



Barriers to integrating diagnostic services for febrile illness to support surveillance and patient management in Asia-Pacific

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Abstract

As malaria cases continue to decline in Asia, an integrated service delivery approach is ever more urgent to ensure that no malaria and fever cases are missed, and that malaria health workers continue contributing to broader infectious disease control efforts. However, despite its perceived merit, translating integrated surveillance into practice poses several systemic challenges. This article aims to identify what is hindering improved processes for integrating diagnostic and surveillance services for febrile illnesses. Data from peer-reviewed and grey literature were reviewed using a systems approach based on the World Health Organisation health systems building blocks to fully understand the connections between different elements and system implications of integration. We include snippets from Sri Lanka, Myanmar, Malaysia and Nepal, highlighting expanded diagnostic integration best practices. This review provides a foundation for 'integration roadmaps' that can be adapted to different contexts and guide national stakeholders on the operational and political steps for a successful integration model. Such a model

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can support malaria elimination efforts and serve as a public health tool in the context of disease surveillance and regional health security.

KEYWORDS

Asia-Pacific, febrile illness, health security, health system integration, malaria

1 | INTRODUCTION

At the 2014 East Asia Summit, Asia and Pacific leaders committed to a malaria-free region by 2030 (East Asia Summit [EAS], 2014). Over the last decade, malaria cases in Asia have almost halved (World Health Organization [WHO], 2020). However, progress towards elimination is precarious, and the COVID-19 pandemic may slow or even reverse hard-won gains. As malaria programs strive for elimination, continuous surveillance is needed to detect all malaria infections, whether symptomatic or not, including in hard-to-reach populations. All malaria cases should be reported in a timely fashion, investigated and promptly treated to prevent secondary infections (WHO, 2015b).

Community Health Workers (CHWs) play an essential role in ensuring that communities still at risk of malaria have access to the right services and tools. As malaria cases decline in Asia and the probability that a febrile patient has malaria dwindles, the perceived value of malaria-only programs also declines (McLean et al., 2018). CHWs at the community and village level should be empowered with the right tools and training to detect other illnesses where febrile patients test negative for malaria. Integrated surveillance has been recognised as a valuable next step in many regional malaria elimination strategies, such as in Lao PDR and Cambodia. Both countries aim to integrate dedicated malaria services into the wider healthcare landscape to make them sustainable and keep the momentum towards malaria elimination (Lao Ministry of Health, 2016; National Center for Parasitology, Entomology and Malaria Control, 2011; WHO, 2015c). However, this strategy has not been successful, partly due to the nature of funding and malaria prevalence among mobile populations (Chhim et al., 2021; Kounnavong et al., 2017).

Integration of malaria services will link to cross-cutting health services, particularly for children in accordance with the Integrated Community Case Management guidelines. Specifically, it can support the management of febrile illnesses. Fever is one of the defining symptoms in most malaria testing guidelines. Providing differential treatment and care guidelines for patients with negative malaria tests is therefore critical. A recent systematic review of the causes of non-malarial fevers in the Asia-Pacific region showed that a large proportion of fevers were due to dengue, typhoid and other vector-borne diseases (Smith et al., 2019). This diversity of fever causes underlines the need to integrate malaria surveillance with other febrile illnesses endemic to the South Asia and Southeast Asia region. Integration also becomes particularly relevant as the region and the rest of the world grapples with the COVID-19 pandemic.

The Asia-Pacific region is a diverse area that encompasses developed economies such as Australia, Japan and Singapore, emerging economy countries such as India and China, the two most populous countries in the world, and developing countries such as Papua New Guinea. The health systems in these countries are also diverse. Still, most of them face similar challenges in delivering healthcare to their respective populations (Zhao et al., 2013). Given the vast

differences in context between regions and the unique requirements for malaria elimination in the Asia-Pacific region, policymakers should take generic recommendations with caution (Baird, 2017). Differences across the region are critical reasons why localised surveillance is important to inform treatment and public health policies (Acestor et al., 2012). For example, even within one country such as Lao PDR, the geographical and temporal differences can result in varying disease profiles and, as a result, require adapted management guidelines (White et al., 2012).

