

สุขภาพผู้ย้ายถิ่นและการควบคุมโรคติดต่อในพื้นที่ชายแดนที่มีการเคลื่อนย้ายสูงของประเทศไทย : กรณีศึกษาเชิงระบบด้านวัณโรค เอชไอวี มาลาเรีย และการสร้างเสริมภูมิคุ้มกันโรคในเด็ก

เสาวพัทธ์ ชื่นจ้อย^{1*}, รเมศ ว่องวิไลรัตน์², สุภาวดี สุขหนู¹, สุนันทา สีโท¹, สุรวดี กิจการ¹, ภัทรนฤณ ชัยตระกูล¹, วิษณุกรณ์ กวยลี¹, พรนภา มักกะสัน¹, ปัทมรา ฉิมมาลา¹

¹กรมควบคุมโรค กระทรวงสาธารณสุข ประเทศไทย

²โรงพยาบาลแม่สอด กระทรวงสาธารณสุข ประเทศไทย

*Corresponding author, ✉ soawapak@gmail.com

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บทคัดย่อ

บทนำ : ประเทศไทยเป็นประเทศปลายทางสำคัญของผู้ย้ายถิ่นในอนุภูมิภาคกลุ่มน้ำโขง โดยการเคลื่อนย้ายข้ามพรมแดนส่งผลกระทบต่อโดยตรงต่อการควบคุมโรคติดต่อ ความต่อเนื่องของการดูแลสุขภาพ และความมั่นคงด้านสุขภาพของประเทศ โดยเฉพาะในพื้นที่ชายแดนที่มีการเคลื่อนย้ายประชากรสูง

วิธีการศึกษา : การศึกษานี้ใช้ระเบียบวิธีวิจัยเชิงคุณภาพร่วมกับการวิเคราะห์ข้อมูลเชิงพรรณนา โดยบูรณาการข้อมูลเฝ้าระวังโรคระดับประเทศ ข้อมูลทางระบาดวิทยาในพื้นที่จังหวัดตากซึ่งเป็นพื้นที่เฝ้าระวังตัวแทน และผลการวิเคราะห์จากการประชุมปรึกษาหารือผู้มีส่วนได้ส่วนเสียที่จัดโดยกรมควบคุมโรคในเดือนธันวาคม พ.ศ. 2568 ครอบคลุม วัณโรค มาลาเรีย เอชไอวี/เอดส์ และการสร้างเสริมภูมิคุ้มกันโรคในเด็ก

ผลการศึกษา : กลุ่มผู้ย้ายถิ่นโดยเฉพาะแรงงานข้ามชาติมีภาระโรคติดต่อในสัดส่วนสูง โดยเฉพาะวัณโรคและมาลาเรียซึ่งกระจุกตัวในพื้นที่ชายแดนไทย-เมียนมา การวิเคราะห์เชิงระบบชี้ให้เห็นช่องว่างสำคัญ 4 ประการ ได้แก่ 1) ความแยกส่วนของระบบข้อมูลสุขภาพ 2) ความไม่มั่นคงด้านการเงินการคลัง 3) อุปสรรคด้านระบบประกันและการเข้าถึงบริการ และ 4) ข้อจำกัดด้านกำลังคนและการสื่อสาร ผลการวิเคราะห์นำไปสู่กรอบยุทธศาสตร์ที่ประกอบด้วย 4 เสาหลัก ได้แก่ 1) การพัฒนาระบบอัตลักษณ์บุคคลด้วยเทคโนโลยีชีวมิติ 2) การบูรณาการชุดบริการควบคุมโรคติดต่อที่สำคัญ 3) การยกระดับการใช้กลไกความร่วมมือข้ามพรมแดนที่มีอยู่ และ 4) การเสริมสร้างศักยภาพบุคลากรสาธารณสุขสองภาษาในระดับชุมชน

อภิปรายผล : การควบคุมโรคติดต่อในกลุ่มผู้ย้ายถิ่นจำเป็นต้องอาศัยการบูรณาการเชิงระบบมากกว่าการดำเนินงานเฉพาะรายโรค การเชื่อมโยงระบบเฝ้าระวัง กลไกทางการเงิน โครงสร้างการกำกับดูแล และความร่วมมือข้ามพรมแดน มีความสำคัญต่อการเสริมสร้างความต่อเนื่องของการรักษาและความมั่นคงด้านสุขภาพของประเทศไทยและภูมิภาคโดยรวม

คำสำคัญ : สุขภาพผู้ย้ายถิ่น; ระบบสุขภาพข้ามพรมแดน; การควบคุมโรคติดต่อ; สุขภาพชายแดน; ประเทศไทย

