



MARKET ANALYSIS FOR A NEW POINT-OF-CARE DIAGNOSTIC TEST FOR GONORRHOEA IN THAILAND

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Lead Writers:

Jennifer Daily (Jennifer Daily Consulting LLC)

Maël Redard-Jacot (FIND)

Reviewers:

Maël Redard Jacot (FIND)

Nada Malou (FIND)

Jennifer Daily (FIND)

Priyanka Singh (FIND)

Copy-editors:

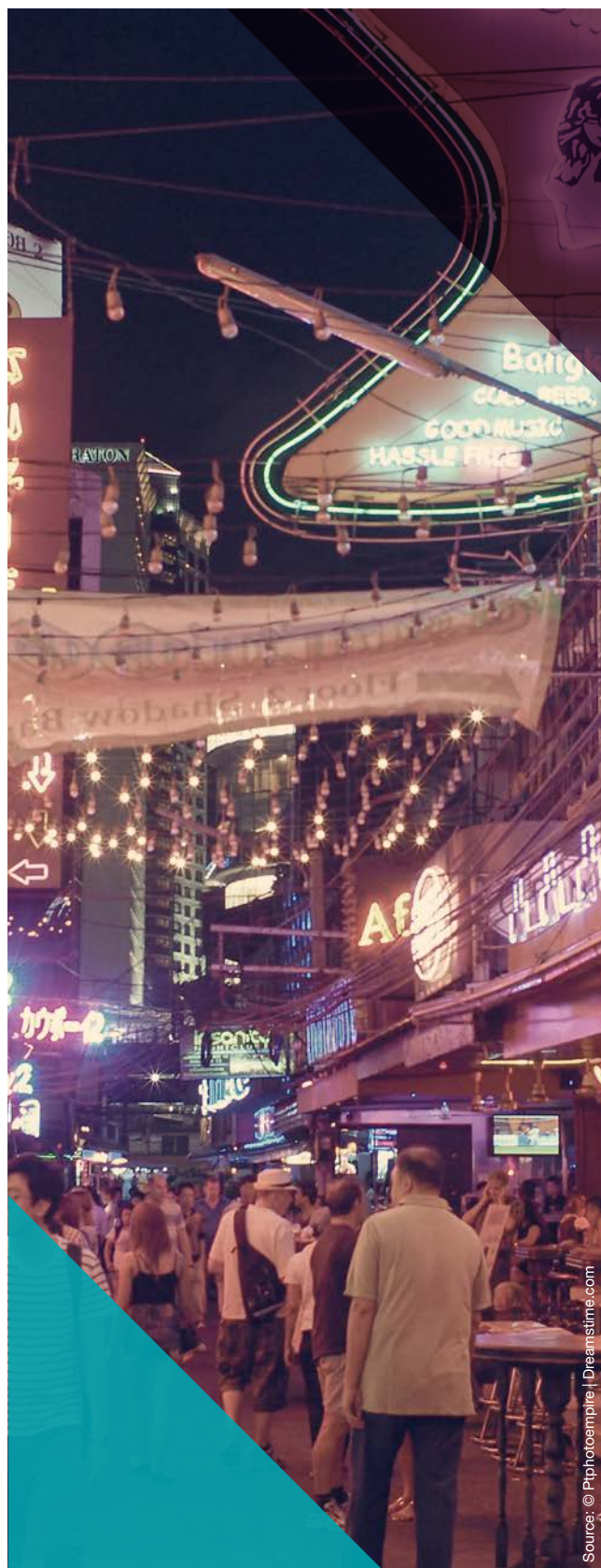
Beatrice Gordis (FIND)

Priyanka Singh (FIND)

Talya Underwood (Anthos Communications UK)

Layout:

J R Papa (SFD Creative)



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ABBREVIATIONS

AMR	Antimicrobial resistance	POC	Point of care
ART	Antiretroviral therapy	PrEP	Pre-exposure prophylaxis
BMA	Bangkok Metropolitan Administration	RDT	Rapid diagnostic test
CSMBS	Civil Servant Medical Benefit Scheme	SHI	Social Health Insurance
CT	<i>Chlamydia trachomatis</i>	STI	Sexually transmitted infection
CDC	U.S. Centers for Disease Control and Prevention	TFDA	Thai Food and Drug Administration
DAS	Division of AIDS and STIs	TGW	Transgender woman
DDC	Department of Disease Control	UCS	Universal Coverage Scheme
DMSC	Department of Medical Sciences	USAID	United States Agency for International Development
EGASP	Enhanced Gonococcal Antimicrobial Surveillance Programme	VCT	Voluntary counselling and HIV testing
FSW	Female sex worker	WHO	World Health Organization
GFATM	Global Fund to Fight AIDS, Tuberculosis and Malaria		
HIV	Human immunodeficiency virus		
IHRI	Institute of HIV Research and Innovation		
KSI	Key stakeholder interview		
MIC	Minimum inhibitory concentration		
MoPH	Ministry of Public Health of Thailand		
MSM	Men who have sex with men		
NAAT	Nucleic acid amplification test		
NG	<i>Neisseria gonorrhoeae</i>		
NGO	Nongovernmental organization		
NHSO	National Health Security Office		
ODPC	Office of Disease Prevention and Control		
PEP	Post-exposure prophylaxis		
POCT	Point-of-care test		

EXECUTIVE SUMMARY

Thailand has made progress in controlling sexually transmitted infections through various efforts, including national condom campaigns and the more recent mother-to-child syphilis elimination programme. However, during the past 15 years, the most common bacterial STI, gonorrhoea, has been increasing, particularly among the youth.

In 2019, public hospitals in Thailand reported 9,799 gonorrhoea cases, which is an underestimate arising from incomplete reporting within hospitals and the absence of reporting at health centres and private facilities. As in many countries, Thailand lacks up-to-date prevalence surveys and STI care-seeking data; nevertheless, it maintains robust surveillance for drug-resistant gonorrhoea. While resistance to the first-line treatment for gonorrhoea, ceftriaxone, has yet to be documented, studies suggest that this treatment is becoming rarely effective.

Thailand has a strong primary care and health promotion programme and, since 2002, universal healthcare. Although Thailand's major health burden comes from noncommunicable diseases, HIV, tuberculosis and drug-resistant malaria remain challenges. The prevalence of HIV in Thailand is among the highest in the region, and a focus on key populations is critical to attaining its 2030 target for ending AIDS.

The Thai healthcare system is relatively complex, comprising of public and private facilities and three major medical insurance schemes. The Thai Ministry of Public Health (MoPH) sets policies and oversees public-sector care delivery through a network of 9800 health centres, 750 community hospitals and 116 general hospitals. The National Health Security Office insures most of the population through the Universal Coverage Scheme. This programme assigns patients to local health centres and

community hospitals, which receive capitation fees for primary care. If patients attend their assigned primary care facility for a symptomatic STI, the cost of their care is covered; elsewhere, patients pay out-of-pocket for their STI care.

Thailand's national STI programme falls under the remit of the Department of Disease Control (DDC) at the MoPH, supported by the Bangrak STI Center, and Thailand's STI reference centre. Thailand routinely updates its national STI guidelines and strategies.

Antimicrobial resistance (AMR) is a high priority in Thailand. Among the drivers of resistance are the high rates of self-medication, attributed to over-the-counter access to antibiotics in pharmacies. Notably, the national STI programme and the Thai Food and Drug Administration (TFDA) are discussing strategies to reduce the use of antibiotics purchased from pharmacies to treat gonorrhoea, in parallel with increasing the etiological management of gonorrhoea in health facilities.

Thailand's current STI guidelines (2019) recommend etiological gonorrhoea management where possible and a syndromic management where laboratory testing is not available. The recommended treatment for gonorrhoea in Thailand aligns with the World Health Organization (WHO) guidelines, while local AMR monitoring informs treatment updates. Separate 2010 guidelines recommend routine screening for key at-risk populations, and the MoPH intends to update these guidelines in 2021. There is no data available about screening coverage. Medical insurance schemes do not cover for most STI screening tests; therefore, patients pay out-of-pocket unless the test provider has access to special prevention funds or donor funding.

Several types of health facilities offer STI care. Generally, etiological management is practiced by eight DDC-affiliated STI clinics, regional and general hospitals, multiple nonprofit/private STI clinics, and district/community hospitals. While district/community hospitals rely solely on Gram staining for gonorrhoea diagnosis, some higher-level and specialized facilities perform culturing and molecular testing as well. Syndromic management is practiced at health centres and occasionally in public hospitals when workloads are high, or test results are not delivered timely.

Private health facilities, as well as pharmacies, provide some STI care. Key stakeholders suggest that concerns around privacy and stigma cause patients to first seek care at pharmacies. Additionally, it is common for patients to avoid their assigned primary care facility, opting to pay out-of-pocket for care at a facility outside their community. Some patients also prefer more expeditious alternatives to the often-crowded public sector.

Interviews with key stakeholders and an online survey were conducted to explore potential use-case scenarios for point-of-care tests (POCTs) for gonorrhoea and chlamydia. As Thailand has a policy for etiological diagnosis, it is not surprising that survey respondents' priority use cases reflected the current guidelines. The top priorities were testing symptomatic men, women and patients attending STI clinics. The second set of priority use cases were testing high-risk/vulnerable populations and in connection with HIV treatment and pre-exposure prophylaxis (PrEP).

The market for affordable, user-friendly POCTs for gonorrhoea in Thailand is encouraging, with the potential to expand etiological diagnosis and test-based screening using both the gonorrhoea rapid diagnostic test (RDT) and the molecular POCT for gonorrhoea/chlamydia. The gonorrhoea RDT would be convenient in the lowest levels of the healthcare system, where testing is not available readily. Additionally, although it is more expensive than

Gram staining, the superior performance of the RDT when testing women justifies its routine use at the hospital level. The molecular POCT could expand access to STI screening, as many hospitals and clinics regularly engage with key populations, yet few have the molecular testing capacity required for screening. Healthcare facility budgets are mainly based on capitation fees, and there is limited funding for screening. Hence, the price of both the tests and their cost-effectiveness will be critical to make any decisions to adopt them. Ease of sample collection, test processing, and interpretation are also important, as the intended use of these tests include settings that lack dedicated laboratory capacity and resources.

For market introduction, Thailand has well-established and transparently structured institutions. However, many processes and players are involved, including MoPH guideline updates, TFDA review, and health technology assessments to inform reimbursement decisions. Following the completion of the national level processes, individual facilities can adopt and procure tests. At the health-centre level, a one-size-fits-all approach is implausible, as each hospital and dedicated STI clinic may prefer a different combination of gonorrhoea testing platforms, depending on their existing gonorrhoea testing capacity (e.g., Gram stain, culture, nucleic acid tests) and the local STI burden.

Concluding, Thailand is a regional and a global leader in STI control and an essential market for new POCTs for gonorrhoea. It would be worthwhile to engage with relevant stakeholders such as conducting studies with leading Thai institutions involved in providing STI services, familiarizing them with new technologies, and building a local evidence base.

OBJECTIVES AND METHODS

In 2016, globally there were an estimated 87 million new cases of gonorrhoea. *Neisseria gonorrhoeae* (NG), the bacteria that causes gonorrhoea, has developed resistance to most commonly available antibiotics used to treat it. In 2018, the first case of extensively drug-resistant NG was reported. In low-resource settings, healthcare providers generally use the World Health Organization (WHO) syndromic approach for managing symptomatic patients, which leads to both under- and over-treatment. To enable etiological case management, the Foundation for Innovative New Diagnostics (FIND) is supporting the development of point-of-care tests (POCTs) for *Neisseria gonorrhoeae*/*Chlamydia trachomatis* (NG/CT).

In 2019, FIND completed a high-level market assessment to understand the potential market size for such tests. Despite the potential need for testing (i.e. a large number of people eligible for NG testing), there is a significant uncertainty around the actual degree of demand for a new test, as well as concerns around many potential barriers to access. Following this, FIND has undertaken more in-depth market assessments in selected countries.

This report summarizes the results from the market assessment in Thailand, which includes the current situation regarding sexually transmitted infections (STIs), access to care, management practices, the structure of healthcare systems, the potential role of any new diagnostics for NG, and potential challenges to the adoption and use of these tests. Ultimately, this market research will inform forecasts of the demand for NG diagnostic tests and strategies for the antimicrobial stewardship-based diagnosis and management of NG.

The methods used for the market assessment included:

- ▶ An extensive desk review of reports, strategic STI and AMR documents, and selected literature on STIs, HIV and AMR in Thailand.
- ▶ A review and analysis of data, including NG case rates and AMR data.
- ▶ A total of 16 key stakeholder interviews (KSIs), conducted between August and November 2020. (Annex 1).
- ▶ An analysis of 25 online survey responses from relevant Thai stakeholders. An English version of the survey was conducted during Q1 of 2020 and had six Thai respondents; a Thai version conducted later in 2020 had 19 respondents.

The data collection and analysis for this report was completed during the second half of 2020, except for the English online survey, which was conducted in early 2020.

I CURRENT STI SITUATION IN THAILAND

1.1 Burden and epidemiology of gonorrhoea and other STIs

Historically, STIs have been among the most significant public health problems in South-East Asia; however, substantial progress has been made in the past three decades. In Thailand, nationwide condom campaigns in the 1990s focused mainly on the sex industry and led to substantial reductions in the numbers of STI cases. New cases of bacterial STIs decreased from 785 cases per 100,000 population in 1986 to 25 cases per 100,000 population in 1999.¹

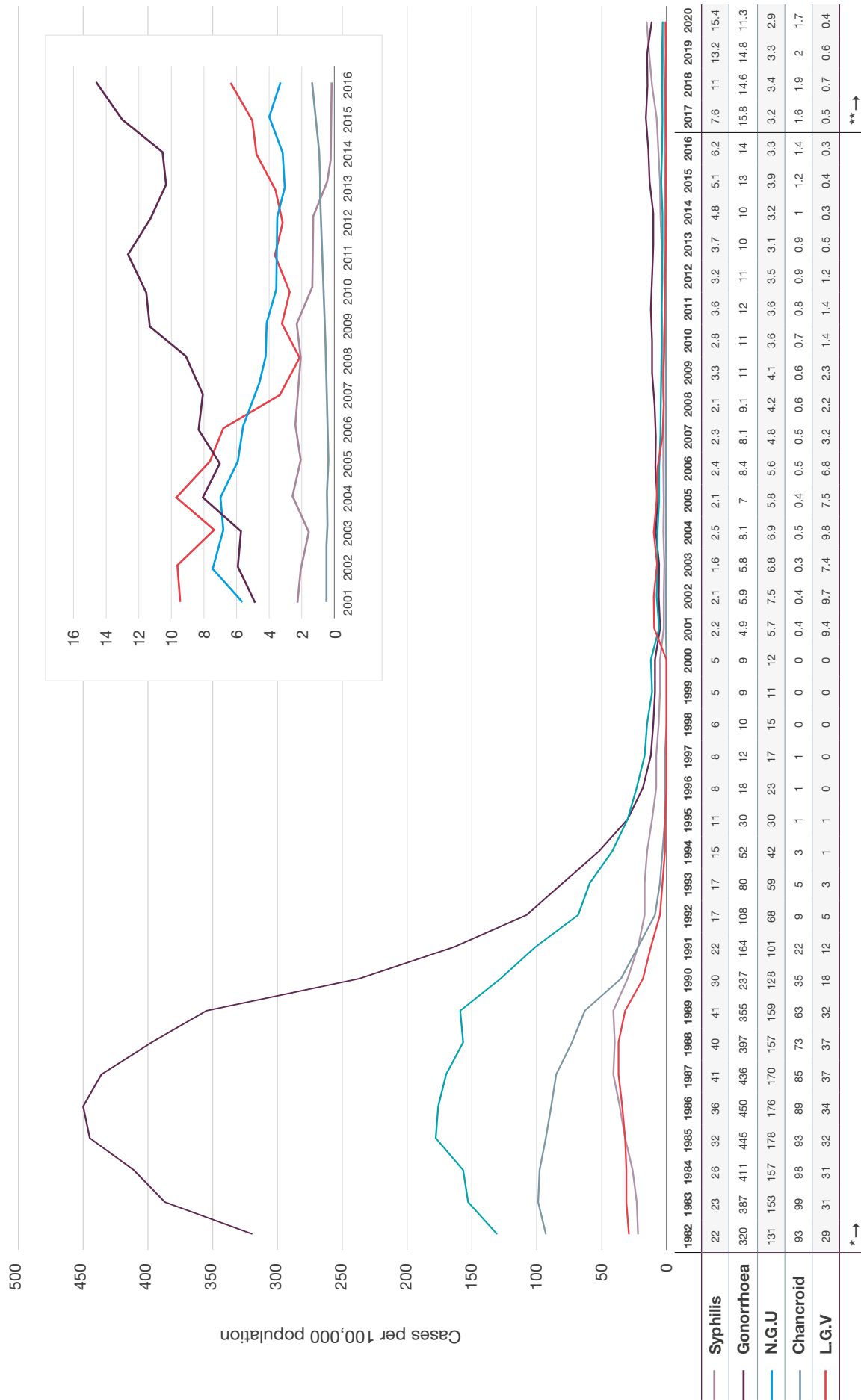
In Thailand, gonorrhoea is the most common bacterial STI, with public healthcare facilities reporting 9,799 cases in 2019. During the past two decades, there has been an upward trend in cases of gonorrhoea nationwide, from 7.4 cases per 100,000 population in 2005 to a high of 15.8 cases per 100,000 population in 2017; there were 11.3 cases per 100,000 population between January and September 2020. (Figure 1). These data come from the Bureau of Epidemiology, Department of Disease Control (DDC), Ministry of Public Health (MoPH) of Thailand surveillance system. The MoPH collects STI data via the “506 Reports”, which are generally completed by public hospitals. Reported gonorrhoea cases include both etiologically confirmed and syndromic cases, with many cases occurring in symptomatic patients (i.e., not patients identified by screening programmes). In the KSIs, several limitations were reported that indicated towards an underestimation of NG case numbers. Generally, public hospitals report cases, excluding those identified at lower-level facilities. Within these hospitals, STI Patients may be treated by various

departments, and some may not be aware of the reporting system. Finally, the private sector does not contribute to STI surveillance, including some STI clinics, pharmacies providing self-medication treatments and private hospitals.