Modelling studies have shown that an integrated system incorporating point-of-care host biomarker testing for various fever illnesses appears highly cost-effective and may warrant piloting in a real-life setting (Chandna et al., 2019). The same study highlights the importance of sharing data across borders to increase cost-effectiveness further. However, translating integrated surveillance into practice poses several challenges, which may be similar across countries, despite differences in the context and allocation of resources (Lloyd & Wait, 2006). Integration of services requires consideration of factors across the tiers of health systems, the connections across other sectors, governance structures, and broader social, economic and political contexts (WHO, 2015d). Thus, a systems approach is needed for successful interventions.

It is critical to identify what is hindering improved processes for integrating clinical and laboratory testing for febrile illnesses and other health challenges, despite its perceived merit. This article aims to do just that by reviewing relevant literature on the barriers to integrated health-care in general and febrile illnesses in particular. Further, it explores the different components of successful integration of services. An enhanced understanding of the barriers to integration and the components of successful integration models can inform future roadmaps for integrated fever management in the region as countries progressively move in that direction. This article proceeds as follows: Section 2 outlines the methodology for the literature review; Section 3 examines the results, structured according to the WHO building blocks for health systems; Section 4 provides examples of successful integration models; and Section 5 concludes.

2 | METHODOLOGY

A scoping review was conducted of published primary and secondary data sources, including peer-reviewed publications, expert opinion pieces, technical guides and reports. Literature searches and bibliography reviews to identify relevant publications were done using PubMed, Cochrane Database for systematic reviews, and grey literature sourced through Google and Google Scholar. Key terms used in the search strategy included ‘integrated healthcare’, ‘integration of healthcare diagnosis’, ‘integration of surveillance for febrile illnesses’ and ‘challenges or barriers’, with ‘malaria’ and ‘Asia-Pacific’ added as filters. The search was limited to English language publications focusing on low- and middle-income countries (LMICs), particularly in the Asia-Pacific region. It was also limited to infectious disease examples to maintain validity in applying outcomes to malaria elimination. Papers included implementation or evaluation of integration program reports where implementation challenges, barriers and successes were clearly stated.

The search with filters yielded a total of 84 peer-reviewed publications, and 25 were found to be relevant and included in the review. Further, a snowballing technique was used to identify more papers based on the bibliographies of relevant papers. An additional 19 papers were identified in this way, bringing the total number of papers and reports for review to 44. This included a total of nine country-specific papers from the Asia-Pacific region. The search also included

government reports ($n = 2$), regional workshop reports ($n = 3$), WHO reports ($n = 8$) and reports from other organisations such as the Global Fund ($n = 1$). A total of 58 articles were included in this review.

All the papers and reports were coded inductively using NVivo and analysed according to predefined themes identified in the literature. This meant each paper was coded on the specific barriers and challenges to integrating diagnostic services presented. These were then categorised using the WHO's Framework for Action for strengthening health systems, which describes six clearly defined health system building blocks that together constitute a complete system: service delivery; health workforce; health information; medical technologies; health financing; and leadership and governance (WHO, 2007, 2010).

3 | RESULTS

Based on the reviewed literature, we found the six WHO health system building blocks are not only interconnected but constantly interacting and must be understood together in a dynamic architecture of interactions and synergies (WHO, 2000). Evidence from high-income countries also suggests that these structural elements of primary healthcare systems are critical to shaping outcomes (Sheikh & Ghaffar, 2021).

Table 1 presents a summary of specific studies and reports that identified barriers to health-care integration. This is followed by a closer look at each of the health system building blocks identified within the relevant studies and the barriers they identify for integrating diagnostic services for febrile illness.