Migrant health and communicable disease control in a high-mobility border setting in Thailand: A systems-based case study of TB, HIV, Malaria, and child immunization

Soawapak Hinjoy^{1*}, Ramate Wongwilairat², Suphawadee Suknoo¹, Sunanta Seetho¹, Suravadee Kitchakarn¹, Phatnarin Chaitrakoon¹, Witsanukorn Gualee¹, Pornnapa Makkasan¹, Paphatsara Chimmala¹

¹*Department of Disease Control, Ministry of Public Health, Thailand*

²*Mae Sot Hospital, Ministry of Public Health, Thailand*

*Corresponding author, ✉ soawapak@gmail.com

Abstract

Background: Thailand is a major destination for migrants in the Greater Mekong Subregion, where cross-border mobility presents persistent challenges to the control of communicable diseases, continuity of care, and national health security, particularly in high-mobility border areas.

Methods: This study applied a descriptive qualitative design with quantitative descriptive components. National surveillance data and sentinel epidemiological evidence from Tak Province were synthesized alongside qualitative findings from stakeholder consultations convened by the Department of Disease Control in December 2025, focusing on tuberculosis, malaria, HIV/AIDS, and pediatric immunization.

Results: Migrants accounted for a substantial share of tuberculosis and malaria cases, with disease burden concentrated along the Thailand–Myanmar border. Beyond epidemiological patterns, qualitative analysis identified four cross-cutting system gaps including 1) fragmented health information systems, 2) financing instability 3) structural barriers to insurance and service access, and 4) workforce and communication constraints. These findings informed a strategic framework comprising four interlinked pillars, including 1) biometric health identification, 2) integrated disease control service packages 3) operationalization of existing cross-border coordination mechanisms, and 4) strengthened community-based bilingual health workforce capacity.

Discussion: The findings highlighted that effective communicable disease control among migrant populations required system-level integration rather than disease-specific interventions alone. Aligning surveillance, financing, governance, and cross-border coordination mechanisms is essential to strengthen treatment continuity and enhance Thailand's national and regional health security.

Keywords: Migrant health, Cross-border health system, Communicable disease control, Border health, Thailand

Background and rationale

The geopolitical and economic landscape of the Greater Mekong Subregion (GMS) positioned Thailand as a primary destination for labor migration. This dynamic mobility was increasingly recognized as a critical determinant of national health security and regional disease control^(1,2). In fiscal year 2025, Thailand hosted an estimated 5.3–5.8 million migrants, which comprised approximately 8–9% of the total population. Consistent with the migration patterns documented in the Thailand Migration Report 2024⁽³⁾ and other assessments^(4,5), official statistics were widely acknowledged to underestimate the actual scale of migration. Evidence indicated a substantial presence of undocumented and irregular populations, including over one million migrant workers, as well as stateless ethnic minorities, asylum seekers, and displaced persons in long-term temporary shelters along the western border.

Migration functioned as a dynamic determinant of public health, as cross-border mobility facilitated the transmission of infectious diseases and challenged containment strategies primarily structured around national jurisdictions^(6,7). Migrant workers represented a critical component of Thailand's economy; macroeconomic analyses estimated that they contributed approximately 4–7% of the national Gross Domestic Product (GDP)⁽⁸⁾. Consequently, the health and protection of this workforce were recognized as integral to sustaining economic resilience and industrial continuity⁽⁹⁾. Conversely, elevated risks of tuberculosis, malaria, and sexually transmitted infections among migrants compounded by inadequate response mechanisms undermined national disease control efforts and increased the

likelihood of disease re-emergence^(10,11). Collectively, these factors indicated that migrant health management was a core element of Thailand's public health system, directly influencing the effectiveness of communicable disease control and economic sustainability.

Health interventions for migrants in Thailand particularly in border settings remained fragmented, with service delivery and disease control efforts depending heavily on project-based programs led by international donors and non-governmental organizations⁽¹²⁾. While these initiatives provided essential services, they often lacked the sustainability and scalability required to address the complexity of migrant health needs. Recent reductions in international funding forced major organizations to scale back or terminate operations, creating gaps in essential services and raising concerns regarding the continuity of surveillance and treatment⁽¹³⁾. This disruption highlighted the vulnerability of core disease control functions when reliant on external assistance, underscoring the necessity of strengthening national mechanisms for surveillance, response, and treatment continuity.