In the 2019 Bangkok HIV Behavioral Surveillance Survey, 7.9% reported having had a STI in the year prior to the survey.² This high rate may be biased as the surveyed population is not representative of the general population: two thirds of the 8,877 people surveyed were under the age of 25 years. The study targeted students, key vulnerable population and the general population (represented by factory workers, migrant workers and army recruits).

Recent epidemiological data is limited and includes primarily prevalence studies focused on priority populations. There are no recent, nationally representative estimates of the STI burden in Thailand.³ The DDC prioritizes STI surveillance and explores various approaches to strengthen the validity of the data. For example, the MoPH is working with the national health insurance programme to access reimbursement data for STI care, which may help to supplement the case report data collected using the “506 Report”. Also, the MoPH intends to improve monitoring of compliance with guidelines at the district-hospital level and above (e.g., whether tests and treatments performed are aligned with the national guidelines).

Figure 1: Reported STI cases per 100,000 population in Thailand



LGV – lymphogranuloma venereum; NGU – nongonococcal urethritis

*Source: Moving ahead on elimination of Sexually Transmitted Infections (STIs) in WHO South-East Asia Region – progress and challenge. New Delhi: World Health Organization, Regional Office for South-East Asia; 2018

**Source: Thai Division of Epidemiology (30 September 2020), presented by Dr. Rossaphorn Kittiyaowamarn, 23 November 2020.



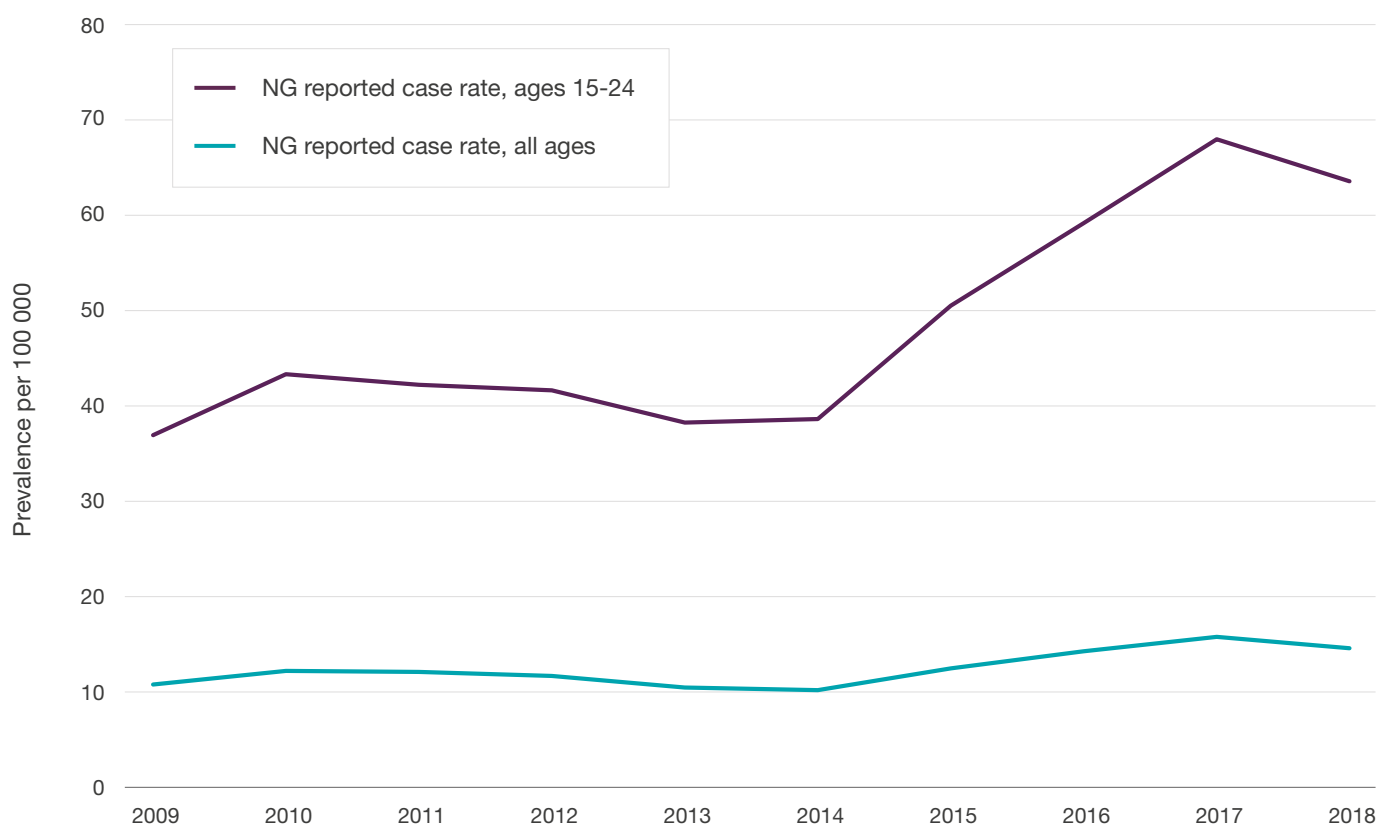
Despite these limitations, the data from Thailand stand out among the country's peers for their continuity and are useful for monitoring trends.⁴ The data indicate that STIs are a growing concern in vulnerable populations. While sex workers were once the main focal population, concerted efforts with this population, such as condom campaigns, outreach, mapping of establishments, and enumeration of sex workers, have been successful. Recent data suggest that increasing STI incidence has shifted towards men who have sex with men (MSM), transgender women (TGW), and young/adolescent populations. Findings from the KSIs suggest that reductions in government condom campaigns and the advent of effective HIV treatments, together with pre-exposure prophylaxis (PrEP), have reduced condom use, especially among younger people, which has led to an increase in STIs.

Almost 65% of reported cases in gonorrhoea occurred in people aged 15 to 24 years, with

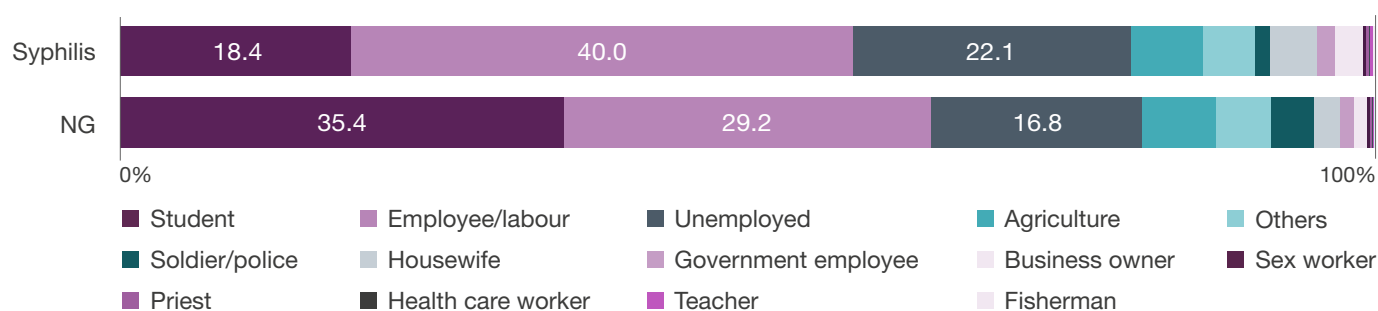
students representing 35% of cases (Figure 2 and 3). Gonorrhoea is also particularly prevalent among certain high-risk populations, such as MSM and TGW.^{5,6} Two extensive studies found a 15% prevalence of NG infection in any anatomical site among Thai MSM, with a higher prevalence among MSM who were HIV-positive compared to those who were HIV-negative.^{7,8} Similarly, a large study of TGW found a 14.5% prevalence of NG infection, indicating higher rates among those HIV positive than those who were not. Notably, these studies reported a higher prevalence of NG infections in oral and rectal sites.⁹

An estimated 2.4 million migrants, representing another vulnerable group living in Thailand, also have a high burden of infectious diseases and are unable to access the universal healthcare coverage scheme. Although they are an important population, the KSIs did not disclose much information about STI burden and access to care among them.

Figure 2: Reported case rates of NG in Thailand by age group



Source: Adapted from the Thai Division of Epidemiology (30 September 2020), presented by Dr. Rossaphorn Kittiyaowamarn, 23 November 2020.

Figure 3: Proportion of syphilis and NG cases by occupation (2019)

Source: Adapted from the Thai Division of Epidemiology (30 September 2020), presented by Dr. Rossaphorn Kittiyaowamarn, 23 November 2020

1.2 Antimicrobial resistance surveillance

Since 2015, Thailand was the first country to implement and maintain the Enhanced Gonococcal Antimicrobial Surveillance Programme (EGASP), in collaboration with WHO and US Centers for Disease Control and Prevention (CDC).¹⁰ There are two EGASP sites: the Bangrak STI Center (general population, MSM and TGW) and the Silom Community Clinic at the Hospital for Tropical Medicine, a CDC partner that focuses on MSM. These sites collect urethral samples from men with discharge, or dysuria, for culture and, if confirmed, test for drug sensitivity. In addition to EGASP, seven regional Offices of Disease Prevention and Control (ODPCs) have STI clinics that perform culturing and drug sensitivity testing for NG cases and regularly report to the DDC.

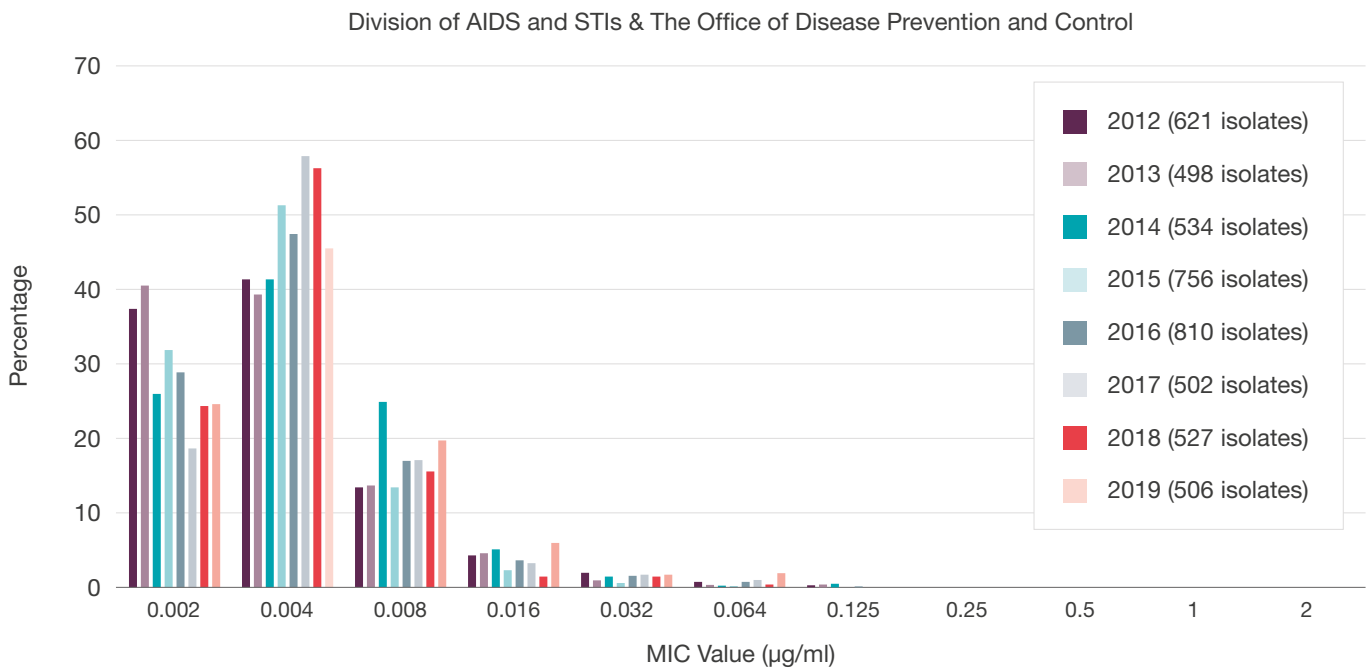
Since 2016, more than 2000 NG isolates have been tested; no resistance has been detected to either of the recommended treatments, ceftriaxone or cefixime. However, isolates from four cases were resistant to azithromycin, with an increasing trend in minimum inhibitory concentrations (MICs) for ceftriaxone, cefixime and azithromycin. Even though resistance is low, these MIC values indicate that sensitivity to these drugs is decreasing. These medicines are crucial to preserve for treatment of STIs and other diseases. For example, ceftriaxone is commonly used in hospitals to treat pneumonia, kidney infections, and fever of unknown origin (Table 1, Figure 4).

Table 1: Summary of antimicrobial susceptibility testing results for NG isolates in Thailand (2016–2019)

Years	Sites	Ceftriaxone		Cefixime		Azithromycin	
		Number of antimicrobial susceptibility tests	Number with decreased susceptibility	Number of antimicrobial susceptibility tests	Number with decreased susceptibility	Number of antimicrobial susceptibility tests	Number with decreased susceptibility
2016	DAS	697	0	608	0	600	0
	ODPC	113	0	119	0	118	1
2017	DAS	428	0	382	0	308	1
	ODPC	74	0	74	0	74	0
2018	DAS	348	0	339	0	416	0
	ODPC	179	0	217	0	156	0
2019	DAS	252	0	252	0	276	2
	ODPC	228	0	228	0	220	0
Total		2,319	0	2,219	0	2,168	4
% Resistance		0%		0%		0.18%	

Note: DAS = Division of AIDS and STIs at the DDC. ODPC = Office of Disease Prevention and Control.

Source: Adapted from the Thai Division of Epidemiology (30 September 2020), presented by Dr. Rossaphorn Kittiyaowamarn, 23 November 2020.

Figure 4: Minimum inhibitory concentrations for NG isolates and ceftriaxone in Thailand (2012–2019)

MIC = minimum inhibitory concentration

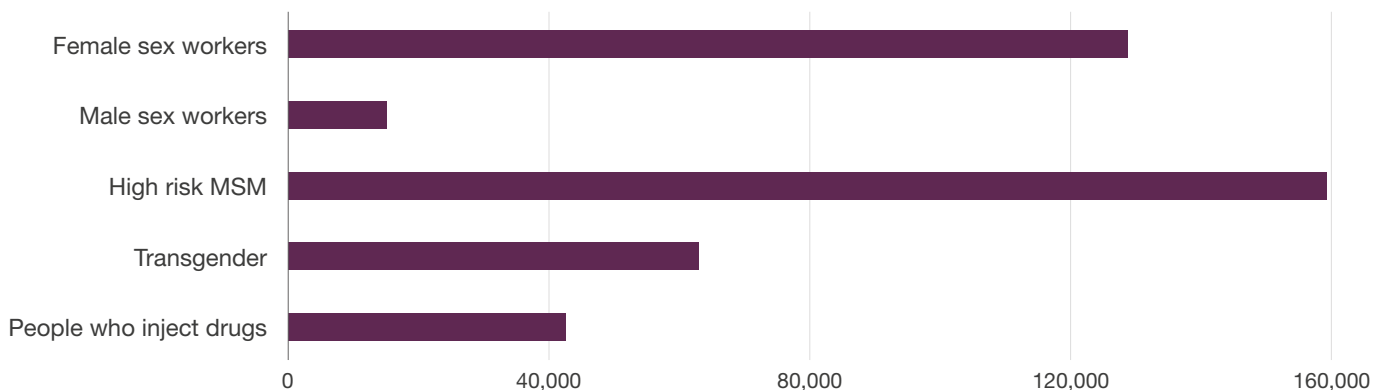
Source: Presented by Dr. Rossaphorn Kittiyaowamarn, 23 November 2020

1.3 Broader epidemiological context

In 2002, Thailand implemented a successful universal health coverage system based on robust primary care and health promotion programmes. Today, the major burden of mortality and morbidity in Thailand comes from noncommunicable diseases, although traffic accidents, HIV, tuberculosis, and drug-resistant malaria remain challenges.