3.1 | Leadership and governance

The leadership and governance building block focuses on health system design and ensures strategic policy frameworks, effective oversight, accountability, regulations and incentives are in place (WHO, 2000). At a political level, integrated surveillance of febrile illnesses depends on the commitment and responsibility of various key stakeholders to ensure ownership and consistency with overall health systems development (Kabaterine et al., 2010). There is political will at the highest level in the Asia-Pacific region to maintain malaria elimination as a priority, as evidenced in commitments made in East Asia Summit statements (EAS, 2014; WHO, 2015c). Simultaneously, several malaria programs recognise the importance of progressively integrating malaria services into the general health system. This political will is critical to eliminating malaria and sustaining malaria services post-elimination to continue case detection, particularly imported cases from border areas. The successful integration of malaria services in the broader health system will take a strong push from senior officials within ministries of health to oversee the appropriate governance changes. These influencers and policymakers can be at a national, district and facility level. A WHO report suggests that integration can be most successful when managed at a subnational or facility level where implementation takes place (WHO, 2015d).

Barriers under the leadership and governance building block are related broadly to the lack of policy clarity at both national and subnational levels of care. Integration of services should be done according to clear strategies and guidelines to avoid gaps in access to services or key health technologies (WHO, 2008). The literature suggests a general lack of national strategies for various febrile illnesses (besides malaria) endemic to the Asia-Pacific region, such as dengue, leading to

TABLE 1 Summary of the literature identified for the integration of programs (descending year of publication)

Author	Title	Health system building block affected	Main challenges identified
Rahi et al. (2021)	India can consider integration of three eliminable diseases control programs on malaria, lymphatic filariasis and visceral leishmaniasis	Leadership and governance; Health financing	Vertical structure of malaria program
Aung et al. (2020)	Challenges in early phase of implementing surveillance and response approach in malaria elimination setting: a field study from Myanmar	Health information systems	Integration of data
Christofferson et al. (2020)	Current vector research challenges in the Greater Mekong Subregion for dengue, malaria and other vector-borne diseases: a report from a multisectoral workshop	Health financing	Less financial support for dengue vs malaria
Burkot et al. (2019)	Integrated malaria vector surveillance and control activities	Health information systems	Integration of data; data utilisation
Nagpal et al. (2018)	Integrated control of vector-borne diseases	Health information systems; Health workforce; Health financing; Leadership and governance	Data management and utilisation; lack of skilled human resources, sustainable funding and internal coordination
Tham et al. (2018)	Integrated healthcare systems in Asia: an urgent necessity	Health information systems	Lack of information technology infrastructure and high-quality data
Druetz (2018)	Integrated primary healthcare with an example of malaria	Health financing; Leadership and governance	Fragmentation of efforts; poor coordination
Tambo et al. (2016)	Integrated dengue early warning surveillance and related vector-borne diseases	Health information systems; Leadership and governance	Lack of sustained monitoring and evaluation systems and coordination

(Continues)

TABLE 1 (Continued)

Author	Title	Health system building block affected	Main challenges identified
de Jongh et al. (2016)	Integration of HIV, tuberculosis, malaria, syphilis, or nutrition services with antenatal care	Leadership and governance; Service delivery; Health workforce; Medical technologies; Health financing; Health information systems	Lack of training and guidelines for healthcare providers, staff shortages, country's legal framework and policies
Anders and Hay (2012)	Lessons from malaria control to help meet the rising challenge of dengue	Health information systems	Weak monitoring and evaluation systems
Brieger (2010)	Integrating public health programs with malaria control	Service delivery	Logistical factors such as cost and duration of training and organisation; attitudinal barriers such as motivation for supervision, affecting the quality of implementation
Shiff (2002)	Integrated approach to malaria control	Leadership and governance	Lack of national implementation strategies may lead to disjointed programs; regular change of personnel; decentralisation of health services, which has led to dispersed and limited technical support

disjointed programs from partners who have their own agendas (Shiff, 2002). A lack of national guidelines can result in suboptimal service provision (de Jongh et al., 2016). In their review of integration efforts for maternal healthcare services in HIV, tuberculosis, malaria, syphilis, or nutrition services with antenatal care in Asia, Africa and the Pacific, de Jongh et al. (2016, p. 552) point to uncertainty about the care pathways. Fear of harming patients resulted in healthcare providers opting for 'doing nothing' rather than intervening and risking an error. Evidence from various LMICs suggested that providers of integrated malaria services were often not clear about how to deliver intermittent preventative treatment of malaria in pregnancy for specific cases such as HIV-positive women and how to address potential side effects (de Jongh et al., 2016, p. 552).