a disproportionate burden of communicable diseases overall, with notable heterogeneity by disease type. In particular, malaria accounted for a substantial share of cases among migrants, with approximately half classified as imported and largely concentrated along the Thailand-Myanmar border^(7,14). Given that malaria accounted for a substantial share of the infectious disease burden among migrants, Tak Province, contributing approximately 60%⁽¹⁵⁾ of the national malaria caseload was selected as a sentinel border province to examine migrant-associated

transmission dynamics. Mobility across borders similarly influences HIV transmission patterns. Migrant workers often face barriers to HIV testing, treatment continuity, and cross-border referral systems, contributing to delayed diagnosis and treatment interruption in border areas⁽¹⁶⁾. Consequently, 'Twin City' models established a practical framework for coordinated cross-border action⁽¹⁷⁾. In addition, child immunization coverage among migrant populations remains uneven due to high mobility, limited documentation of vaccination history, and barriers to accessing health services. These challenges contribute to delayed or incomplete vaccination schedules and increase the risk of vaccine-preventable disease outbreaks in border settings⁽¹⁸⁾. Despite Thailand's extensive experience in migrant health management, important gaps remained in understanding how cross-border mobility, disease transmission, and governance interact within national surveillance and response systems, particularly in border settings. Existing studies often focused on individual diseases or short-term project outcomes, limiting insight into how high-burden border provinces function as transmission hotspots rather than representative contexts. This gap was especially evident for infectious disease burden among migrants and was largely concentrated along the Thailand–Myanmar border.

Therefore, the objectives of this study were to examine migrant-associated infectious disease transmission dynamics in a high-burden border context using Tak Province as a case study, and to assess how Thailand's national disease control system particularly the Department of Disease Control (DDC) institutionalizes surveillance and response for migrant populations. The study aimed to inform the transition

from fragmented, project-based interventions toward a more sustainable national migrant health framework.

Methodology

Materials and Study design

This study employed a descriptive qualitative design with quantitative components to descriptively examine communicable disease burden among migrant populations in Thailand in terms of disease prevalence and incidence, and the operational burden on frontline health services. The analytical framework (Figure 1) was designed to capture both the macro-level policy contexts and the micro-level operational realities at the frontline of service delivery.

Mae Sot Hospital in Tak Province was purposively selected as the case study site due to its unique demographic composition and epidemiological significance. As of March 2025, Tak Province hosted approximately 37,580 registered Myanmar migrant workers⁽¹⁹⁾. These individuals were employed primarily in labor-intensive sectors, including manufacturing, food production, construction, agriculture, and fishing; 87% held regular migration status, while 13% remained irregular. This site provided granular data on disease prevalence, patient demographics, and the operational burden of communicable diseases.

For qualitative data, stakeholder consultation data were generated through facilitated group discussions conducted during structured consultation meetings. Discussion outputs included meeting notes, summary matrices, and consolidated action points produced during the sessions. Participants were guided to examine three core areas: (1) the current situation of migrant health service delivery and communicable disease control, (2) operational bottlenecks encountered

in implementation, and (3) potential approaches to address these challenges within existing policy and institutional frameworks. Following the consultations, discussion outputs were reviewed iteratively by the research team under the supervision of a senior advisor from the DDC. Recurring operational issues identified across discussions were synthesized inductively and organized into four analytical domains: data fragmentation, financial instability, insurance barriers, and workforce constraints. Strategic proposals proposed by the DDC were subsequently examined in relation to these domains to assess feasibility and alignment with national health security objectives.

For the epidemiological component, descriptive statistics (frequency, proportions, and percentages) were used to summarize morbidity patterns among migrant populations across four priority areas regarding communicable diseases, including on tuberculosis (TB), malaria, HIV/AIDS, and vaccination coverage.

Data Sources

1. Policy recommendation development meeting (December 2025): data were generated from a one-day structured policy consultation convened by the DDC on 15 December 2025. The meeting combined plenary presentations and facilitated group discussions, with both in-person and online participation. A total of 39 participants were purposively selected based on their institutional roles and technical expertise in communicable disease control and migrant health governance. Participants included senior experts, technical officers from multiple DDC divisions, researchers from the Health Systems Research Institute (HSRI), and frontline clinicians from Mae Sot Hospital.

Meeting outputs comprising presentation summaries, discussion notes, and consolidated recommendations documented in the official meeting report were used as qualitative inputs for policy analysis.