In 2019, Thailand had 470,000 people living with HIV, the highest prevalence in the region. Thailand thus

set out an ambitious target of ending AIDS by 2030 and was the first country in the Asia Pacific region to effectively eliminate mother-to-child transmission of HIV and syphilis.¹¹ While HIV testing rates are high, and 80% of those infected are on treatment,¹² meeting the 2030 target will require strengthened efforts, particularly among key populations (Figure 5), including the youth. PrEP, initially piloted in 2014, is now integrated into the health system, with approximately 22,000 people enrolled.¹³

Figure 5: Size of key HIV populations in 2019

Source: MoPH Thailand.¹⁴

1.4 Structure of healthcare

The MoPH is the core agency in Thailand's complex health system (Figure 6). It is the national health authority responsible for formulating, implementing, monitoring and evaluating health policies. However, there are several other agencies such as the National Health Security Office (NHSO) which is the primary healthcare purchaser in Thailand and insures most of its population. Additionally, there are several MoPH departments, which play a key role in STI diagnosis and care.

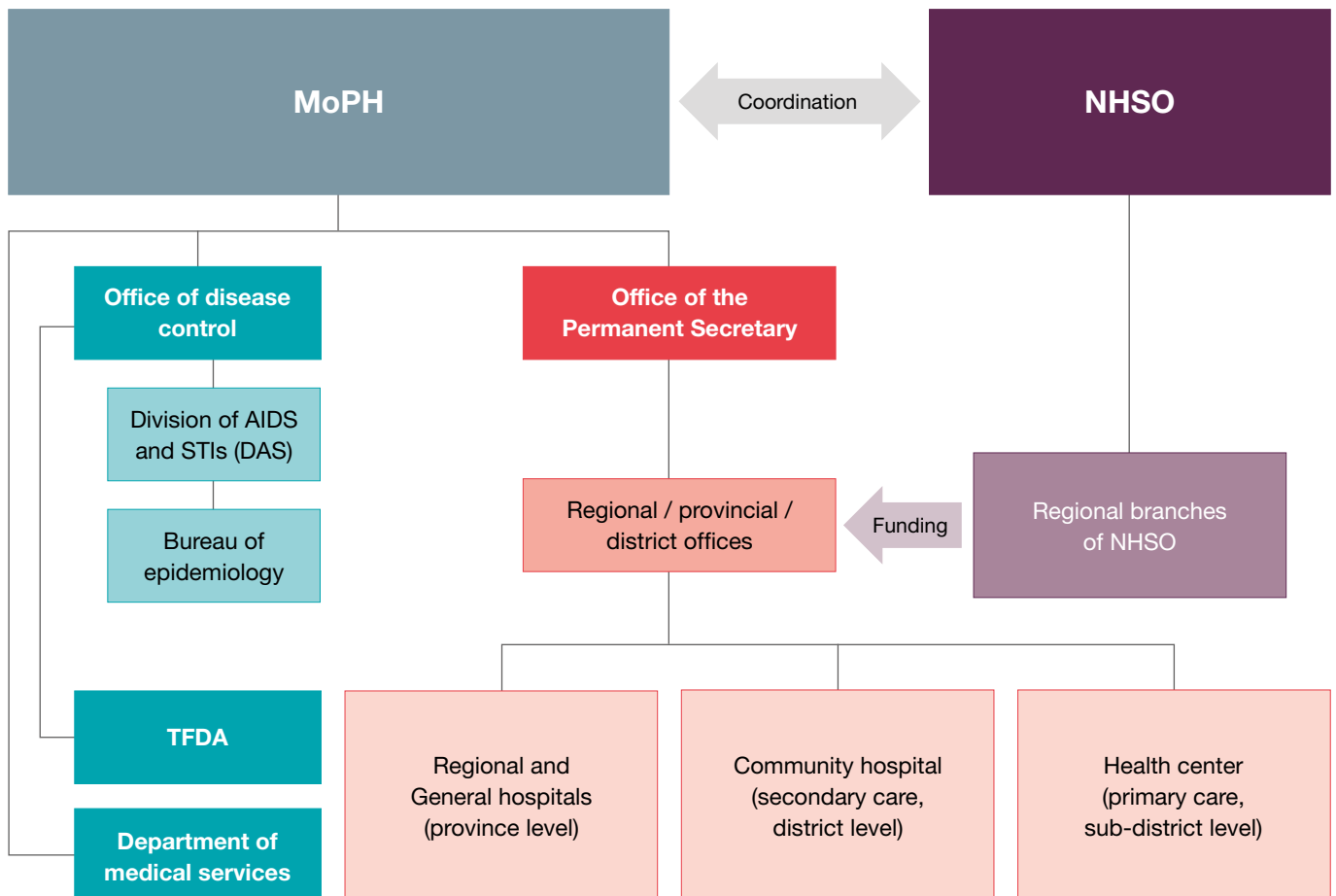
The DDC which is responsible for disease control include the Division of AIDS and STIs (DAS) and the Bureau of Epidemiology. The DDC also has Offices of Disease Prevention and Control (ODPCs) in Thailand's 13 health regions and which support the DDC's efforts in each region to tackle infectious and noninfectious disease. Generally, for STIs, the ODPCs are responsible for prevention, control,

education and supporting local hospitals. Currently, seven of the ODPCs have STI clinics.

The Permanent Secretary of the MoPH Office oversees the delivery of care, including all public health facilities, from hospitals to health centres, through a network of regional and district offices. The hospitals at the highest level of care, and university hospitals, are not under the remit of the Permanent Secretary; however, they receive tertiary care funding through NHSO.

The Thai Food and Drug Administration (TFDA) regulates diagnostics, and the Department of Medical Services (DMSC) regulates laboratories in Thailand. The DMSC is the national reference laboratory, providing external quality assurance and accreditation services for public and private laboratories in Thailand.

Figure 6: Organization of public healthcare for STIs (simplified)



Universal healthcare coverage

Since 2002, three insurance schemes have covered Thailand's population (Table 2):

1. Civil servants and their dependents belong to the Civil Servant Medical Benefit Scheme (CSMBS).
2. Private-sector employees are covered by the Social Health Insurance (SHI) scheme.
3. The rest of the population (approximately 70%) is covered by the Universal Coverage Scheme (UCS).

Table 2: Overview of Thailand's health insurance coverage

	Universal Coverage Scheme (UCS)	Social Health Insurance Scheme (SHI)	Civil Servant Medical Benefit Scheme (CSMBS)	Private insurance (local or international)
Nature of the scheme	Citizen entitlement	Mandatory	Fringe benefit	Private contract
Target beneficiaries	Thai citizens (not covered by SHI or CSMBS)	Private sector employees, excluding dependants	Government employees, including dependants, retirees	Additional insurance for those who can afford the premiums, private and group
Population coverage	70.60%	20.30%	7.20%	8.6–13.0%*
Total population covered (2017)	49 million	14 million	5 million	6–9 million
Source of funding	Government (general tax)	Tri-party: employer, employee, government (33% each)	Government (general tax)	Premiums paid by buyers
Management organization	National Health Security Office (NHSO), MoPH	Social Security Office, Ministry of Labor and Welfare	Controller General, Ministry of Finance	Private insurance companies, large private companies
Care pathway	No out-of-pocket costs when patients attend their assigned public sector "primary care contracting unit", which generally comprises a health centre and a community/district hospital within 30 minutes of travelling distance from their home. Except for accidents or emergencies, if a patient bypasses the primary care unit, they pay 100% out-of-pocket	Assigned to either public or listed private hospital only (n=240+)	Free choice of public hospitals and listed private hospitals (n=96)	Free choice of public and private hospitals

*Some people purchase additional private insurance because of gaps in the public programmes (i.e., UC/SHI only available where registered).

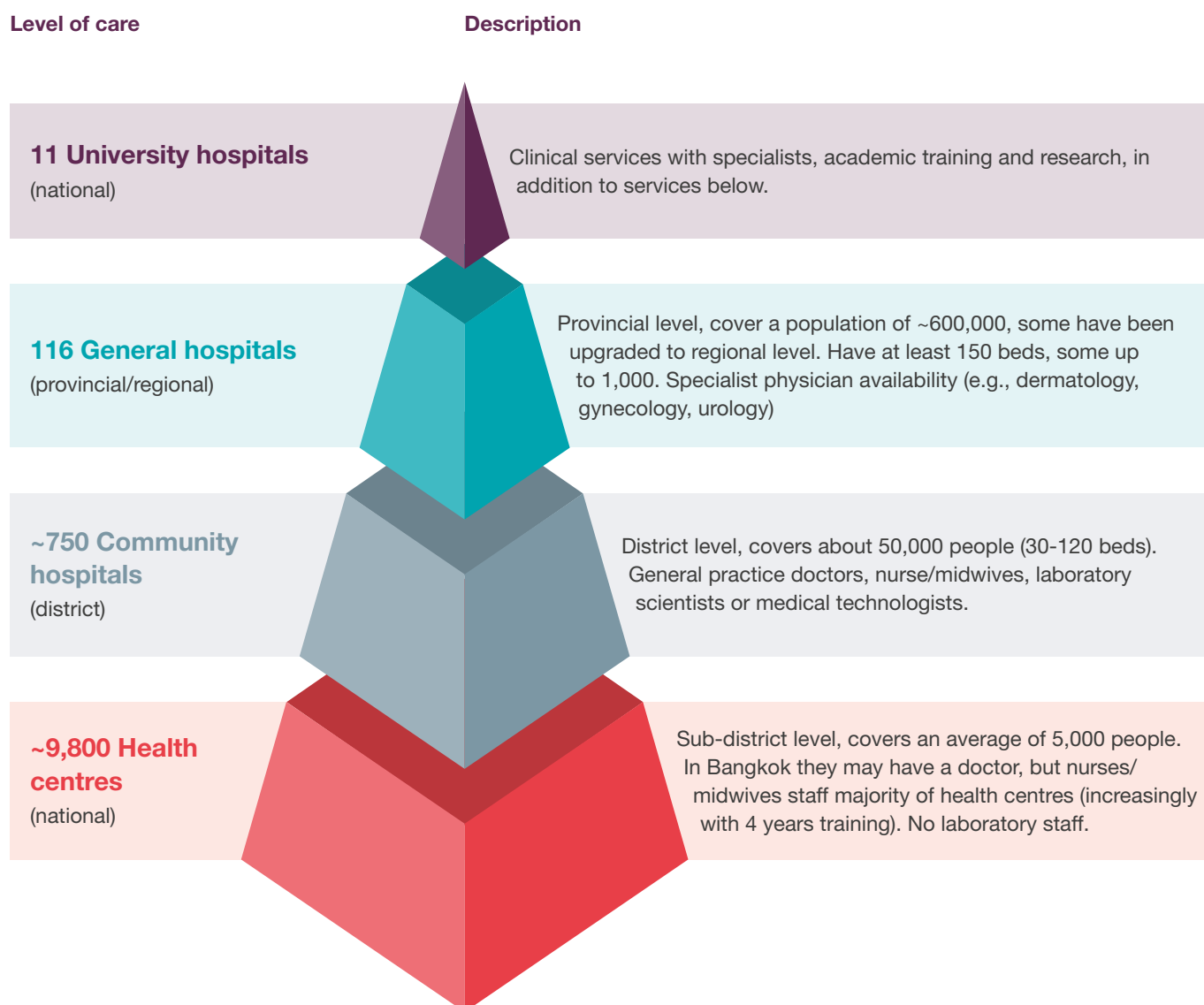
Source: Ministry of Public Health, National Economic and Social Development, National Health Security Office, Ispor.org, prachathai.com, WHO.

The UCS assigns patients to “primary care contracting units”, comprising of first-level community/district hospitals and healthcare centres located near their homes. The NHSO pays an annual per-patient capitation fee these units. Unless referred through their primary care contracting unit, when a patient seeks care outside of their assigned facilities, they have to pay the full cost out-of-pocket.

Patient pathways for SHI are similar; SHI contracts with larger hospitals and patients have to go directly to the outpatient department of their registered hospital. CSMBS is a fee-for-service model, in which patients have more flexibility to choose where they receive care. The premise that each scheme has its own set of rules and policies contributes to the complexity of the Thai healthcare system.

Delivery of care

Figure 7: Overview of Thailand’s public healthcare delivery structure



Sources: WHO 2017, Primary health care systems (PRIMASYS): case study from Thailand, abridged version. Geneva: World Health Organization; 2017. Asia Pacific Observatory on Health Systems and Policies, The Kingdom of Thailand Health System Review. World Health Organization, 2015. Key Stakeholder Interviews.

1.5 Public sector

Thailand's basic health infrastructure is good, rendering health services largely within reach of the population (Figure 7). At the lowest level, there are approximately 9,800 government health centres. Just under half of Thailand's 70 million people live in rural areas, and each village in these areas has a health centre. In urban settings, there may be doctors based in the health centres, while rural health centre staff may include only junior nurses and technicians with two years of training or nurses with four years of training. Health centres lack laboratory capacity beyond simple, rapid tests (e.g., lateral flow tests for HIV, malaria, etc.). As a result of understaffing and resource limitations, many health centres must formally associate with the local district/community hospital to be eligible for reimbursement under the insurance schemes.

There are approximately 900 public hospitals with at least one community or district hospital (30–120 beds), providing primary care to a population of around 50,000. Under the insurance schemes, patients qualify for free care either at their assigned health centre or the outpatient department of their assigned community hospital.

At the provincial level, general hospitals cover a population of approximately 600,000, and some general hospitals have upgraded to become regional referral hospitals. At the top level of the system, there are 11 University hospitals. There are also several public health facilities and hospitals run by government departments other than the MoPH (e.g., military hospitals).

1.6 Private sector

There are 350 private hospitals, most of them small and located in larger cities. Some are contracted to provide care through medical insurance schemes; however, they increasingly cater to the growing medical tourism sector of the Thai

economy. Additionally, there are approximately 25,000 private clinics in Thailand. However, KSIs indicated that approximately half of them are beauty clinics. Others are general practice physicians or specialist physicians (e.g., specializing in allergies, gastrointestinal conditions, or orthopaedics) catering to clients who wish to avoid the waiting times at public hospitals.

1.7 National STI programme

The Division of AIDS and STIs (DAS) at the DDC, MoPH, oversees STI service implementation in the public sector. The STI programme manager sits in the DAS and is supported by the Bangrak STI Center, which is Thailand's STI reference centre. The Bangrak STI Center leads the development and revision of national STI guidelines. DAS works closely with NHSO to ensure accurate translation of STI screening, diagnostics and treatment recommendations to the NHSO service reimbursement system.

Thailand's STI and HIV programme recently eliminated mother-to-child transmission of HIV and syphilis through its expanded coverage of testing and treatment. However, in other populations STIs have been increasing during the past five years. In response, the DDC collaborated with WHO and the Thai Medical Society for the Study of Sexually Transmitted Diseases and developed a National Strategy on STI Prevention and Control (2017–2021). The long-term vision is to end harmful STIs by 2030, largely by leveraging existing institutional structures to expand coverage of STI prevention and treatment services. The target for gonorrhoea is to decrease its incidence from 10.6 to <8 cases per 100,000 population by 2021.

A November 2020 update¹⁵ from the STI programme manager outlined the following priorities: implementing prevention in school and community settings; access to prevention, testing and treatment for all; boosting STI testing in priority

populations, including adolescents; expanding the AMR programme to regional hospitals; strengthening STI surveillance; and minimizing stigma and discrimination. A particular challenge includes reaching out to young people in light of Thai cultural norms that discourage speaking openly about sexuality. New research is needed to identify possibilities to reach adolescent populations with high-quality information about sexual health and ensuring STI care is affordable and convenient for them. Finally, stigma and discrimination are significant issues in Thailand, not only for HIV but also for STIs.

