitoring and Evaluation		\$ 583	
Sub-Total Recurrent Costs Per Year	\$ 10,021	\$ 5,323	\$ 7,078
CAPITAL COSTS			
Desktops	\$ 1,600	\$ 800	\$ 3,200
Tablets		\$ 1,600	
Sub-Total Capital	\$ 1,600	\$ 2,400	\$ 3,200
Total Costs	\$ 35,995	\$ 15,063	\$ 29,044

Annual Financial Costs of Adding Mobile Case-Based Reporting Component to Electronic Surveillance System

	Cambodia	Lao PDR	Myanmar
START-UP (TOTAL)			
Mobile App Design	\$ 1,986	\$ 1,223	\$ 0
Mobile App Development	\$ 6,286	\$ 7,824	\$ 0
Mobile App Piloting	\$ 3,158	\$ 1,886	\$ 1,393
Mobile App Training	\$ 2,685	\$ 2,760	\$ 4,224
Sub-Total Start-Up	\$ 14,115	\$ 13,693	\$ 5,617
CAPITAL (ANNUALIZED)			
Equipment (Mobile Devices or Tablets)	\$ 37,385	\$ 0	\$ 26,733
Sub-Total Capital	\$ 37,385	\$ 0	\$ 26,733
RECURRENT (ANNUALIZED)			
Mobile Data Packages	\$ 34,860	\$ 2,880	\$ 12,000
MCS App Maintenance & Routine Upgrades	\$ 8,045	\$ 4,292	\$ 0
Sub-Total Recurrent	\$ 42,905	\$ 7,172	\$ 12,000
Total Annual Financial Costs	\$ 97,088	\$ 20,866	\$ 44,350
Annual Cost Per Provider	\$ 166	\$ 87	\$ 2.77

Average Annual Financial Cost of Mobile Reporting by Type of Cost and Study Setting



Comparison of Paper Reporting vs. Mobile Reporting in Cambodia and Lao PDR

In Lao PDR, the total annual financial cost of a fully-electronic system (e.g. all providers reporting by mobile device) is \$50,959 compared to \$62,535 for a paper-based system. The main cost drivers for the paper-based system were increased number of supervision visits by PSI staff to providers for the purpose of collecting reports; and the cost of data entry clerks. Recurrent annual costs for electronic reporting were \$27,476 compared to \$52,745 for paper-based reporting. In Cambodia, the annual financial cost of a fully electronic system was \$144,989 compared to \$83,420 for a paper-based system. The cost drivers of the electronic system were procurement of mobile devices and monthly data packages. Recurrent annual costs for electronic reporting were \$67,514 compared to \$57,496 for paper-based reporting.

Annual Financial Cost of Paper-Based vs Mobile Surveillance Reporting Systems in Cambodia and Lao PDR