2. National routine surveillance and programmatic data sources: national-level data were analyzed as a separate secondary data source to contextualize and verify findings from the policy consultation. These data were drawn from routine surveillance systems, including the National Notifiable Disease Surveillance System (Report 506), and national programmatic datasets presented by disease-specific control programs (e.g., tuberculosis, malaria, HIV/AIDS, and immunization). Information from Mae Sot Hospital presented during the December 2025 meeting was cross-checked against national surveillance trends to ensure consistency and to situate sentinel findings within the broader national epidemiological context.

Data Analysis

I. Qualitative Data Analysis

Qualitative data consisted of outputs from the stakeholder consultation convened by the DDC in December 2025. These included meeting notes, presentation materials, summary matrices, and consolidated recommendations documented in the official meeting report. The research team reviewed these materials iteratively to identify recurring operational issues discussed during the consultation. These issues were grouped into four analytical domains reflecting system-level challenges, consistent with the framework presented in Figure 1: (1) data fragmentation and unlinked systems (2) financial instability and donor dependency (3) access and insurance barriers related to documentation gaps and

(4) workforce constraints and language barriers. Collectively, these structural challenges were identified by stakeholders as contributing to three core operational consequences for migrant communicable disease control including treatment interruption, surveillance gaps, and increased cross-border health risks. The strategic pillars were derived through structured synthesis of stakeholder consultation outputs.

Recurring operational gaps were organized into analytical domains based on their health system functions and subsequently consolidated into strategic pillars according to shared implementation pathways, feasibility within existing institutional mandates, and relevance to continuity of care for migrant populations.

II. Quantitative Data Analysis

National routine surveillance data, sentinel epidemiological information from Tak Province, and programmatic datasets presented during the policy consultation were reviewed to summarize the burden of communicable diseases among migrant populations. Analysis focused on compiling and synthesizing reported case numbers, proportions, and

trends related to tuberculosis, malaria, HIV/AIDS, and child immunization. Findings from Mae Sot Hospital were examined alongside national surveillance information to situate local observations within the broader national context.

III. Data Triangulation

Findings were interpreted by reviewing information from multiple sources together. Epidemiological data from national surveillance systems and the case study site were considered alongside qualitative insights from stakeholder consultations to provide a comprehensive systems-level perspective on migrant communicable disease control.

Ethical Considerations

This study involved the analysis of secondary, aggregated data from routine surveillance systems and policy documents. No individual patient data was accessed or analyzed, ensuring compliance with data privacy standards. The study was conducted as part of the routine policy development activities under the DDC.

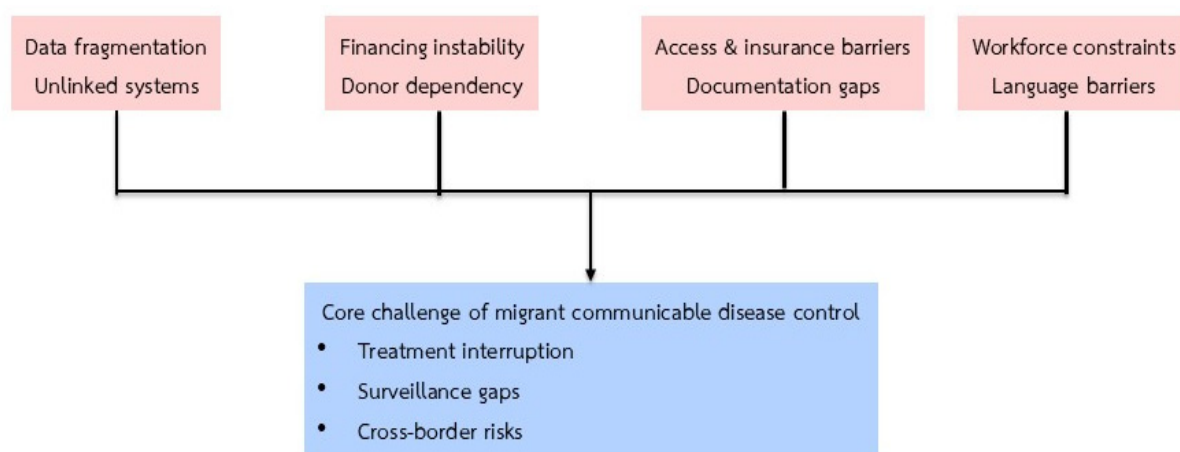


Figure 1 Systems-based framework for migrant communicable disease control in high-mobility border settings

Results

The results are presented in three sections. First, epidemiological findings describe the burden and distribution of priority communicable diseases among migrant populations, including tuberculosis, malaria, HIV/AIDS, and pediatric immunization. Second, qualitative analysis of stakeholder consultations identifies key systemic operational gaps affecting disease prevention and control. Third, these findings inform the development of an integrated strategic framework and its proposed operationalization to strengthen migrant health system responses.