1.8 National AMR response

Antimicrobial resistance (AMR) is a serious threat in Thailand, and South-East Asia is a focal region for the emergence of AMR globally. For example, Thailand is among the countries with the lowest relative effectiveness of antibiotics,¹⁶ and on a per capita basis, three to five times more people die in Thailand of drug-resistant bacteria each year than in the European Union or the United States.¹⁷

While multiple factors contribute to high AMR rates, the high rate of self-medication is one of the major drivers. In Thailand, antimicrobials are available over the counter, and self-treatment is convenient and inexpensive. The national AMR strategy notes that “pharmacies dispense antibiotics for diseases that do not require them, for instance, common cold, sinusitis and fresh, clean, minor wounds, at levels up to 64–80%.”¹⁸ Additionally, the Thai language has just one word for both “antibiotic” and “anti-inflammatory medicine”, making it challenging to communicate clearly with the public about rational antimicrobial use.

Thailand has a long track record of efforts to combat AMR. For example, Thailand already has a surveillance programme in place, EGASP, to track the emergence and spread of NG drug resistance. However, the various AMR efforts were not well

coordinated until recently, in 2016, when the Thai cabinet endorsed the first National Strategic Plan on Antimicrobial Resistance in Thailand for 2017–2021. Aligned with the WHO Global Action Plan on AMR, the strategy adopts a “One Health” approach (Annex 2). The national plan includes gonorrhoea among five priority drug-resistant pathogens directly affecting humans in Thailand.¹⁹

In 2020, the national STI programme and the TFDA convened to discuss self-medication for STIs using antibiotics purchased over the counter from pharmacies. The TFDA aims to decrease such inadvertent use of antibiotics in pharmacies, including cefixime for gonorrhoea. In connection with this effort, the national STI programme will strengthen and expand etiological management of STIs. Additionally, the possibility of pharmacists referring STI patients to nearby hospitals is being discussed.

1.9 Where is STI care available in Thailand?

Many channels offer STI care, varying by setting and provider, some with testing and others without (Figure 8). In urban areas, patients have many choices for testing, including at pharmacies, health centres, hospital outpatient departments, hospital-based specialists, and standalone STI clinics. In rural areas, there are fewer options, including pharmacies and primary care delivered through health centres and community/district hospitals. A recent behavioural survey conducted in Bangkok concluded that there is no data available on where patients seek care if they experience STI symptoms.

Figure 8: Overview of the channels for STI care

	Description	Management	Test	Insurance coverage
Department of disease control	<ul style="list-style-type: none"> ▶ STI clinics at: <ul style="list-style-type: none"> – Bangrak STI Center – 7 offices of Disease Prevention and control (ODPC). 	Etiologic	Gram stain, Culture, Bangrak and some ODPC have NAAT	Have budget for prevention and control to cover many but not all patients; each clinic sets policy, providing free care to target populations.
Tertiary hospitals	<ul style="list-style-type: none"> ▶ ~116 provincial hospitals; ▶ STI care provided in urology, gynaecology/obstetrics, and dermatology and general outpatient departments. ▶ Some operate STI clinics a few hours / days per week. 	Etiologic preferred; some syndromic	Gram stain, Culture (NAAT in some university hospitals)	If symptomatic, and accessing care via assigned channels, gram stain, culture and NAAT where available are covered. Screening would only be covered if accessed via VCT. NAAT for screening is out of pocket.
Community / district hospitals	<ul style="list-style-type: none"> ▶ ~750 community/district hospitals ▶ STI services are largely provided through outpatient department. 	Etiologic preferred; syndromic	Gram stain	If symptomatic and accessing care through assigned facility, gram stain is covered. Screening (gram stain only) covered if accessed via VCT.
Health centers	<ul style="list-style-type: none"> ▶ ~9,800 primary care clinics ▶ STI services are largely provided through outpatient department. 	Syndromic; can refer to hospital for testing	None	If symptomatic and accessing care through assigned facility, treatment is covered (no diagnostics performed).
Non-profits and CBOs	Several non-profit organizations in Thailand, mostly in larger cities, providing various levels of STI services ranging from prevention to diagnosis and treatment. For example: IHRI, Thai Red Cross; Rainbow Sky Association of Thailand.	Etiologic	Gram stain, some NAAT	Non-profit STI clinics: patient pays out of pocket, unless part of research. CBO: mostly covered if patient from the target population
Private hospitals and clinics	<ul style="list-style-type: none"> ▶ ~350 private hospitals ▶ unknown number of private clinics providing STI 	Mix of etiologic and syndromic care.	Gram stain, some culture, NAAT	Largely out of pocket, unless medical scheme contracts with facility
Pharmacies	Many antibiotics, including common treatment for STIs, are available in pharmacies	Syndromic, not necessarily per guidelines	None	Out of pocket (no diagnostics performed)

Department of Disease Control (DDC) and Offices of Disease Prevention and Control (ODPCs)

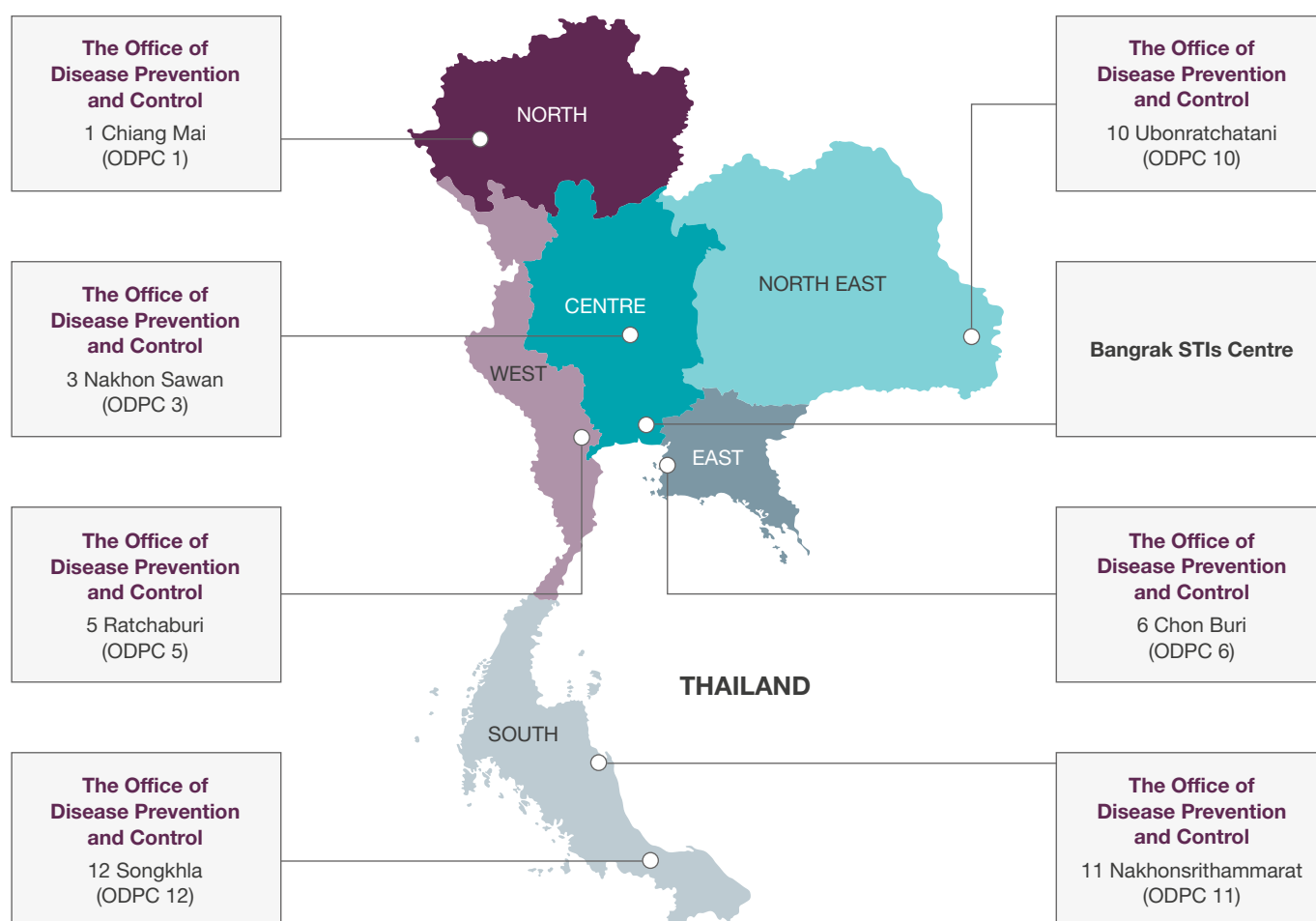
Bangrak STI Center, under the DDC, is the national reference centre for STIs and a training hub for physicians with an interest in STIs from Thailand and neighbouring countries. The Bangrak STI Center provides STI care for the general population, including MSM and TGW. Gonorrhoea diagnosis is etiological, with Gram staining, culturing, and nucleic acid amplification tests (NAATs); the Bangrak laboratory occasionally tests samples from difficult cases referred by other hospitals (three to five cases per month).

There are seven ODPCs, also under the MoPH DDC, with STI clinics that diagnose gonorrhoea using Gram staining, culturing and, if available, NAAT; they also perform antimicrobial susceptibility testing (Figure 9). In the past, additional ODPCs offered STI services, especially for key populations. However, the Thai government scaled-back the broader role of ODPCs, preferring instead to integrate STI care

into primary and general hospital services. Today, there are 13 ODPCs, only seven of which continue to run specialized STI clinics.

The Bangrak STI Center and the ODPC STI clinics use budgets for prevention and control to support treatments in their target populations. These budgets are not sufficient to cover all patients, leading to some patients paying out-of-pocket for STI care and screening. Each clinic sets its own policy depending on local priorities, decides how to apply available funds and which patients should be eligible for free care. For example, the Bangrak STI clinic provides free care to patients who cannot afford to pay, or who are referred by community-based organizations. The clinic also leverages Global Fund support to expand free-of-charge care among key populations. Additionally, each ODPC STI clinic may prioritize populations differently (e.g., MSM or young adults) for free care.

Figure 9: The Thai STI network comprises the Bangrak STI Center and seven Office of Disease Prevention and Control (ODPC) STI clinics



Source: : Thai Division of Epidemiology (30 September 2020), presented by Dr. Rossaphorn Kittiyaowamarn, 23 November 2020.

Hospitals and primary care

In the public sector, tertiary and university hospitals provide STI care through their outpatient departments and, frequently, through specialists. Symptomatic women may see a gynaecologist, while symptomatic men would generally see a dermatologist or urologist. Additionally, some gynaecology and dermatology departments operate STI clinics for a few hours per week.

At district/community hospitals, patients with STIs are seen in the outpatient department by nurses or general practitioners. Some of these hospitals operate STI clinics, limited to a few hours or days each week. In hospitals, nurses or doctors who see patients generally collect swabs and send them to the laboratory, where a laboratory scientist or medical technologist performs Gram staining of the samples.

As an example of hospital-based STI clinics, KSI participants explained that in the Bangkok area there are nine public, hospital-based specialty STI clinics, called Rak Puen Clinics. One of these is open for four hours on three evenings a week and provides STI care and PrEP, primarily to MSM and TGW. In this clinic, all counsellors are drawn from key populations; it is known to provide a safe and supportive environment.

Health centres represent the lowest level of the healthcare system for STIs. In Bangkok, physicians may staff these health centres, while in other cities and rural areas, health centres are staffed primarily by nurses. In both, patients with an STI would be seen in the outpatient department. The health centres lack laboratory facilities and staff, so while some rapid tests are available (e.g. HIV, syphilis RDTs), Gram staining and culturing are not, leading to a syndromic NG management at this level. At times, health centres will refer a patient with an STI to the district/community hospital rather than use syndromic management; there is not enough data available to show how frequently this happens.

Private hospitals also provide STI care, with the set-up being similar to that of the district/community hospitals. Few private hospitals run dedicated STI clinics, and some have testing on-site, while others refer samples to contracted external laboratories.

Specialty clinics

In addition to the general hospitals, Thailand has many STI and HIV specialty clinics run by local non-profit organizations. The clinics are primarily located in urban areas, and most have outreach staff focused on high-risk populations, including MSM, TGW and sex workers. Some of the not-for-profit operated STI clinics in Bangkok include:

- ▶ Anonymous Clinic, operated by the Thai Red Cross AIDS Research Center, is the largest HIV testing and sexual health centre in Thailand. Clients with STIs come from the general population as well as key populations, especially men.
- ▶ IHRI recently opened the Pribta and Tangerine Clinics, to provide comprehensive and non-discriminating HIV and sexual health screening, prevention and treatment services for all. Clients are mainly MSM and transgender individuals, while 20% are heterosexual men and women.
- ▶ Silom Community Clinic is a research clinic run by a collaboration between the Thai MoPH and US CDC. It mainly serves MSM clients and participates in EGASP.
- ▶ The Pulse Clinic has five branches, focusing on HIV and STIs, and serving Thai and non-Thai populations.
- ▶ Safe Clinic focuses on HIV and STIs and serves Thai and non-Thai populations.
- ▶ The Global Clinic is a private clinic in Bangkok.

Typically, in these specialty clinics, a nurse will perform counselling and risk assessment and sometimes collect samples for testing. Patients will then see a doctor for diagnosis and treatment. Notably, patients generally pay out-of-pocket for STI testing and treatment at these clinics (approximately USD 35–100 per visit, (Table 3)) unless they participate in research studies or qualify for coverage through one of a few special funding programmes.

In Bangkok, the AIDS Control Division of the Department of Health of the Bangkok Metropolitan Administration (BMA) has a special funding programme. The BMA has nine specialty clinics, called Safe Love Clinics. These provide STI, PrEP and post-exposure prophylaxis (PEP) services for all at-risk populations. (Note, in addition to the Safe Love Clinics, there are other PrEP/PEP clinics and public health service centres run by the BMA). In the BMA area, all STI, PrEP and PEP services are free of charge for the patient. If a service is not covered under a medical scheme, it is supported through a special fund from the prevention and control budget of the BMA Department of Health. This policy aims to link patients with appropriate care, provide preventive treatment, targeting the youth as they are often unable to afford treatment.

There are also several community-based organizations (CBOs) that work with MSM, TGW and sex workers. These groups vary in their ability to provide diagnosis and treatment, but they play a significant role in outreach, prevention and linking clients with appropriate STI care and treatment. CBOs include Rainbow Sky Association of Thailand, Sex Workers in Group (SWING), Mplus Foundation, and Caremat Foundation.

Outside of Bangkok, other major cities also have NGO-run and private STI clinics. such as private clinics in Chiang Mai.

Pharmacies

In Thailand, there are two types of retail outlets selling medicine. There are 17,000 pharmacist-staffed outlets, almost a third of them in Bangkok, and 2,865 registered drug shops that do not have pharmacists. Only pharmacies staffed by licensed pharmacists can provide the antibiotics recommended in the STI guidelines for NG treatment. Although pharmacies are less crowded than public healthcare facilities, privacy is not guaranteed due to their small size.

Where do people seek care for STIs in Thailand?

The only care-seeking survey identified as part of this assessment was a 2019 HIV behavioural surveillance survey, which investigated STIs in several populations in Bangkok at high-risk of contracting HIV (Figure 10). The results showed that for young people and factory workers, public-sector facilities were preferred. In contrast, preferences were mixed in other groups, including public and private health facilities, specialty STI facilities, and self-treatment. Taking no action was most common among female sex workers (FSWs).

Similarly, the KSIs generally suggested that many symptomatic patients would first seek care at a pharmacy. If their symptoms did not resolve, they would attend the facility assigned under their medical scheme because it is free; they would attend a private STI clinic as a last resort. However, KSI participants were quick to point out that this pattern of behaviour is far from universal and noted several factors that could influence care-seeking behaviour.

Stigma and shyness are major drivers of care-seeking practices. The preference for discretion often leads to self-medication through pharmacies, or seeking care where one would not be recognized, i.e., at a facility that is far from home. As this is not likely to be a patient's assigned facility, services would not be reimbursed under the medical insurance schemes. Other patients wishing to avoid having an STI listed in their medical records and may elect to

seek care outside of their assigned network.

Many KSI participants reported that healthcare workers stigmatize and blame patients who have STIs, believing that the government should not cover the costs of STI care. This is especially true for FSWs, MSM and TGW, who may prefer specialty STI clinics if they can afford it, self-medication, or no treatment at all.