3.2 | Health financing

Barriers to health financing related to declining investment in malaria, disproportionate funding to country disease burden and lack of funding for other febrile illnesses endemic to the region. Having adequate funding for health services is necessary to ensure availability of and access to services and to provide protection from financial hardship associated with paying for such services (WHO, 2000). A modelling investment case for the Asia-Pacific region showed that malaria elimination provides a 6:1 return on investment (Shretta et al., 2019). Estimates further showed that malaria elimination in the region could save over 400,000 lives and prevent 123 million malaria cases, providing almost US\$90 billion in economic benefits. However, discontinuing vector control interventions and reducing treatment coverage rates to 50% would result in an additional 845 million cases, 3.5 million deaths and excess costs of US\$7 billion (Shretta et al., 2019). The investment case provides compelling evidence for continuing to prioritise funding for malaria. Part of such funding should be set aside for long-term investment in integrated health systems.

However, the literature points to funding for integration programs as a key barrier to implementation. In many countries, malaria control and elimination are standalone programs that receive targeted funding. The Global Fund provided almost 50% of the total funding for malaria in Asia-Pacific in 2016 (Shretta et al., 2019). It was the only donor to provide funding for malaria case management (rapid diagnostic tools and treatment) in Papua New Guinea, for example. About 70% of malaria control funding in Cambodia was from the Global Fund. When funding was halted between 2015 and 2016 due to accountability concerns, core malaria activities were disrupted (Chhim et al., 2021).

In general, funding for malaria has been declining, with governments reallocating resources as the burden of malaria declines (CEPA, 2013; Global Fund, 2019). Reduced funding leads to reduced malaria activities, a dangerous trend as a systematic review has highlighted. Cohen et al. (2012) found that of the 75 malaria resurgence events identified between the 1930s and 2000s, 91% were attributed at least in part to reduced malaria control activities. A case in point is in Sri Lanka. Following a successful elimination strategy in the mid-1960s, the government disbanded the malaria program, contributing to a massive resurgence of the disease in 1967–1968 (Cohen et al., 2012). In contrast, other diseases, including fever-related diseases such as dengue, receive less funding even if they have a significant economic burden in some countries. For example, in Southeast Asia, the annual economic burden of dengue fever was between \$610 and \$1,384 million, with a per capita cost of \$1.06 to \$2.41. In comparison, malaria control's annual per capita cost ranged from \$0.11 to \$39.06 and for elimination from \$0.18 to \$27 (Shah et al., 2020).

Most health programs in LMICs are vertical, selective and disease-specific versus horizontal, comprehensive and system-wide (Druetz, 2018). Vertical programs are necessary for targeted control efforts, particularly in higher burden settings. However, there is growing empirical evidence that despite the effectiveness of these targeted disease programs, progress towards agreed health goals remains slow due to weak and fragmented health systems, which are unable to deliver the volume and quality of service needed (Shakarishvili et al., 2010). As we approach elimination in many Asia-Pacific nations and the burden of malaria reduces, integration becomes critical for the continuity of malaria services. For example, in Thailand, the unique malaria clinics model has successfully reduced malaria to elimination levels (Sudathip et al., 2019). In 2003, Thailand began partially integrating the malaria program into provincial and local public health

systems by adding it to the control of other vector-borne diseases and transferring some activities to the public health department (Suwonkerd et al., 2010).

Funding and investment in these health programs can also be affected by the performance of other system building blocks such as information systems. Challenges in evaluating the impact of integrated programs affects the program's investment case and the quality and relevance of decisions (Brieger, 2010). Impact data ensures a solid investment case can be made for integrated surveillance of febrile illnesses. In the Asia-Pacific, there is a particular need for knowledge of how to effectively consolidate existing vertically funded programs and operationalise the delivery of an integrated package of primary healthcare services (Palagyi et al., 2019).