1. Epidemiological burden of communicable diseases

1.1 Tuberculosis (TB)

- Tuberculosis among migrant populations remained a major public health concern, with cases heavily concentrated among cross-border migrant workers in western border provinces.

- Key epidemiological and operational characteristics included: Disease burden and concentration: TB cases among migrants represented a substantial proportion of the national TB caseload, with a marked concentration among Myanmar nationals.

- Case detection patterns: Active case-finding in Tak Province identified TB cases across multiple service platforms, including hospital-based screening, community clinics, and temporary shelters. Screening at Mae Sot Hospital identified 2,367 migrant workers with abnormal chest X-rays, while community clinic screening yielded 424 TB cases among 1,893 symptomatic patients (22.4%).

1.2 Malaria

Malaria among migrant populations remained concentrated in border areas, reflecting the strong

influence of cross-border mobility and occupational exposure patterns.

Key epidemiological characteristics included:

- Disease burden and concentration: Migrant malaria cases were highly concentrated geographically, with 95% detected in eight provinces along the Thailand–Myanmar border. Tak Province alone accounted for 51.4% of all migrant cases.

- Transmission characteristics: *Plasmodium vivax* predominated among migrant infections, accounting for 89% of cases, while *P. falciparum* represented 11%.

- Population profile: Most migrant patients were male (72%), aged over 15 years (78%), and primarily employed in labor-intensive occupations (57%).

1.3 HIV screenings

HIV among migrant populations presents important service delivery challenges, particularly due to insurance gaps and limited access to routine screening services.

Key epidemiological and programmatic characteristics included:

- Treatment access mechanisms: The national “Antiretroviral Therapy (ART) for Migrants” project established a treatment quota for 7,500 HIV-positive individuals without health insurance.

- Screening coverage limitations: Policy data indicated that HIV and syphilis screenings were not included under Social Security health check-up benefits during the study period.

- Case detection patterns: Health examinations of migrant workers at Mae Sot Hospital identified 141 cases of syphilis through November 2025, highlighting the importance of facility-based screening for early detection of sexually transmitted infections.

1.4 Pediatric Immunization

Immunization among migrant children remains a critical public health priority; however, accurate coverage estimates are constrained by population mobility and limitations in population registration systems.

Key epidemiological and programmatic characteristics included:

- Denominator uncertainty: Immunization coverage among migrant children could not be reliably estimated due to the absence of accurate population denominator data. Migrant children were not systematically captured within routine national population registries.

- Population mobility challenges: Frequent cross-border mobility and fragmentation of registration systems contributed to substantial uncertainty in estimating immunization coverage.

- Service utilization patterns: Available programmatic data therefore focused on service utilization rather than coverage rates. In Tak Province, immunization service records for 2024 documented the administration of 127,026 vaccine doses to migrant children under five years of age.

2. Systemic operational gaps

Analysis of operational gaps identified during the DDC National Focal Point Meeting in December 2025 revealed four primary systemic failures affecting communicable disease prevention and control among the migrant population, including:

2.1 Financial instability and funding shortfalls

The financial sustainability of migrant health services was threatened by a significant "funding gap." This was compounded by the reduction of

international support from organizations such as the Global Fund and various NGOs, which previously funded active case-finding and vaccine procurement for uninsured populations.

2.2 Data fragmentation and denominator uncertainty

A fundamental challenge was "denominator uncertainty" caused by the absence of a unified identification system. Health data remained siloed between the Ministry of Public Health (MOPH), NGOs (e.g., World Vision), and the private sector. This fragmentation prevented the calculation of accurate disease incidence or vaccine coverage rates. Stakeholders consistently emphasized this issue: "Health data are scattered across multiple systems—public health, NGOs, and labor databases—which makes it impossible to track migrants or calculate accurate disease coverage rates."

2.3 Health insurance and structural barriers

Financial and structural barriers to healthcare access were consistently raised during the discussions. Stakeholders noted that migrant health insurance premiums were widely perceived as unaffordable for informal and low-wage workers, contributing to gaps in service uptake. In addition, Social Security benefits did not adequately cover essential screenings for HIV and syphilis, and no dedicated state budget existed for those unable to purchase private health insurance. One participant summarized, "Many migrant workers cannot afford health insurance premiums, and those without insurance are often excluded from essential screening and treatment services."