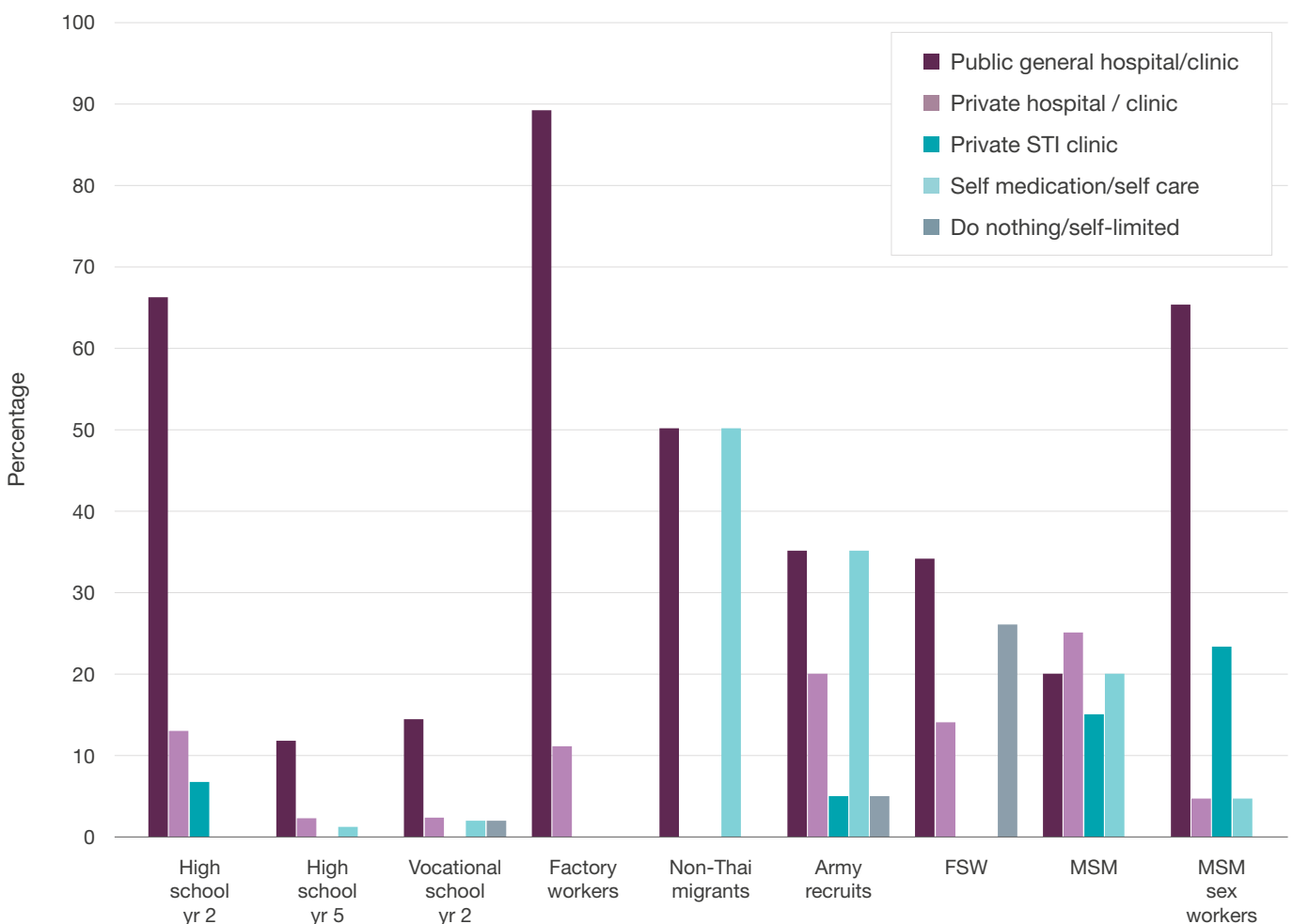
Convenience is a major factor influencing care-seeking behaviour and may drive many people with STI symptoms to pharmacies. Hospital outpatient departments are notoriously overcrowded compounded with long queues and waiting times. Additionally, even where available, STI clinics within

hospitals are not offered every day or at convenient hours due to staff and testing capacity limits.

Economic status also influences care-seeking behaviour for STIs. Those patients who can afford to pay out-of-pocket attend specialty clinics, where services are friendly and same-day results more likely. Those with fewer means might be more apt to self-treat or attend public-sector services.

Some KSI participants reported that online platforms for STI care were available or were starting to become an option; however, online channels are not currently a common source of STI care, and were lacking details.

Figure 10: STI care-seeking preferences among selected Bangkok populations (2019)



Source: HIV Behavioral Surveillance Survey among 10 Key Populations in Bangkok: 2019.²⁰ The 2019 survey included 8877 people, including a sample of students, the general population (factory workers, migrant workers, army recruits), and key populations. Two thirds of the sampled population were under the age of 25 years. The participants completed a questionnaire comprising 65 items.

II STI MANAGEMENT

2.1 Guidelines

The MoPH published the first national guidelines for the management of STIs in 1988. Since then, they have been revised regularly every three to six years, with input from a multidisciplinary group of stakeholders, for a total of eight versions, with the latest in 2019.^{21,22}

The STI guidelines include sections for each of the major treatable STIs assisting physicians to correlate a patient's symptoms, etiology and follow the corresponding guidelines for that disease. The current guidelines present nine sections on the management of NG infection: clinical manifestations, diagnostic criteria, treatment, treatment of sex partners, special populations, monitoring and follow-up, treatment failure, and treatment failure notification.

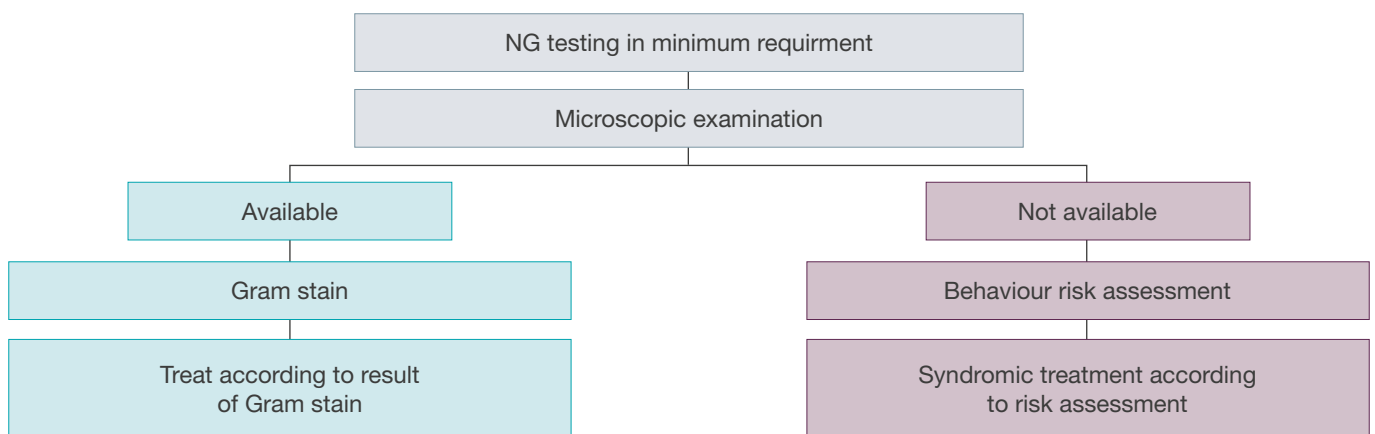
According to the guidelines, diagnosis of gonorrhoea requires Gram staining, culturing or NAAT; the last of these was added in 2019. (Figure 12) Gram staining is the minimum requirement for diagnosis and the most commonly available test. While the guidelines recommend etiological management, the MoPH acknowledges that there are situations where testing is not available or feasible and, if

this occurs, recommends syndromic management based on a risk assessment (Figure 11).

The preferred treatment for uncomplicated gonorrhoea (genital, rectal and oral) is a single dose of intramuscular ceftriaxone 500 mg plus treatment for CT infection (azithromycin 1 g or doxycycline 200 mg/day for 14 days). The 2019 guidelines recommend that cases of NG are treated in combination with CT, because there is limited diagnostic capacity for CT (i.e., NAAT) in Thailand. A single dose of oral cefixime 400 mg instead of ceftriaxone is an alternative treatment for uncomplicated genital and rectal gonorrhoea. Cefixime is the most offered treatment in pharmacies because pharmacists are not allowed to inject ceftriaxone.

Treatment is also recommended for any sexual contacts in the past 60 days, and expedited partner therapy is advised if the partner is unable to visit the clinic. Two follow-up visits are scheduled for uncomplicated gonorrhoea: first at seven days for repeat Gram staining or culturing and the second at one to three months after treatment, for a repeat blood test for syphilis and HIV infection.

Figure 11: NG testing in practice

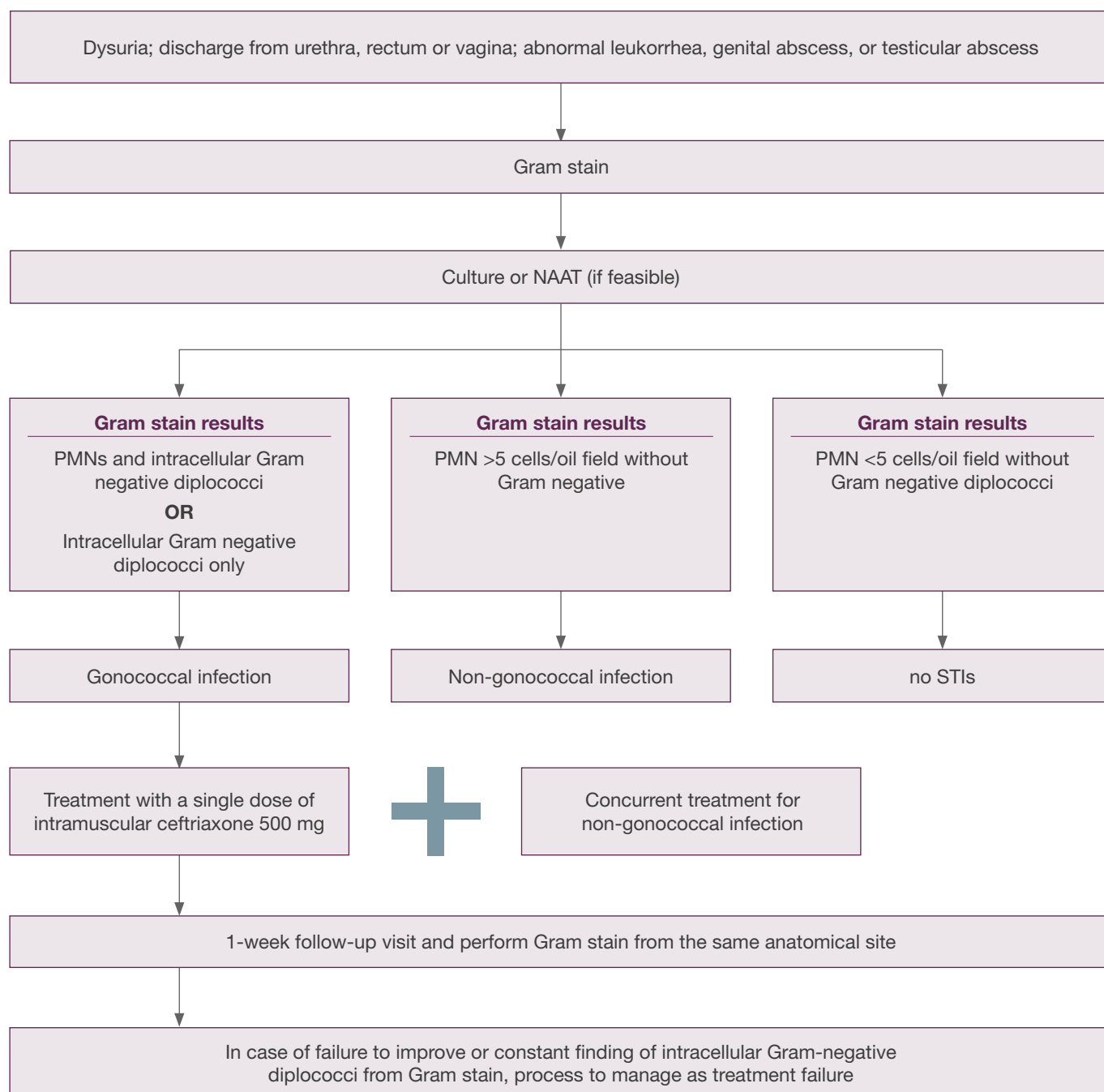


Source: Thai Division of Epidemiology (30 September 2020), presented by Dr. Rossaphorn Kittiyaowamarn, 23 November 2020.

Generally, KSI participants estimated that most patients (>90–95%) recovered after their first visit. In case of treatment failure, defined by no improvement in symptoms after seven days and no probability of reinfection, culturing and antimicrobial susceptibility testing as well as notification to the DDC are recommended. There are three treatment options for suspected

treatment failure: a single dose of intramuscular ceftriaxone 1 g plus oral azithromycin 2 g, a single dose of intramuscular spectinomycin 2 g plus oral azithromycin 2 g (limited to extra-oral infections), or a single dose of intramuscular/intravenous gentamicin 16–240 mg plus oral azithromycin 2 g. It should be noted that spectinomycin is currently unavailable in Thailand.

Figure 12: Algorithm for treating uncomplicated gonorrhoea



Note: PMN = polymorphonuclear leukocyte

Source: IHRI, simplified and translated from the Thai guidelines. CT is the main cause of nongonococcal STIs in Thailand; the flow chart assumes CT testing is not available, as is the case in most of Thailand. If CT testing is available dual treatment is not needed.

Clinical practice

While Thailand has an etiological diagnosis policy, as in all countries, there is variation in practice. Some KSI participants stated that they always relied on laboratory results to inform treatment, even if these were not available at the time of the patient's visit. Others felt that patients must receive treatment during their visit, even if test results are not yet available. As a result, in practice, there is a mix of syndromic and etiological management. One KSI informant estimated that providers manage half of NG and CT cases etiotogically, whereas they manage nearly all syphilis cases based on test results.

Overall, practice is affected by the availability of testing and turn-around-times of test results; healthcare worker experience and comfort in dealing with STIs; workloads; and patient factors, such as severity of infection or insurance coverage. Some specific themes included:

► **Primary care facilities and lower-level hospitals are unprepared to manage STIs.**

Several KSI participants thought the decision by the MoPH to reduce the number of ODPC STI clinics led to a general deterioration in the quality of STI care in Thailand. They explained that the government made these reductions when intense condom campaigns had reduced STI burdens but, as the condom initiatives subsided, the STI burden increased. The KSI participants pointed out that many primary health centres and hospitals that were meant to take on the STI patient workload following the ODPC closures lack the capacity to offer adequate STI care. First, health centres and lower-level hospitals may not have the necessary laboratory staff and resources, even though Gram staining requirements are minimal. Second, healthcare workers may be unaccustomed to caring for patients with STIs, and their professional experience and training around STIs may be limited to their schooling/pre-service training. As a result,

they treat patients suboptimally or refer them unnecessarily to higher-level facilities.

► **Workload challenges.** Hospital outpatient departments have heavy workloads, resulting in syndromic management of STIs even when skilled providers and appropriate testing facilities are available. One KSI informant noted that larger hospitals might only perform STI tests once or twice a day, so delays in results may cause physicians to prescribe treatment before the laboratory results are available.

► **Even at specialty clinics, practice varies.**

One KSI participant who worked in an STI clinic described several nuances that affect implementation of the guidelines. For example, if initial testing via Gram staining does not show NG, treatment for the most common form of nongonococcal urethritis, i.e., chlamydia, will be given. Meanwhile, the patient's specimens will be tested by culturing or polymerase chain reaction (PCR), and the patient will return for a follow-up visit, when the health worker could provide additional treatment depending on the culture or PCR results. Patients whose diagnosis is unclear (e.g. those with mild symptoms or lacking white blood cells in Gram stain) would not be prescribed any treatment during their visit and would therefore await their culture or PCR results. One patient who was interviewed indicated that the waiting time for results could be as much as two weeks.

STI screening

STI screening can take several forms, ranging from simply asking patients about any symptoms or risk factors, to periodic testing for asymptomatic infections. In Thailand, the current STI screening guidelines are from 2010; the DDC plans to update the guidelines in the coming year. The 2010 guidelines recommend screening; specifically, monthly NG/

CT screening and three-monthly syphilis and HIV screening for sex workers and annual screening for MSM (more frequent if they have a higher sexual risk). There are also recommendations around STI screening in the HIV guidelines, e.g. advising MSM and TGW who are HIV-positive to be screened for NG infection every six months at anatomical sites of sexual contact.²³

There are no national data on the implementation of these screening recommendations, or the quantity of screening tests performed in Thailand. The 2019 Bangkok HIV Behavioral Surveillance Survey reported that 30% of people surveyed had been “screened for STIs” in the year prior to the survey; however, it is not clear if this screening covered certain symptoms or involved any testing, and the population surveyed is biased towards high-risk groups and not necessarily representative of the general population. In practice, the KSIs indicated that specialized STI clinics test sex workers for NG every three months, and other high-risk individuals every six months. KSI participants reported that,

among the general population, providers do not routinely ask patients about urogenital discharge or risky behaviours.