3.3 | Health information

The health information system building block includes production, analysis, dissemination and use of reliable and timely information on health determinants, health system performance and health status (WHO, 2000). High-quality and robust evidence is required to help stakeholders make informed decisions on developing and implementing integrated surveillance of febrile illnesses.

A major organisational challenge highlighted in the literature is the lack of monitoring and evaluation (M&E) systems to measure the performance of integrated programs, resulting in erratic and inconsistent surveillance (Tambo et al., 2016). There is a need for appropriate process, outcome and impact metrics that result in translatable outcomes for integrated services (Fowkes et al., 2016) as well as improved local, regional and global endemicity and disease burden indicators to monitor the progress of disease surveillance effort (Anders, 2012). Ultimately, this means there is a weak evidence base for integrated surveillance of febrile illness in general. For example, despite interest in CHW programs and their proven efficacy in reducing morbidity and mortality from acute respiratory infections and diarrhoeal disease, there is relatively little information on their efficacy in malaria control and their effect on community uptake in the context of malaria elimination (McLean et al., 2018). In many countries in Southeast Asia, surveillance is supported by partners such as research institutions and non-governmental organisations (NGOs), and the standardisation of indicators and data requirements assists with more efficient data sharing and reporting (Nagpal et al., 2018).

A survey of Asia Pacific Malaria Elimination Network country partners with interventions that targeted populations at risk revealed that most countries did not have robust M&E procedures. Bhutan, Nepal and Vanuatu reported that mobility and porous borders present challenges to M&E efforts (Wen et al., 2016). There is therefore a weak evidence base for programming among these target populations and for integrated surveillance with other diseases.

An integrated data reporting system, which ensures a full picture of where the combined disease burden lies, is needed for effective integration of disease surveillance. However, information technology infrastructure and literacy across Asia are inconsistent (Tham et al., 2018) and require coordinated support from different providers. The comparative weakness of national health management information systems versus the heavily funded vertical malaria programs is a disincentive to integration. Vertical programs remain effective against ill-equipped and weak public health systems and have better monitoring and accountability owing to transparent governance arrangements (Rahi et al., 2021). For example, in Thailand, the process of integrating malaria programs into the public health system have only been partially successful as the resulting management process was inadequate in many facilities. This may be due to vulnerabilities

in the health system, incomplete transfer of responsibilities to public health departments, and social and ecological factors (Suwonkerd et al., 2010).

Despite the efficiency of vertical programs, such as the Global Fund-funded malaria program in India, this has created parallel systems of planning, implementation, information systems and M&E frameworks that adversely influence national policies by diverting and deflecting the coordinated efforts of policymakers to strengthen health systems (Rahi et al., 2021). An assessment of the malaria surveillance program in China highlighted the challenges of using different reporting systems (electronic and paper-based) by international NGOs and various administrative units across the study area (Feng et al., 2014). Unifying and streamlining case reporting was necessary to maintain the central malaria database and ensure it remained error and duplication free. In Myanmar, Aung et al. (2020) proposed that the National Malaria Control Programme strengthen the surveillance database system by integrating it with the District Health Information System platform and upgrading the electronic surveillance database system to township and regional-level data systems. They concluded that this would ensure timely and effective reporting from a single accessible centralised database (Aung et al., 2020).

Data utilisation can also be a challenge even where routine monitoring data is collected. A lack of evidence-based decision-making has been noted in integrated vector control programs. Surveillance data were collected by 89% of countries on at least one of eight priority vector indicators. Yet only 64% of countries identified one or more program decisions considering this vector data (Burkot et al., 2019). Better estimates of the dengue disease burden, for example, would inform economic analyses of control activities and advocacy for more coordinated funding to achieve adequate coverage, which has proven effective in malaria control (Anders & Hay, 2012).