2.4 Communication and workforce challenges

Linguistic and cultural barriers significantly impeded treatment adherence. While 200 Migrant

Health Volunteers (MHVs) in Tak were trained in 2025 to assist in surveillance and non-communicable disease (NCD) screening, a formal cadre of bilingual health assistants within the civil service had not yet been fully integrated to alleviate the burden on clinical staff.

3. Integrated strategic framework

In response to these identified gaps, an integrated strategic framework was developed to advance the national mission of disease control and prevention, informed by technical recommendations from the Office of the Senior Expert Committee and close coordination with national program focal points and research partners. This operational framework is structured around four interlinked strategic pillars: (1) digital identity and biometric integration, (2) integrated disease control service package implementation, (3) strengthening of cross-border collaboration and regional infrastructure, and (4) workforce capacity development and community engagement (Table 1), as summarized in Table 1.

4. Operationalization of the strategic pillars

The strategic pillars were developed by discussing and grouping the key system gaps identified during stakeholder consultations, without applying a formal strategic prioritization methodology, focusing on technological integration, governance shifts, and regional collaboration.

4.1 Digital identity and biometric integration

National programs proposed the adoption of a Biometric health identification system to resolve persistent identification failures. Developed through a partnership between the DDC, NECTEC, and the Thai

Red Cross, the system utilized iris and facial recognition technology, which had demonstrated high sensitivity and specificity in pilot evaluations. This technology served as a foundation for linking health records across various national surveillance databases, ensuring the continuity of care for mobile populations. During the stakeholder consultation, participants highlighted the operational challenges created by fragmented identification systems. One participant noted that “Many migrant patients receive services from multiple facilities, but without a shared identification system it is difficult to track their treatment history. A unified health ID would help link records across programs and ensure continuity of care.”

4.2 Governance and service package integration

To support the implementation of these recommendations, the meeting reached a consensus to establish sub-committees within the DDC. These sub-committees will be responsible for transitioning from disease-specific silos toward a more holistic “Service Package” approach, as outlined in Table 1. One stakeholder highlighted this coordination challenge, noting that “Multiple programs are already working on migrant health, but they often operate separately. What we need is a mechanism to connect these efforts and ensure continuity of care across diseases and across borders.”

To drive the implementation of these recommendations, stakeholders emphasized the need for strengthened coordination mechanisms to transition from disease-specific programs toward a more integrated “service package” approach, as outlined in Table 1. This coordination mechanism aims to connect existing programs working on migrant

health and ensure continuity of care across diseases and across borders.

One stakeholder highlighted this challenge, noting that “Multiple programs are already working on migrant health, but they often operate separately. What we need is a mechanism to connect these efforts and ensure continuity of care across diseases and across borders.”

4.3 Cross-order collaboration and regional infrastructure strengthening

The strategic framework emphasized the reinforcement of existing cross-border health mechanisms, specifically the "Twin City" model (e.g., Mae Sot, Thailand, and Myawaddy, Myanmar). Stakeholders highlighted the necessity of leveraging established infrastructure in Tak Province, notably the Border Health Learning Center and the Joint Information & Coordination Center (JICC), to serve as primary hubs for regional coordination. During the consultation, participants emphasized that existing coordination mechanisms could play a stronger role in supporting cross-border disease control. One stakeholder noted that “Cross-border collaboration already exists through mechanisms such as the Twin City model and the JICC. Strengthening these platforms will help ensure better information exchange, referral systems, and coordinated responses to communicable diseases across the border.”

4.4 Workforce capacity and community engagement

Linguistic, cultural, and trust barriers were identified as key constraints affecting service uptake and treatment adherence among migrant populations. Stakeholders therefore emphasized the need to expand and institutionalize bilingual health workforce

models, including migrant health volunteers and cultural mediators. Strengthening community-based workforce capacity was considered essential to improve risk communication, facilitate service access, enhance patient follow-up, and build trust between migrant communities and health systems. During the consultation discussions, participants highlighted the critical role of culturally and linguistically appropriate health personnel in bridging gaps between migrant communities and formal health services. One stakeholder noted that “Language and cultural barriers remain a major obstacle for migrant patients. Migrant health volunteers and community mediators play an important role in helping patients understand treatment instructions and maintain follow-up with health services.”

These perspectives underscored the importance of strengthening community-based workforce models as part of a broader strategy to improve service accessibility and continuity of care for mobile populations.

These platforms were designed to enhance the following operational capacities:

- Synchronized surveillance: disease detection and vector control campaigns (e.g., malaria interventions) were harmonized through real-time data exchange via the JICC.
- Capacity building: the Border Health Learning Center was utilized to standardize training for health personnel and Migrant Health Volunteers (MHVs) on both sides of the border.
- Continuity of care: cross-border referral systems for TB and HIV/AIDS were strengthened to mitigate treatment interruption and reduce the risk of drug-resistant strains.