Despite the benefits of regular STI testing in key populations, most medical insurance schemes do not cover such testing unless it is accessed via a particular channel: voluntary counselling and HIV testing (VCT) sites.[†] A special NHSO fund covers “STI screening” for patients attending VCT. However, KSI participants noted that the recommendations lack specificity about which STIs should be included in the screening, and that only syphilis is included. Certainly, syphilis is the most commonly screened-for STI, because it can be detected in the blood, whereas other STIs require swab specimens, limiting convenience and requiring privacy. The DDC and ODPCs may make screening tests available free of charge to target populations that they serve Antenatal clinics in Thailand also regularly screen women for HIV, syphilis and hepatitis B.

[†] Although STI clinics offer HIV testing, they may not necessarily be part of the formal VCT programme.

Price of STI tests and care

Although not collected systematically, the KSIs revealed several data points on the availability and cost of STI testing and care not covered by insurance schemes (Table 3). The KSI data indicate that there are relatively few STI-related reimbursement requests in the NHSO database,

suggesting that many patients with STI symptoms prefer not to access care where it may be covered by their medical scheme. Instead, due to stigma and privacy concerns, they either seek no care at all or pay out-of-pocket for their care.

Table 3: Availability and prices for STI testing and healthcare visits, based on KSI data

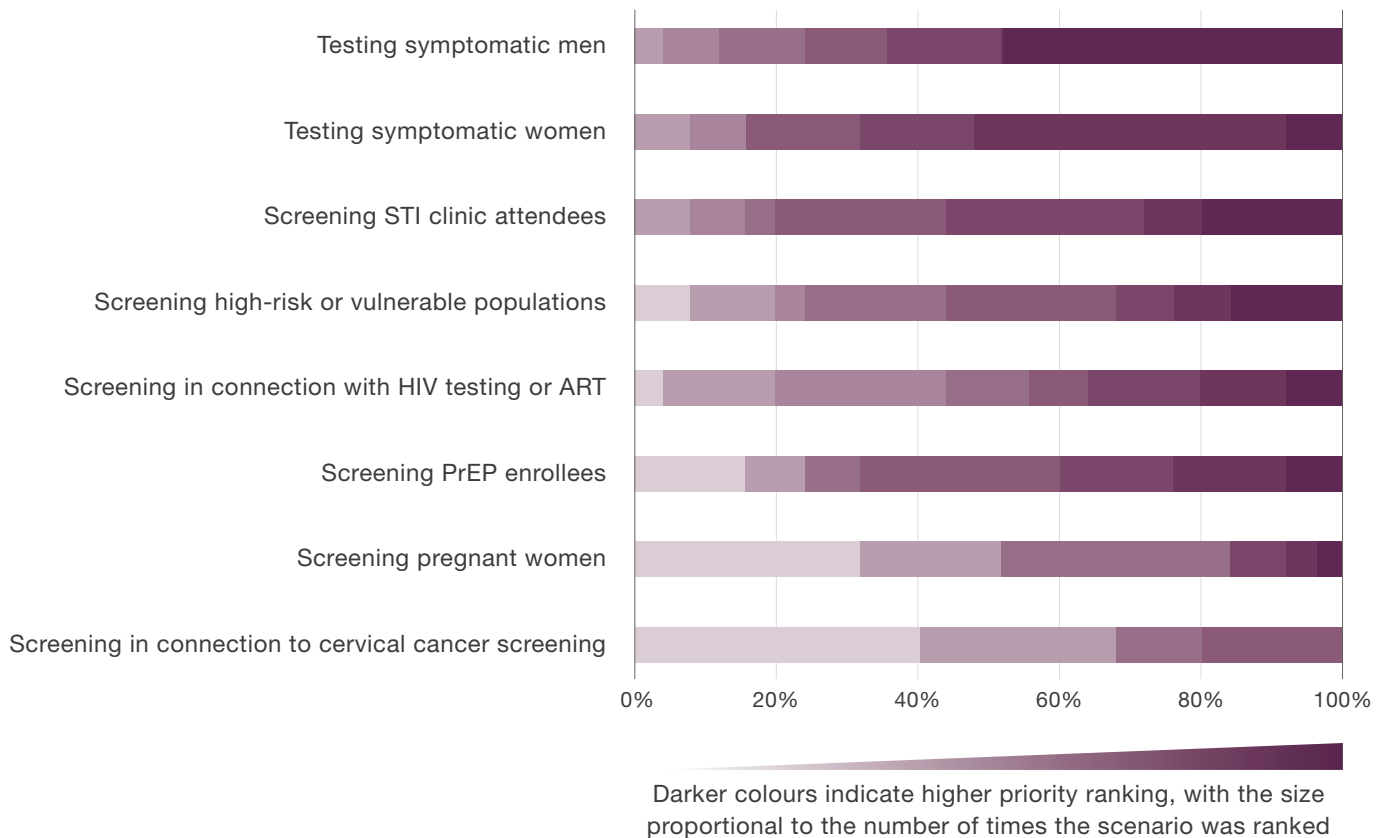
Service	Availability	Selected prices (in USD)
NAAT	<p>Available at 13 sites:</p> <ul style="list-style-type: none"> ▶ 4 research clinics ▶ 2 ODPC clinics ▶ 1 private hospital ▶ 1 private STI clinic ▶ 2 private laboratories ▶ Bangrak STI Center has in-house PCR <p>One site reported a 3–7-day turn-around time for PCR</p>	<p>The cost of NAAT is reimbursed if it is used for diagnostic purposes. For screening, NAAT is out-of-pocket. A range of prices for NAAT testing were mentioned:</p> <ul style="list-style-type: none"> ▶ USD 65/anatomical site, in government hospitals ▶ CT/NG GeneXpert, USD 30/test in government and USD 60/test in private hospitals ▶ USD 15 (includes 1 to 3 anatomical sites) at Bangrak STI clinic, where the test is priced at average cost, using an in-house assay
Gram stain	<p>Should be available at hospital level and higher, with results ideally within 1–2 hours. No data are available as to whether the majority or minority of facilities perform Gram staining</p>	<p>NHSO indicated the cost is USD 0.50–1.00</p>
Gram stain + culture + NAAT	<p>Bangrak STI clinic</p> <p>Turnaround times approximately 2–5 days</p>	<p>If paying out-of-pocket: USD 28.00</p>
Full STI visit	<p>Diagnosis and treatment, including tests (likely Gram stain)</p>	<p>Generally, if care is sought through a patient's assigned primary care network, it is covered by insurance schemes. Otherwise, out-of-pocket costs range from:</p> <ul style="list-style-type: none"> ▶ USD 35–70 for a complete visit, including tests at a general hospital ▶ USD 86–100 in private clinics (e.g., in Chiang Mai)
Pharmacy care	<p>Widespread, there are >17,000 licensed pharmacies. Syndromic management only, no testing</p>	<p>Treatment for NG/CT USD 5.00–8.50</p>

2.2 Priority use scenarios for an NG/CT POCT

Interviews and an online survey were performed to explore potential use case scenarios for an NG/CT POCT. As Thailand has a policy of etiological diagnosis in place, it is not surprising that the priority use cases identified by survey respondents reflect the current guidelines. The top priorities

were testing symptomatic men and women and patients attending STI clinics. The second set of priority use cases was testing in high-risk/vulnerable populations and testing in connection with HIV PrEP and antiretroviral therapy (ART) (Figure 13).

Figure 13: Online survey results, ranking eight different use scenarios for an NG/CT POCT



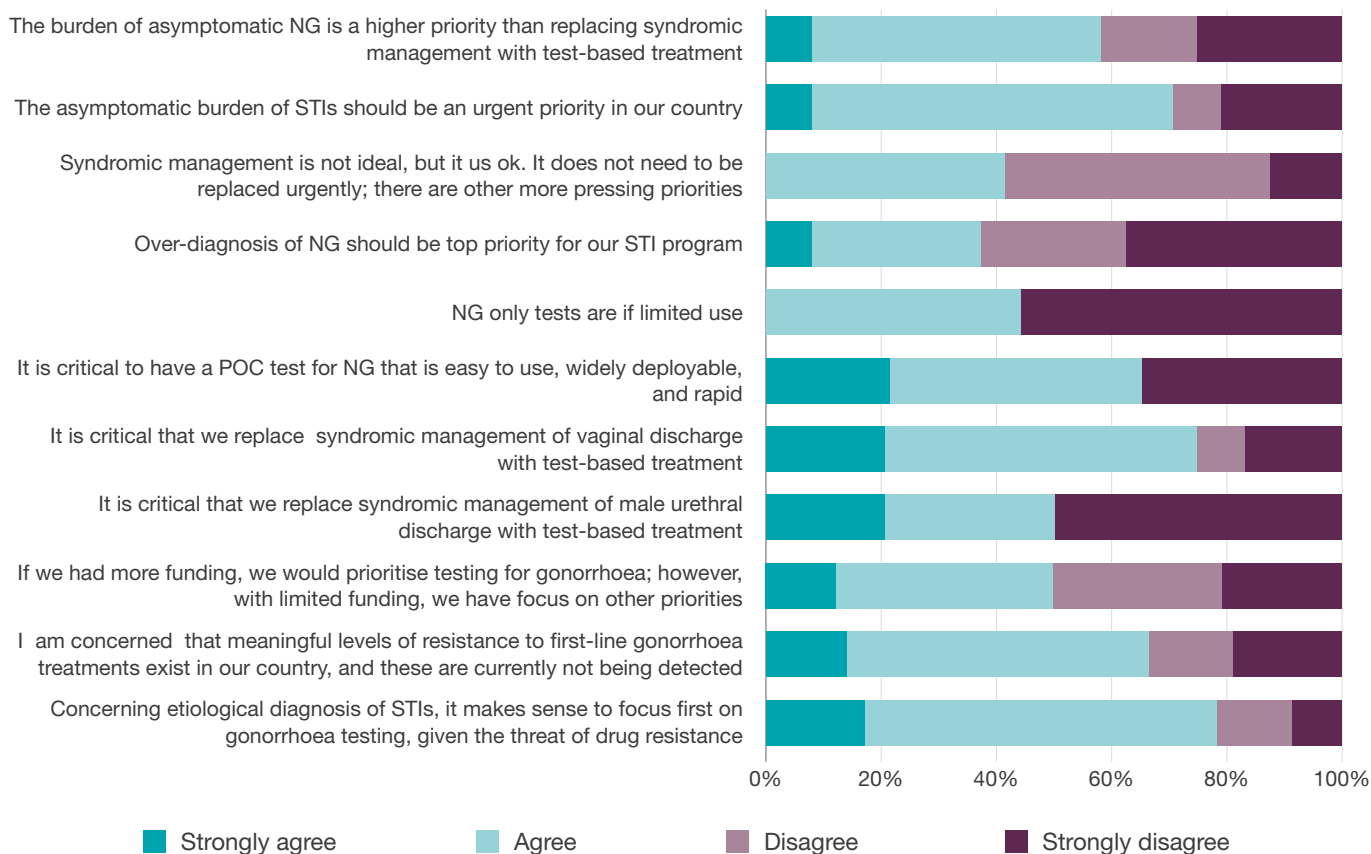
Several other “niche” use cases were discussed in the KSIs, including:

- ▶ The potential of NG/CT screening in key populations and in the general population during annual physical examinations. It was pointed out in the KSIs that implementation of the latter would likely be too expensive, and the cost-benefit of screening would not be favourable unless targeted at key populations. Some CBOs working with key populations thought that rapid NG/CT POCTs that facilitated screening services would be an entry point to additional services, such as HIV prevention and treatment or partner screening
- ▶ NG/CT screening for youths attending schools and universities could relate to existing HIV, syphilis and hepatitis screening programmes. These programmes are typically operated by NGOs/CBOs or through the BMA Safe Love Clinics.
- ▶ It was suggested in a few KSIs that NG/CT POCTs could be offered in pharmacies. However, one pharmacy owner mentioned several drawbacks to this, including the lack of private space for sample collection, lack of confidentiality for disclosing results, and a preference for using the available space for products that are more profitable than testing kits.

- ▶ Stakeholders discussed self-testing for NG/CT; however, even HIV self-testing is not widely available in Thailand. One KSI participant who worked with key populations had concerns about patients performing an RDT themselves and recommended that patients self-sample and then trained staff perform the test and interpret the results.
- ▶ A few nontraditional placements were suggested. One KSI suggested that NG/CT POCTs be placed in entertainment venues, such as saunas, karaoke bars, pubs, bars, and massage parlours, where people who are concerned about CT/NG might use the test, assuming it is straightforward.
- ▶ NG/CT POC testing could also be used in various clinics (e.g., beauty, skin, allergy, well-being, and diabetes clinics). Currently, skin clinics that carry out surgery first test clients for HIV; hence, they might also wish to screen for NG/CT.
- ▶ Another more novel use case mentioned was testing in connection with tele-pharmacy, a service that has emerged in Thailand in response to the COVID-19 pandemic. Currently, tele-pharmacy is only offered in cities, and couriers deliver medications or patients pick them up at a designated neighbourhood hub. While this is not yet common practice, KSI participants envisioned self-sampling at home, using a similar tele-pharmacy arrangement and courier service for samples and treatments.

In Thailand, as in other countries, stakeholders were not unanimous in prioritizing different interventions for STIs. There is a strong support for etiological diagnosis over syndromic management in women and a good degree of concern about asymptomatic infections and drug resistance. On other issues, such as prioritizing over-diagnosis of NG, viewpoints varied (Figure 14).

Figure 14: Online survey, showing the level of agreement with various statements



Source: Online survey.



2.3 NG/CT test preferences

The interviews and the online survey explored preferences for NG testing, specifically for two new POCTs: an NG RDT and an NG/CT POC molecular test (Table 4).

Overall, Thailand relies heavily on Gram staining for NG diagnosis, and this affects the opportunity for any new tests. As such, it was noted in many KSIs that Gram staining is seen as the “first-line” diagnostic tool, with new POC devices filling in when Gram stain performance is suboptimal. KSI participants believed that Gram staining performs

almost as well as culturing and NAAT in males with urethral discharge. They noted a sensitivity decrease to about 50% in women, for non-genital sites in men, and in asymptomatic patients. Additionally, they noted that at the moment there is no accessible test for CT in Thailand; the only option is NAAT, which is only available at a few locations. Currently, culturing and NAAT are used in cases where Gram staining does not perform well; however, these methods are only available at higher-level hospitals or at specialized STI clinics.