3.4 | Service delivery

Service delivery as a pillar of the health system includes effective, safe and quality health interventions (including infrastructure) provided to those in need, when and where needed, with minimal resources (WHO, 2000). In a technical brief on integrated health services, the WHO states that integration is not a cure for inadequate resources or a system that does not work (WHO, 2008). Integrating two separate programs may provide some savings but integrating new activities into an existing system can cause severe strains on the system. A given workforce of health workers cannot be expected to add more and more duties to their workload without expanding the overall workforce at some point. In Tanzania, for example, integration of malaria services into antenatal care has been hampered, as these were not accompanied by additional resources and funding (de Jongh et al., 2016). A review of Integrated Management of Childhood Illness (IMCI) interventions in 29 countries from Asia and sub-Saharan Africa revealed that more than half of the countries had no significant improvement in health outcomes or coverage of services because service availability depended on the frequency of demand for a service, the complexity of delivery and the donor agencies' preferences (Brieger, 2010).

Lack of infrastructure, geographic access and targeted support are key barriers for effective integration of services. In the Asia-Pacific region, populations at higher risk of malaria are predominantly adult males who are exposed to infectious mosquitoes in their work in relatively isolated and impoverished rural areas, populations along national borders such as the Laos–Cambodia, Vietnam–Cambodia and Thailand–Myanmar borders, labourers returning from malaria-endemic regions, mobile ethnic groups, rural indigenous communities and persons displaced due to civil unrest. These mobile and migrant populations (MMPs) usually have

limited access to health facilities and prevention programs (Baird, 2017; Kounnavong et al., 2017; Sundararajan et al., 2013; Wen et al., 2016).

In Nepal, for example, there is a higher risk for imported malaria from neighbouring India. There is a need to target regions with high cross-border movement and MMPs (Smith et al., 2019). These MMPs can be missed during routine surveillance in health facilities or household visits due to their frequent movement and low use of public sector health services. Targeting surveillance strategies such as border screening and cross-border strategies may be more effective in tackling a specific disease and informing interventions (see, for example, Wangdi et al., 2021). However, the need for targeted interventions can be a disincentive for integration as it may not be cost-effective or optimal.

3.5 | Medical technologies

Health technology, equipment and an effective supply chain is one of the health system pillars that affect the availability and quality of service delivery (WHO, 2000). Some of the issues identified under this function area related to the procurement and supply of testing kits and medicines. Unavailability of commodities and irregular supply of essential consumables and drugs were major barriers to the uptake of integrated HIV, syphilis and malaria services in several Asian and African countries (de Jongh et al., 2016).

3.6 | Health workforce

The success of integration services will depend on health worker skills and compliance with the intervention (Mannava et al., 2015). There is a need for a responsive, fair and efficient health workforce available in sufficient numbers (WHO, 2000). This is because human resources ultimately affect how and what service is delivered. The literature shows that human resource capacity constraints are a major barrier to integrating surveillance with other diseases. Staff at all levels will need to acquire new knowledge about the additional diseases they are now meant to control (Kabaterine et al., 2010). The increased workload from new tasks combined with existing shortages and high turnover of staff have been highlighted as hurdles to scaling-up integrated services in Fiji, among other countries (de Jongh et al., 2016). Druetz (2018) argues that integration is more than just a juxtaposition of different tasks at the primary healthcare level where CHWs administer bundles of care for three or four diseases. Integration should be viewed as a continuous process to improve health services coverage and maximise health outcomes, rather than the end goal.

In most LMICs, primary healthcare services are delivered through a network of CHWs with varying degrees of training and differing remuneration arrangements (Dodd et al., 2019). Most malaria programs rely on CHWs trained to diagnose and manage malaria and access people in remote areas. However, with integrated surveillance for febrile illnesses, policymakers are concerned that CHWs are not adequately trained to provide the correct diagnosis for non-malaria fevers and can only refer them to the nearest health facility. A systematic review of barriers and facilitators to lay health worker programs found that while there were often high levels of trust in lay workers in the community, they also saw the care delivered by these workers as “insufficient”, particularly when they lacked access to medicines and equipment’ (Dodd et al., 2019, p. 10). Similarly, in one Thai study, while the community felt nurses based in local facilities delivered

lower-quality care, they also appreciated the benefit of not travelling to the hospital to receive treatment (Dodd et al., 2019).