Table 1. Strategic framework for strengthening migrant health systems to enhance communicable disease control and prevention

Grounded problem (from findings)	Strategic Pillar	Operating Mechanism	Anticipated Impact
Fragmented patient identification systems and poor continuity of care among mobile and cross-border populations	Digital identity and biometric integration	Deployment of a national Biometric Health ID system, developed through collaboration between the Department of Disease Control (DDC), National Electronics and Computer Technology Center (NECTEC), and Thai Red Cross, utilizing iris and facial recognition technologies to enable unique patient identification and linkage across national surveillance and health information databases	Improved accuracy of migrant identification, enhanced interoperability of health data systems, strengthened longitudinal health records, and improved continuity of care for mobile and cross-border populations
Siloed, disease-specific programs and financial constraints resulting in fragmented service delivery	Governance and service package integration	Establishment of strengthened coordination mechanisms to transition from disease-specific vertical programs toward an integrated “Service Package” model, standardizing surveillance, referral, diagnosis, treatment, and follow-up care across communicable diseases	Enhanced program coordination, reduced service fragmentation, improved efficiency and quality of care delivery, and strengthened system-wide accountability and performance monitoring
Disrupted continuity of surveillance, referral, and treatment across borders	Cross-border collaboration and regional infrastructure strengthening	Operationalization of the “Twin City” coordination model (e.g., Mae Sot–Myawaddy), leveraging existing regional platforms including the Border Health Learning Center and the Joint Information & Coordination Center (JICC) as coordination hubs for surveillance, referral, and data exchange	Improved continuity of surveillance and treatment across borders, strengthened outbreak preparedness and response capacity, enhanced referral efficiency, and reinforced regional health security
Communication barriers, workforce constraints, and limited trust between migrant communities and health services	Workforce capacity and community engagement	Expansion and formal integration of trained bilingual health assistants and cultural mediators to support frontline service delivery, community outreach, and risk communication	Improved provider–patient communication, increased service uptake, strengthened treatment adherence, and enhanced trust between migrant communities and health systems

Discussion

Thailand's tuberculosis (TB) control efforts were shaped by cross-border mobility, particularly along the Thailand–Myanmar corridor. While the high TB burden among migrants, especially in border provinces such as Tak—had been well documented, the more critical implication lay in the systemic challenge of treatment continuity across borders. Loss to follow-up among migrant patients remained a key vulnerability, raising concerns about the emergence and transmission of multidrug-resistant TB (MDR-TB)⁽²⁰⁾. These findings underscored that TB elimination could not be achieved through domestic interventions alone but required mechanisms that explicitly accounted for mobility and cross-border care pathways.

In this context, the study emphasized the operational value of the 'Twin City' approach (e.g., Mae Sot–Myawaddy) as a practical platform to maintain treatment continuity through shared patient registries and harmonized treatment protocols⁽²¹⁾. Although the Twin City model already existed as a policy instrument, qualitative findings from the stakeholder consultations revealed that its use was largely confined to the DDC's international and regional coordination units, with limited integration into routine disease-specific programs. Strengthening the approach therefore referred to institutionalizing its use across DDC divisions so that surveillance, referral, and follow-up mechanisms were consistently applied in everyday service delivery. Without such integration, TB elimination goals remained difficult to attain due to the continual reintroduction of infection across porous borders. A similar logic applied to malaria elimination. While malaria among migrants remained geographically concentrated in border provinces, the

qualitative findings highlighted that human mobility and program fragmentation, rather than biological factors alone, sustained transmission. The persistence of *Plasmodium vivax*, with its relapsing hypnozoite stages and lengthy primaquine regimen, posed particular challenges for mobile workers^(22,23). Stakeholders emphasized that without synchronized cross-border follow-up and adherence support, relapse-driven transmission would continue despite declining national case numbers. The proposed Twin City model thus represented a governance solution to an operational problem, enabling patients diagnosed on one side of the border to complete treatment on the other⁽²⁴⁾.

Beyond TB and malaria, the qualitative analysis revealed systemic vulnerabilities in HIV services and immunization that were not captured by disease burden metrics alone. Although the national "ART for Migrants" program provided an important safety net, its capped coverage and reliance on case identification through passive systems limited its reach. Stakeholders highlighted that the principal gap lay not only in treatment quotas, but in identifying and retaining migrants living with HIV within care pathways, particularly those who were undocumented or highly mobile. Similar gaps were observed for syphilis screening and maternal STI prevention, contributing to preventable adverse outcomes⁽²⁵⁾. These findings pointed to the need for stronger linkage mechanisms between surveillance, outreach, and treatment services rather than expansion of disease-specific quotas alone.