Table 4: Test descriptions used for the survey and interviews

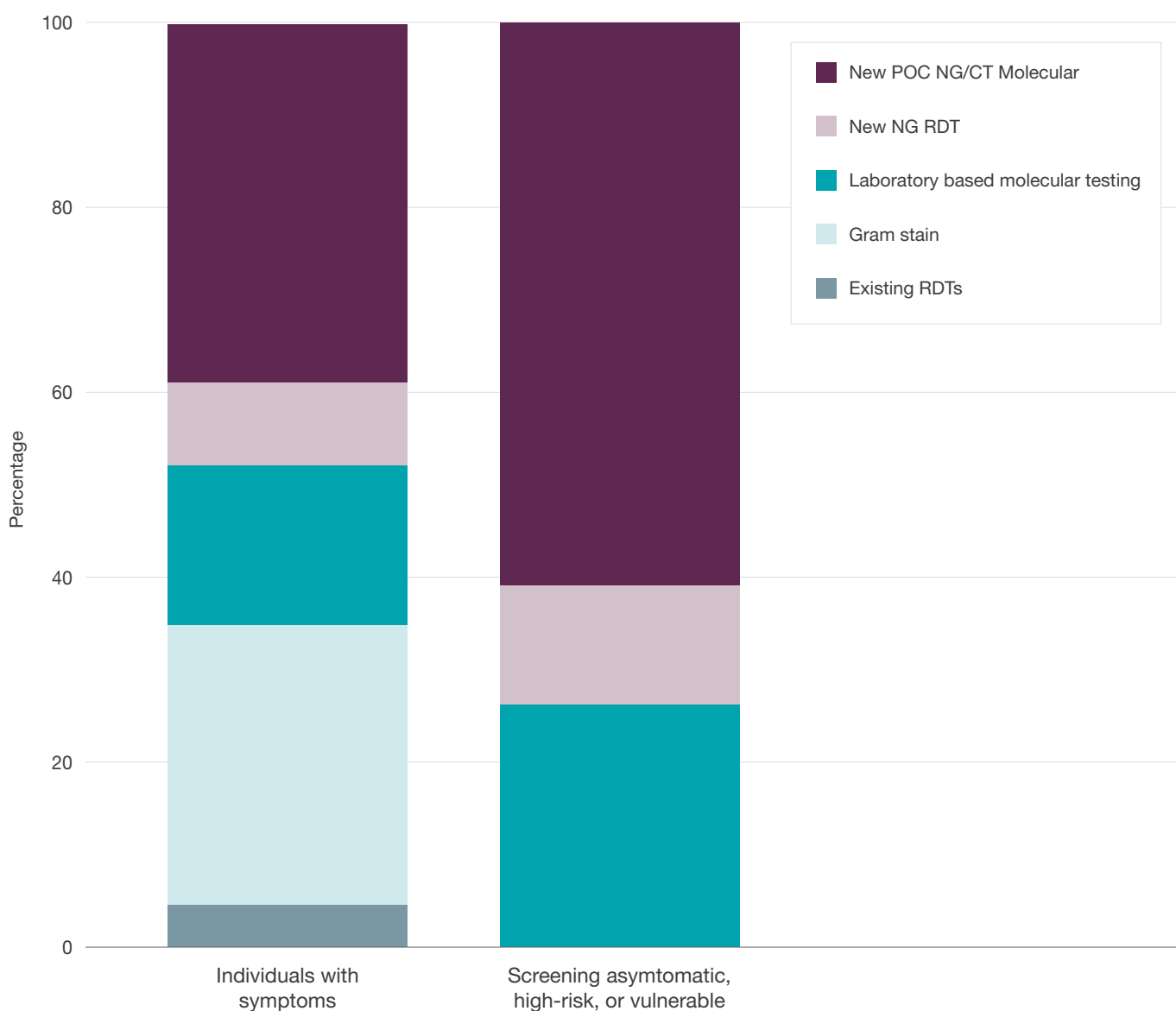
	Target product profiles: POC test for NG/CT	
	Minimal TPP (RDT)	Optimal TPP (POC molecular)
Description	<ul style="list-style-type: none"> ▶ Point-of-care test for use in primary health care settings, including health posts ▶ Single-use disposable diagnostic test (e.g. lateral flow assay) with a battery-powered reader 	<ul style="list-style-type: none"> ▶ Point-of-care test for use in primary health care settings, including health posts ▶ Disposable molecular cartridge and battery-powered small instrument (with 8 hours of operation between charges)
Use	Diagnose NG in symptomatic women and men*	<ul style="list-style-type: none"> ▶ NG and CT diagnosis in both men and women who are symptomatic ▶ NG and CT screening to detect asymptomatic infection in both men and women
Specimen type	(f) vaginal swab (provider or self collected) (m) urine	(f) urine, vaginal /cervical /pharyngeal /rectal swab (m) urine, urethral /pharyngeal/ rectal swab
Performance	Sensitivity: > 80% Specificity: > 95%	Sensitivity: 95% Specificity: >98%
Time to result (TAT)	<30 minutes	<30 minutes
Ex-works price	Targeting < USD 4-5/test kit (including swabs, consumables) + reader cost est. <USD 100	Targeting USD 8/test kit (including swabs, consumables) + device cost USD 500
	<ul style="list-style-type: none"> ▶ Disposable ▶ Easy to use, suitable for primary level 	<ul style="list-style-type: none"> ▶ Easy to use, battery-operated, suitable for primary level ▶ More affordable than some near-patient systems ▶ Faster time to results ▶ Can be used as a screening test
	<ul style="list-style-type: none"> ▶ No CT diagnosis ▶ Reader is not universal, only works with selected RDTs 	<ul style="list-style-type: none"> ▶ Cost

* **Note:** the RDT profile changed during the project. Initially, the profile included NG and CT detection for both men and women; then NG and CT for women, but only NG in men; finally, the RDT could not detect CT, hence it is an NG-only RDT for both sexes.

Despite the availability of Gram staining and other tests, KSI participants were open to new approaches that offer operational affordability and performance advantages over existing tests, which would increase access to NG testing and its etiological management. The KSIs showed there was an overwhelming preference for the NG/CT POC molecular test over the NG RDT. For symptomatic patients, survey participants preferred the new NG/CT POC molecular test and Gram staining. For screening high-risk populations, survey respondents preferred the NG/CT POC molecular test or laboratory-based molecular testing (Figure 15).

The benefits of the new POC molecular test that the KSIs highlighted included acceptable performance; convenience, small size, and short turn-around-time; the ability to detect both CT and NG; and the potential to test rectal and pharyngeal samples. However, because of its low cost, and easy implementation, Gram staining was preferred. Still, the POC molecular test was seen as a good “back up” for situations where Gram staining is inconclusive, for populations and sample types in which Gram staining does not perform well, or when Gram stain results do not match the clinical picture.

Figure 15: Preferred tests for patients with NG symptoms and for NG screening in asymptomatic, high-risk or vulnerable populations



Source: Online survey.

Despite the benefits of the new NG/CT POC molecular test, KSI participants had concerns and comments related to price, sampling, non-genital sampling, and performance validation.

The KSI survey results suggested the proposed test price as reasonable (Figure 16), and for some participants, the USD 8 price for the POC molecular NG/CT test and USD 500 for the instrument was acceptable. However, several KSI participants advised a lower price (e.g., USD 3–5), especially for patients paying out-of-pocket, including youths, students, and those who were unemployed. The price of testing multiple anatomical sites was raised as an issue, for example the price for testing three sites (urethra, rectum and pharynx) would be USD 24. One KSI participant raised concerns and envisioned the requirement of more than one machine for a clinic, which can lead to increased costs. The test price was predicted to be closer to USD 3 in order for medical insurance schemes to consider it cost-effective, especially since the treatments are reasonably inexpensive.

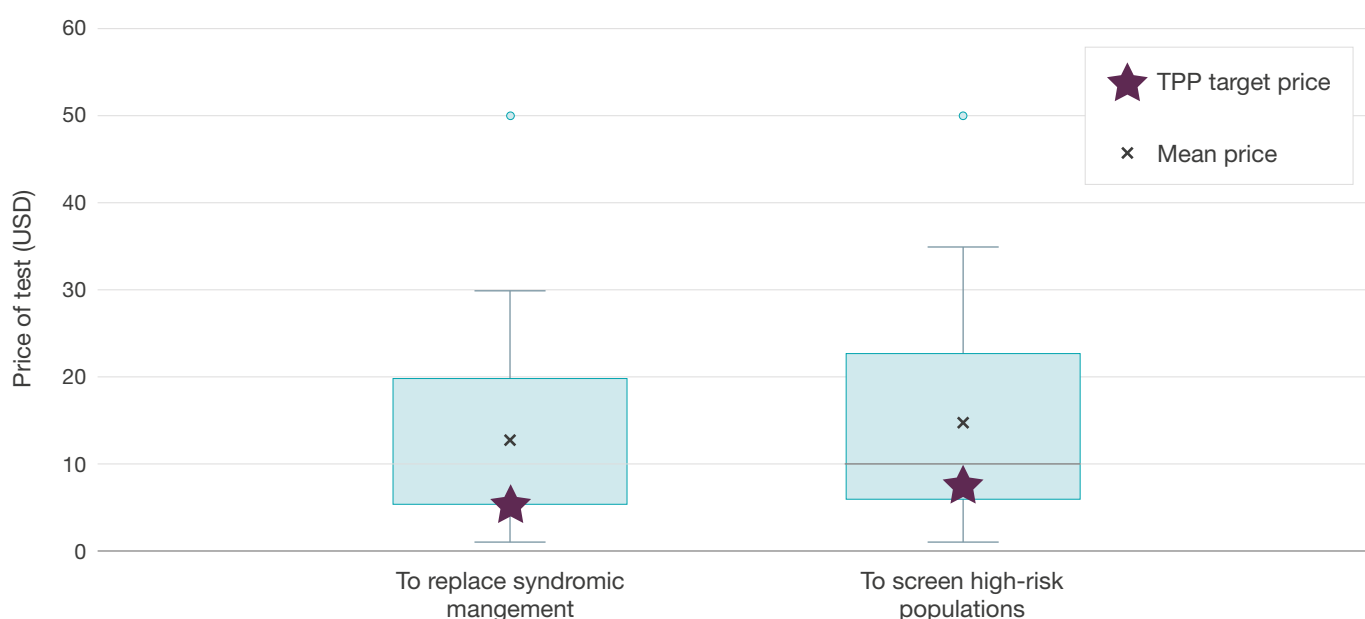
The logistics of specimen collection is equally important for adopting any new test, especially for

screening high-risk populations. Depending on the setting, space for specimen collection in private, either by the patient or a provider, may not be available. KSI participants recommended exploring models for self-collection of samples.

The importance of considering non-urogenital sites was flagged during several KSIs; there were also concerns about the performance and validation of new tests for these sites. Recent studies among MSM and TGW in Thailand have documented high rates of oral and rectal gonorrhoea that would have been missed if only one anatomical site was tested. One KSI participant asked if pooling samples from one individual could keep costs down.

The initial reaction to an NG-only RDT suggests that it would be poorly accepted by several experts and laboratory scientists. During the KSIs, its low sensitivity and inability to detect CT were pointed out. In one KSI it was indicated that, in men, the sensitivity of the RDT was lower than that of Gram staining. Even for women, this interviewee believed that at 80% sensitivity, the RDT was not “much of an improvement over Gram stain”.

Figure 16: Maximum price the public sector should pay for an NG/CT POCT for symptomatic patients and for screening high-risk populations



Source: Online survey.

III FINANCING

There are three primary ways in which STI care, and NG testing, are financed in Thailand: i) UCS and other medical insurance scheme coverage for symptomatic cases, ii) special funding budgets supporting STI screening in targeted populations, and iii) patients paying out-of-pocket for both symptomatic care and screening tests.

3.1 STI testing covered

The main entity financing STI care, the NHSO, is responsible for the UCS; the other medical insurance schemes typically follow the lead of the NHSO. The NHSO needs to strike a balance between ensuring the general population access to a basic package of healthcare benefits and addressing the needs of high-risk populations.

For STIs, the NHSO aims to align its coverage with guidance from the MoPH DDC STI programme. Currently, routine care for symptomatic patients, including Gram staining and culturing for NG, is covered by the annual capitation fee that primary care contracting units receive for each patient. One KSI participant indicated that the current fee is USD 124/year/patient to cover basic preventive care and general illnesses. Facilities can then decide which tests to offer, with Gram staining being the minimum recommendation as per the guidelines. Often, facilities procure their own HIV and STI tests using their per capita funding.

3.2 Special funds supporting targeted testing

STI testing in Thailand is also funded through programmes targeting specific populations. These may be supported by domestic resources or donors, while international donors contribute relatively little to HIV and STI budgets in Thailand, e.g., in 2018, the Thai government funded 90% of the country's HIV response.²⁷

Currently, a few special domestic funds support STI screening, including:

- ▶ A special HIV prevention fund at the NHSO supports screening for STIs; although the tests included are not specified, screening accessed through HIV VCT sites is covered.
- ▶ In Bangkok public health facilities, local government resources are used to fund STI screening that is not reimbursable through other channels.
- ▶ The DDC, Bangrak STI Clinic and ODPC STI clinics have prevention and control budgets that they use to fund STI care for focus populations. Each clinic can prioritize different populations for care that is free-of-charge, depending on their local context and policies.
- ▶ A special antenatal fund covers syphilis, HIV and hepatitis screening in pregnant women.

In addition to these special funds, the Global Fund to Fight AIDS, Tuberculosis and Malaria (GFATM) and the United States Agency for International Development (USAID) provide funding focused on HIV prevention work in key populations. However, international donor funding has been decreasing, and financing from GFATM for STIs is limited and piecemeal (e.g., funding for some syphilis tests, testing in key populations). USAID has funded several implementation research projects to advance STI service delivery models, such as models providing screening for asymptomatic STIs in MSM and TGW by key-population providers at community-led clinics through the use of near-patient NAAT. Going forward, the KSIs revealed that Thailand would likely request funding for STIs, including diagnostics, from the Global Fund, based on the country's increasing STI numbers despite declining and stable HIV incidence. However, the likelihood of gaining approval is low, as Global Fund support has dropped from USD 39 million in 2014 to USD 11.7 million in 2020.²⁸

3.3 Out-of-pocket payment by patients

The last source of financing for STI testing is patients' out-of-pocket payments for services, occurring when patients seek care outside of their assigned facility, seek screening tests that are not covered, or attend several of the specialized STI clinics. The prices for testing and complete health-check visits vary considerably, but options such as NAAT are unaffordable for most, as the average monthly income in Thailand is just USD 200.



Source: © Pumpump | Dreamstime.com

IV MARKET INTRODUCTION PROCESS FOR NEW NG/CT TESTS

4.1 Guideline updates

From a policy perspective, Thailand has guidelines in place for etiological testing. It also has STI screening recommendations covering several key populations. The DDC, in consultation with local stakeholders, periodically reviews and updates these guidelines. The MoPH published the first national treatment guidelines in 1988 and has regularly revised them every three to six years. Except for the first version, a multidisciplinary team, comprising up to 40 members, has supported the development of the guidelines. The KSI participants suggested it might be helpful to have representatives from relevant organizations, such as the Thai Medical Society for the Study of Sexually transmitted Diseases, the Thai AIDS Society, and the Association of Medical Technologists of Thailand, involved in updating NG testing policies.

The DDC plans to update the STI screening guidelines soon, as the current policy dates from 2010. The expansion of STI screening recommendations to cover additional populations, such as young people, is a consideration, but generally, KSI participants had mixed opinions about whether this would occur, citing a lack of financial support. It would require a strong investment case, including a sense of urgency (i.e., evidence of high and increasing NG/CT prevalence), an evidence of cost-effectiveness, and demonstrated impact (especially considering other approaches like the promotion of condoms) to mobilize funding for additional screening.

4.2 Testing policy development process

Both proposed POCTs for NG – RDTs detecting NG antigens and POC molecular tests using

isothermal amplification techniques – are novel methods for gonorrhoea diagnosis. As such, neither is specifically included in the current MoPH guidelines for diagnosing gonorrhoea. While there is a recommendation for traditional PCR techniques in the guidelines, it is unclear if it includes isothermal amplification methods. Nevertheless, the DDC STI programme would likely draw on colleagues at Bangrak STI Center and the DMSC to assess these new diagnostic technologies. It is likely the group would require local performance data prior to making a recommendation. The DMSC which is in charge of evaluating the performance of new tests has a specific protocol for evaluating HIV testing kits, however there is currently no protocol for evaluating STI testing kits.

4.3 Test registration

The Medical Control Device Division of the TFDA is responsible for registering in vitro diagnostics (IVD) in Thailand. It coordinates with the DMSC to ensure the effectiveness and quality of tests. In 2020, the TFDA adopted new standards for IVD control that are harmonized with the ASEAN Agreement on Medical Device Directive. Under this system, IVDs are divided into four risk groups, with rules corresponding to each group.

NG/CT tests are classified as having a high risk for individuals and an intermediate risk for public health and fall under the rule 3/type 3 level of TFDA regulation. The TFDA were drafting the specific guidelines in 2020; they are expected to be published in 2021. However, the new regulations for NG/CT tests will be stricter than the current requirements, requiring a more extensive submission dossier and longer TFDA review period (40–90 business

days) before a seller's license is approved. Seller's licenses allow the distributor or manufacturer to sell their product in Thailand for five years.

KSI participants expected the registration of a new NG/CT test to require validation using specimens from the Thai population. These criteria exist for HIV testing, are in development for syphilis rapid tests, and are likely to apply to other tests in the future.

4.4 Reimbursement coverage

The NHSO covers STI testing through the capitation fee and the special fund for screening via VCT. Although the Thai MoPH will consider procuring for the entire country in the case of serious events (e.g., the COVID-19 pandemic), it is more common for health facilities to conduct their own procurement.

For symptomatic patients, an individual health facility may decide to adopt testing platforms once they have been registered for use in the country and recommended as part of disease management guidelines. With facility revenues largely based on capitation fees, out-of-pocket payments, and other medical scheme reimbursements, hospital budgets are likely to be a significant factor influencing the adoption of any new tests. Capitation fees fund STI care, and therefore a facility must consider the cost and effectiveness of a new test compared with the cost-effectiveness of existing options such as Gram staining (USD 1–2) and the cost of treatments.

There is a multi-step process for the NHSO to cover a new test, especially for the STI screening fund (i.e., at VCT sites). The first step is a favourable performance review by major stakeholders, such as local laboratories and STI or infectious disease associations, and subsequent inclusion in MoPH guidelines. The MoPH Health Intervention and Technology Assessment Program (HITAP) also conducts assessments focused on the cost-effectiveness of tests compared with other tests, using Thai data on prevalence, burden of disease, sensitivity/specificity, direct costs and indirect costs. Two NHSO committees then review the test: the Service Type and Coverage Subcommittee

and the Fund Management and Implementation Regulations Subcommittee.