Although in some countries, such as Myanmar, CHWs can only prescribe antimalarials and not antibiotics, they are still the most cost-effective way of reaching people in smaller remote villages where access to government health services is hampered by poor infrastructure and geographical factors (McLean et al., 2018). This would be especially valuable during outbreaks and pandemics such as COVID-19 where CHWs can help increase reach and coverage of services. McLean (2018) suggests that CHWs offering integrated healthcare services can be trained and adequately supported to diminish irrational use and distribution of antibiotics. Frontline workers need to be trained to deliver different healthcare packages to distinguish between different febrile diseases. Additionally, the CHWs need supportive clinical supervision to ensure quality service delivery, build skills and confidence, and ensure proper documentation of cases (Gera et al., 2019). Monitoring and supervision have been seen as the main cost driver for CHW programs, especially in difficult-to-access settings, where support is provided by mobile health teams (Kyaw et al., 2016). Strengthening febrile disease diagnosis and management will support malaria elimination efforts and improve preparedness for future outbreaks (Dittrich et al., 2020).

The reviewed literature also suggests that staff motivation and perceived lack of capacity by health workers may result in weak surveillance and service delivery of unfamiliar diseases in favour of a focus on easier services. The motivation and retention of CHWs, for example, is a key challenge for the Ministry of Health in Bhutan, similar to other low-income countries, which affects the delivery of health services (Tshering et al., 2019). Studies globally have generally shown that individual benefits (such as allowances) are important for recruitment. Still, professional benefits (including interpersonal relationships and opportunities) are more important for retention. However, what incentives work will vary considerably among various health service delivery contexts and models of care, both within health systems and between individual workers (Langlois et al., 2020).

4 | EXAMPLES OF SUCCESSFUL INTEGRATION MODELS

Several models around the world have successfully demonstrated how to integrate surveillance of febrile illness effectively. Sri Lanka is a good example of a country where people are being monitored for malaria and COVID-19 in an integrated case surveillance system under quarantine conditions, to the success of both programs. Sri Lanka was certified by the WHO as a malaria-free country in 2016 and now implements a rigorous surveillance program to prevent its re-establishment. Sri Lanka has also dealt with the COVID-19 epidemic by limiting the cumulative number of infections and deaths through coordinated efforts (Ranaweera et al., 2020).

In Myanmar, although the burden of non-malarial illness remains high, the malaria burden in villages has declined significantly. Consequently, the role of malaria volunteers in the community, who only provided services for malaria, diminished as evidenced by declining malaria testing rates. The malaria volunteers were retrained as integrated community malaria volunteers (ICMVs) in 2017–2018 to restore their motivation and social role. The ICMV model integrates activities for five additional diseases—dengue, lymphatic filariasis, tuberculosis, HIV/AIDS and leprosy—and this has been expanded nationally (Oo et al., 2021). In a case study in rural Myanmar, where there has been a decline in malaria cases, ICMVs have received additional training to expand their remit to general healthcare. This has sustained community uptake of malaria services by ensuring continued testing (McLean et al., 2018). This can be replicated in similar

settings where rural health workers can be trained to identify pathogens such as dengue and diagnose other illnesses such as COVID-19. However, some areas still need attention, such as the increased non-malaria workload placed on ICMVs and a reduced concentration on malaria elimination activities. Nonetheless, there are limitations in the expansion of volunteers' services. The health services law in Myanmar states that malaria volunteers cannot provide treatment for non-malaria diseases. However, they can provide prevention and referral services for other communicable and non-communicable diseases for community members (Oo et al., 2021).

In Mati City, Nepal, which is affected by both malaria and dengue, integrated surveillance has shown success. Malaria control has been well structured through the National Malaria Control Programme, with support from the Roll Back Malaria Project and Global Fund, resulting in a decline in malaria prevalence during 2005–2010. However, dengue control has been less structured and has received far less financial support than malaria control (Christofferson et al., 2020). A malaria-dengue task force was established, with a mandate to detect and respond to the incidence of malaria, dengue and any emerging vector-borne disease. Cases of dengue fever dropped from 185 in 2010 to 108 in 2011.