Pediatric immunization further illustrated how mobility may interact with health system access. Although catch-up vaccination activities existed,

previous studies have reported that barriers such as high mobility, lack of formal identification, and fear of arrest among undocumented migrants can deter families from accessing health services⁽²⁶⁾. These contextual factors may partly explain the persistent immunization gaps observed among migrant populations. The deployment of MHVs was viewed as a promising strategy to bridge trust and access gaps. Institutionalizing community-based workforce models such as MHVs within routine health services was therefore considered critical to closing immunization gaps.

Across all disease areas, two cross-cutting system constraints, including data fragmentation and financing gaps, emerged as central barriers. “Denominator uncertainty,” arising from unlinked health, labor, and immigration databases, undermined accurate risk assessment and continuity of care⁽²⁷⁾. In response, stakeholders supported the exploration of biometric or unique health identification systems to improve patient tracking across facilities and borders. Evidence from other settings suggested that biometric identification had improved data integrity and service continuity among mobile populations, including migrant workers and refugees in countries such as India and Rwanda, where biometric-linked health or social protection systems enhanced interoperability and reduced duplication⁽²⁸⁾.

Financing constraints were similarly interpreted as a structural issue rather than a short-term funding gap. Border hospitals continued to absorb unreimbursed costs for uninsured migrants, reflecting limitations of existing insurance and budgetary arrangements⁽²⁹⁾. While increasing insurance premiums was discussed in policy debates, stakeholders expressed concern that this approach alone might further exclude low-wage

and informal workers. Alternative financing approaches including pooled public subsidies for high-burden areas, blended financing models combining employer contributions with government support, and dedicated cross-border health funding mechanisms were viewed as potentially more equitable and sustainable. Evidence from health financing reforms in other settings suggests that public fiscal transfers, pooled government subsidies, and shared financing responsibilities can significantly expand service coverage and reduce regional inequities, particularly for underserved populations, although further economic evaluation is needed to assess feasibility in the migrant health context⁽³⁰⁾.

Taken together, these qualitative insights informed the development of a multidimensional strategic framework that prioritized functional integration rather than program expansion. By linking biometric identification, cross-border coordination, standardized service packages, and a strengthened bilingual workforce, the framework addressed the underlying system constraints that repeatedly surfaced across disease areas^(29,31). Rather than proposing new vertical programs, the study highlighted how existing mechanisms could be better aligned to improve resilience and equity in migrant health systems.

This study had several limitations. Data relied on routine surveillance, which was susceptible to underreporting and misclassification among mobile populations. In addition, the analysis focused on four priority disease areas—tuberculosis, malaria, HIV/AIDS, and pediatric immunization as tracer conditions to illustrate system-level challenges. While these conditions were selected due to their public health significance and relevance to migrant populations,

they may not fully represent the diversity of communicable disease risks affecting migrants. Persistent denominator uncertainty restricted the precision of incidence estimates, while the purposive selection of Tak Province as a sentinel site meant findings were not necessarily generalizable to other migration contexts.

In addition, the qualitative component was subject to potential social desirability and respondent bias, as data were derived from stakeholder consultations involving institutional actors who may have emphasized system constraints aligned with their organizational roles. The absence of migrant and employer perspectives further limited the breadth of viewpoints captured. As the analysis was conducted by researchers embedded within the policy environment, reflexivity and positionality may have influenced interpretation, despite efforts to triangulate findings across data sources. Finally, the cross-sectional design precluded assessment of long-term feasibility, effectiveness, or cost-efficiency of the proposed approaches.

Suggestions

Findings from this study indicated that persistent system gaps particularly data fragmentation, financing instability, weak cross-border coordination, and workforce constraints limited the effectiveness of communicable disease control among migrant populations. To address these gaps, future efforts should prioritize:

- Evaluating the feasibility and governance implications of biometric or unique health identification systems to reduce denominator uncertainty and improve continuity of care.

- Assessing integrated service delivery models that link surveillance, referral, and treatment across TB, malaria, HIV, and immunization programs in high-mobility settings.

- Examining how existing cross-border mechanisms, such as the “Twin City” model, can be more effectively operationalized across disease programs.

- Exploring sustainable financing and workforce models, including the formal integration of bilingual health workers and Migrant Health Volunteers.

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