4.5 Procurement

For public facilities, procurement policies and procedures exist that identify the party responsible for purchasing and processes. Diagnostic tests are procured both centrally and by facilities themselves. In emergency situations (e.g., COVID-19) or when a test is only available from one supplier, procurement may be pooled to cover the whole country, otherwise hospitals carry out their own procurement. Typically, once a test has been included in the national guidelines and covered by the benefit packages, then hospitals begin to adopt the technology.

4.6 Acceptance, training and communications

A common theme in the interviews and survey feedback are stigma and low awareness around STIs. Some KSI participants suggested that demand for STI testing in Thailand would not reach its full potential without additional communications aimed at increasing the awareness of STIs among the public. While many of the key populations are well-educated about STIs, findings from the KSIs suggested there is scope for strengthening outreach to some subgroups and the youth more generally.

Similarly, reducing discrimination at healthcare facilities is a priority. KSI participants suggested that many general practice physicians and nurses needed refresher training on STI management.

Concerning the new tests, as both the RDT and POC molecular test are simple to use, some KSI informants felt the main challenge would be around sample collection, but that this could be addressed through training.

V

THE MARKET FOR NG POC TESTS IN THAILAND TESTS

The market for affordable POC NG tests in Thailand is promising. The NG RDT would serve the lowest level of the healthcare system and potentially women at the hospital level. The POC molecular test has more promise for screening and supplemental testing at STI clinics and higher-level facilities. Going forward, increasing STI care-seeking behaviour at health facilities is possible if the TFDA moves to discourage over-the-counter gonorrhoea treatment in pharmacies.

Despite their promise, the affordability of these POCTs will be a challenge. As the POCTs are more expensive than Gram staining, a cost-benefit analysis will be necessary to guide medical reimbursement schemes and facilitate adoption decisions. Facility budgets are mainly based on capitation fees; therefore, the price of the POC molecular test is probably too high for most public facilities. While the price of the RDT is more acceptable, implying the strong level of impact evidence needed to support its use.

Despite the opportunity to add value presented by the new NG tests, the potential market size is difficult to assess in the absence of prevalence, care-seeking, diagnostic testing, and screening coverage data. Based on the KSIs and surveys, and the subsequent data analysis, the following market segments are likely to be the most promising and worth considering.

1. NG RDT for symptomatic men and women at the health centre level

The 9,800 health centres in Thailand lack Gram staining capacity; the NG RDT could add value by providing an etiological diagnosis in both symptomatic women and men presenting for care. Data from the KSIs suggest that the target price is high (USD 4–5); therefore, evidence of cost-effectiveness and impact compared with syndromic management will be required. As a reference value, KSI participants suggested that the market for an affordable, easy-to-use RDT in Thailand could be 1–1.5 million tests per year (on par with HIV RDTs).

2. NG RDT for symptomatic women, at hospitals and in STI clinics

Hospitals and STI clinics rely on Gram staining as the first-line diagnostic tool for gonorrhoea. However, Gram staining performs poorly with samples from women, and the NG RDT represents a practical alternative. Although some KSI participants preferred the POC molecular test for women due to its superior performance, considering capitation fees, its price puts it out of reach for most facilities. Assuming approximately 950 hospitals and STI clinics adopt RDTs for women and test on average 2–3 women per day, volumes could exceed half a million tests per year.

3. NG/CT POC molecular test for screening

Screening is another important use case, and experts favoured the POC molecular NG/CT test for screening asymptomatic infections. Many clinics and facilities work with key populations or offer VCT, HIV and STI services but do not currently have access to NAATs. These sites could use the POC molecular NG/CT test to offer rapid STI screening, along with using RDTs to screen for syphilis and HIV.

Based on key-population sizes, screening recommendations, and coverage, the total potential market for the screening use case is half a million tests annually (Table 5). Existing NAATs would address some of this screening demand, especially in higher volume facilities. The POC molecular NG/CT test would support screening at sites that do not currently have NAATs. Currently, the UCS does not cover screening; however, there are several special prevention funds and donor programmes that support STI screening. For example, CBOs and NGOs envision using the POC molecular test to expand STI screening in high-risk populations. A primary rationale is to engage high-risk individuals and link them with further care, including PrEP or ART. The linkages to HIV prevention and care means these sites may receive donor support for NG/CT testing. In other instances, e.g., ODPC, BMA, clinics may be able to access special prevention funds to cover the cost of testing, or patients could pay out-of-pocket. It is also possible for new populations to be targeted for screening (e.g., high-risk adolescents and young adults); these have not been included here because the criteria and pathways for accessing these groups are yet to be defined.



Source: © Tampatrat | Dreamstime.com

Table 5: Market-size estimates for screening

Target population	Policy					Assumptions and notes		
	Population size estimate	Population recommended for testing	# tests yr.	20%	40%		60%	80%
FSW	129,000	129,000	4	103,200	206,400	309,600	412,800	66% of FSW testing/know HIV status; guideline is monthly, but in practice KSI report every 3 months
Male sex workers	15,000	15,000	4	12,000	24,000	36,000	48,000	Same as FSW
High risk MSM	159,600	159,600	2	63,840	127,680	191,520	255,360	42.9% of MSM testing/knowHIV status. Guideline is 1 or more/year depending on risk; KSI report in practice screening 2ce year
Transgender	62,800	62,800	2	25,120	50,240	75,360	100,480	41.6% of TGW are testing/know HIV status. Guideline is 1 or more/year depending on risk; KSI report in practice screening 2ce year
Antenatal care	600,000	600,000	1	120,000	240,000	360,000	480,000	ANC coverage is >95%
PrEP	21,500	32,250	1	6,450	12,900	19,350	25,800	Assume growth 1.5x over current PrEP
HIV tested	2,150,000	2,150,000	1	430,000	860,000	1,290,000	1,720,000	Tests/year, WHO data 2018
HIV test positive	5,400	5,400	1	1,080	2,160	3,240	4,320	Unaided

*Most likely assumption

There are several additional scenarios where the POC molecular test could add value and contribute incrementally to overall testing volumes. For example, despite its cost, some larger hospitals and STI clinics might adopt the POC NG/CT molecular test based on its ability to diagnose CT, its better performance, and the ability to test samples from extragenital sites. These facilities could also use the POC molecular test as a rapid back-up for situations where Gram staining in men proves inconclusive or when Gram stain findings are not in line with a patient's presentation. Lastly, many STI clinics cater to patients who pay out-of-pocket, and the POC molecular test may appeal to patients who are willing to pay more for high

sensitivity and rapid turn-around-times. The market size for such supplemental testing is difficult to estimate because the adoption and associated volumes are likely to be heterogeneous and facility-dependent. For example, facilities may consider patient characteristics, the overall volume of tests, laboratory capacity, other available NG diagnostics, etc.

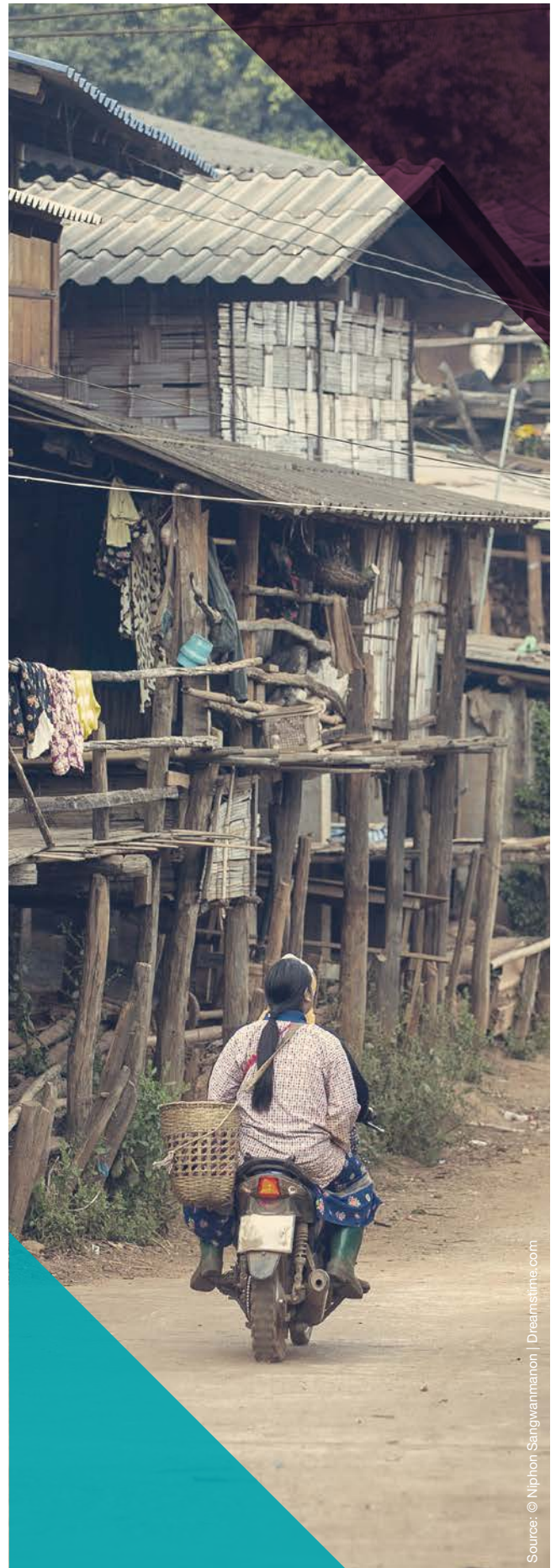
While NG testing in pharmacies and other highly accessible outlets is of interest, there are no models for implementing this in the near term, as Thailand is only just piloting HIV self-testing, and NG/CT testing is unlikely to be very attractive to pharmacies compared with other opportunities.

VI CONCLUSION

For Thailand, POC NG tests offers an opportunity to expand etiological diagnosis to settings where it is not currently available or consistently implemented. Additionally, POC molecular tests could expand access to NG/CT screening, as many facilities regularly engage with patients who could benefit from STI screening, yet few have NAAT capacity. With budgets mainly based on capitation fees, and limited dedicated funding for screening, price is paramount in any adoption decision. Ease of sample collection, test processing, and interpretation of results is also critical, given the vision for decentralized testing in facilities that lack laboratories or laboratory staff.

For market introduction, Thailand has well-established institutions and a transparent structure. However, many steps and parties are involved, including guidance updates by the MoPH and local professional associations, TFDA review, and health technology assessments to inform reimbursement decisions. For the NG RDT, strong evidence for the impact of the test will ease skepticism around its lower performance than molecular methods. Demand for gonorrhoea testing is fragmented: each facility will likely make adoption and procurement decisions, considering its Gram staining capacity and the size and characteristics of the local STI care-seeking population.

Overall, Thailand is a regional and global leader in STI control, and therefore an essential market for POC tests. It is worthwhile engaging early, for example conducting studies with leading Thai institutions, familiarizing stakeholders with POC gonorrhoea tests, and building a strong local evidence base.



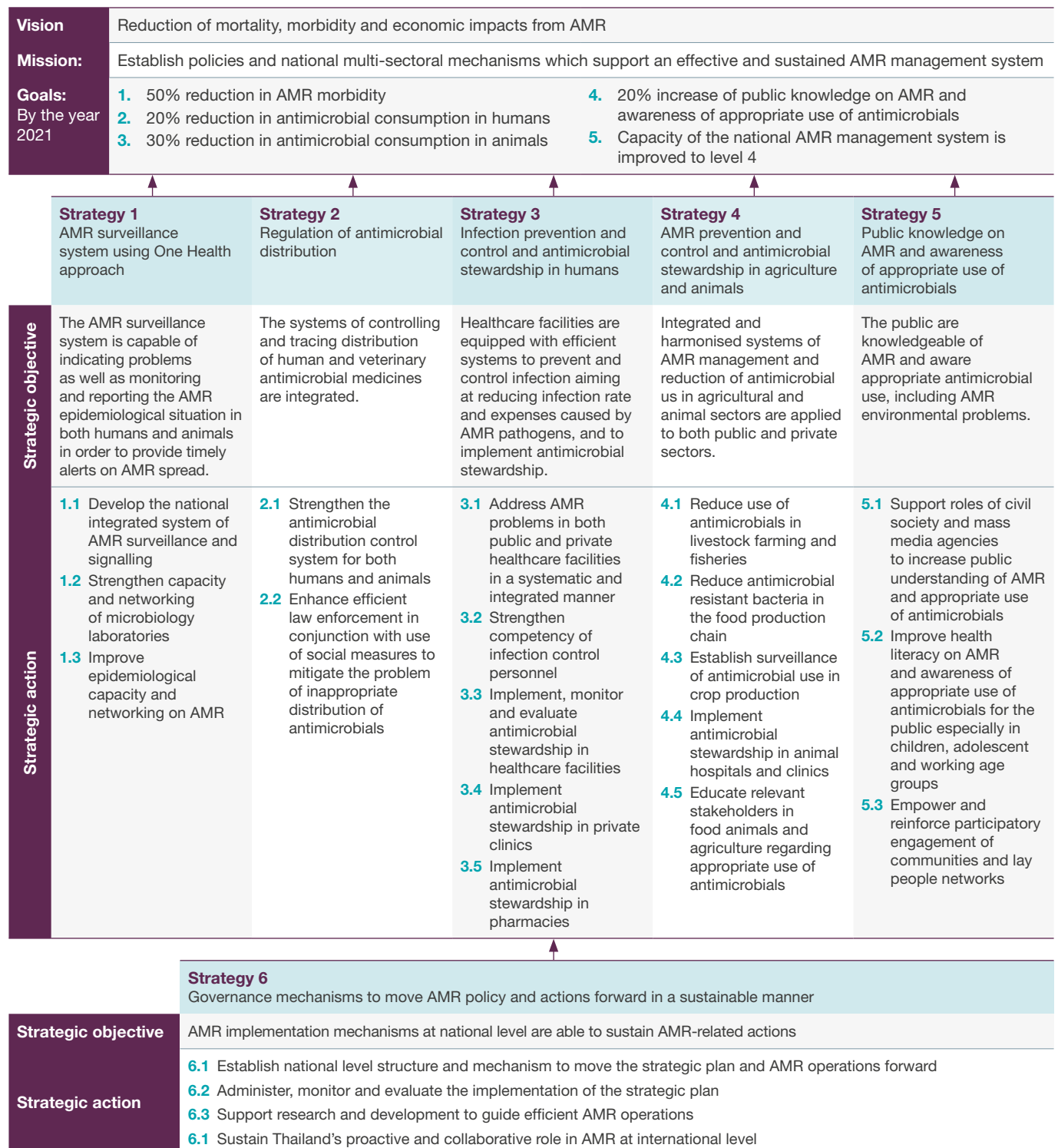
Source: © Niphon Sangwanmanon | Dreamstime.com

ANNEX 1: INDIVIDUALS CONSULTED

Organization	Position
National Health Security Office (NHSO)	Assistant Secretary-General
Global Fund (GF)	Senior Expert in Prevention Medicine
<ol style="list-style-type: none"> Country Representative, LINKAGES Thailand project, FHI 360 Director, Project Portfolio, Asia-Pacific Regional Office, FHI 360 	<ol style="list-style-type: none"> Country Representative, LINKAGES Thailand project, FHI 360 Director, Project Portfolio, Asia-Pacific Regional Office, FHI 360
FHI 360	Senior Laboratory Specialist
Thai Food and Drug Administration (TFDA)	Medical Control Device Division
	Medical Technologist
Secondary/tertiary hospital	Physician at Public Health Service Center 28
	Physician at Public Health Service Center 26
Thai Red Cross Anonymous Clinic (TRCAC)	Physician
Bangrak STI Center	Physician
Silom Community Clinic	Director, HIV/STD Research Program
Community-based organization	Director of Service Workers in Group Foundation
Thai NGO Coalition on AIDS (TNCA)	Independent scholar (นักวิชาการอิสระ)
Private Clinic	Medsign STD Clinic owner at Chiang Mai
Product user	CT/NG Client and head of care and support at Service Workers in Group BKK
Pharmacist	Owner of Rungruang Pharma drug store
MoPH, DDC	STI program manager

ANNEX 2: ADDITIONAL FIGURES

Annex figure 1: Framework of the implementation and evaluation of the national strategic plan on antimicrobial resistance (NSP-AMR)populations



Source: Ministry of Public Health, Ministry of Agriculture and Cooperatives. National strategic plan on antimicrobial resistance 2017-2021 Thailand

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