In a case study developed by the WHO and University of California, San Francisco, one of the drivers for successful change in Malaysia was integrating the vertical Malaria Control Programme into the Vector-Borne Disease Control Program (VBDCP) in the mid-1980s. Sabah and Sarawak, high malaria-endemic areas in Malaysia, were integrated by 1986. The national-level Malaria Control Programme, housed within the VBDCP, develops policy and provides technical expertise to state and district-level malaria programs. The VBDCP, which consists of entomologists and support staff, also coordinates policy development and supervision of vector control activities, mainly for malaria and dengue. The program adopted a primary healthcare approach to malaria control in 1990, where diagnosis occurred at clinics and hospitals rather than solely relying on staff from the national Malaria Control Programme. In 1994, Sabah was responsible for 83.4% of the total national malaria burden, declining to 27.9% by 2003. These trends largely reflect the prioritisation of vector control and surveillance interventions. There have been no indigenous human malaria cases for the last two years in Malaysia (WHO, 2015a).

5 | DISCUSSION AND CONCLUSION

Significant efforts have been made in the Asia-Pacific and worldwide to support more holistic care of patients at all levels of the healthcare system. However, this scoping review highlights the significant challenges associated with integrated programs ranging from integrated health delivery, integrated diagnostic testing services (including surveillance), and integrated public health response capabilities.

As malaria cases continue to decline in Asia and around the world, thinking about integrated service delivery is becoming increasingly important. While the widely used IMCI guidelines already take a clinically integrated approach, this is rarely reflected in the way programs, laboratories and departments are structured. Yet, continuing to monitor malaria and at the same time ensuring that those who do not have a positive malaria diagnosis are getting evidence-based care (including diagnostic testing) and treatment is important. Disease programs should consider integrated care, testing and surveillance of febrile illness to inform adequate diagnosis, treatment and public health interventions in a holistic and timely manner.

Our analysis of the reviewed literature shows that the barriers to successful integration are systemic and will require a health systems approach to addressing them, recognising the

interdependence of many elements. A lack of systematically assembled knowledge of what is needed and what works for effective integration of febrile illnesses in Asia-Pacific may hinder progress for health system planners in this region. It is important to identify evidence-based implementation strategies, determine where relevant evidence gaps exist and prioritise them for future study.

Building on the learnings from experience will be critical to tailoring integration attempts (outside of existing integrated clinical guidelines such as IMCI) to individual countries' needs and existing infrastructure. This is the case both in terms of the operationalisation of integration and the selection of which diseases (e.g., vector-borne diseases, including malaria) or syndromes (e.g., respiratory versus undifferentiated fevers in the context of outbreaks) are best suited to diagnostic integration. It is also about political and economic interests to advance the success of integrated disease programs. Some of the successful programs, particularly in Sri Lanka, Myanmar, Nepal and Malaysia, guide other countries and provide an entry point for expanded diagnostic integration in the future. However, it is worth noting that Sri Lanka and Malaysia had relatively strong primary healthcare systems to start with. These successes may not be easily transferable in countries with weak primary healthcare systems.

This review aims to build the foundation for more contextualised 'integration roadmaps' that can guide national stakeholders on the different operational and policy planning steps towards a successful integration model in countries that are nearing malaria elimination. The components of successful integration and integration roadmaps can serve as a public health tool in disease surveillance and health security. Such roadmaps need to provide country-specific guidelines for operationalising such integrated models and monitoring their success, healthcare spending, health outcomes and patient satisfaction. Further, such roadmaps and the careful mapping of steps and suggested solutions will highlight where digital health (e.g., data transfer and communication) and diagnostic innovations (e.g., multi-pathogen platforms) could support integration and address current challenges in terms of data integration as well as integrated clinical diagnosis. Further, this review highlights the need for additional research to understand the underlying drivers for the success and failure of integrated systems at different health system levels and the need for fit-for-purpose monitoring and evaluation systems.

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CONFLICT OF INTEREST

Gamuchirai Pamela Gwaza and Sabine Dittrich declare that they are employed by the Foundation for Innovative New Diagnostics (FIND).

DATA AVAILABILITY STATEMENT

Data sharing is not applicable to this article as no new data were created or analyzed in this study. All the information used is referenced and included in the reference list.

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