WEBINAR ON USE OF ANTIGEN TEST KITS TO CONTROL COVID-19

SUMMARY REPORT

SEPTEMBER 14, 2021

HEALTH INTERVENTION AND TECHNOLOGY ASSESSMENT PROGRAM
MINISTRY OF PUBLIC HEALTH, THAILAND

Contents

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List of Abbreviations

ADP	Access and Delivery Partnership
ATK	Antigen Test Kit
CORESIA	COVID-19 Vaccination Policy Research and Decision Support Initiative in Asia: a regional study on vaccination certificates
COVID-19	Coronavirus disease
CCSA	Centre for COVID-19 Situation Administration
FDA	Food and Drug Administration
HITAP	Health Intervention and Technology Assessment Program
HSRI	Health Systems Research Institute
MOH	Ministry of Health, Singapore
NHF	National Health Foundation
NRCT	National Research Council of Thailand
PCR	Polymerase chain reaction
SSHSPH NUS	Saw Swee Hock School of Public Health National University of Singapore

Acknowledgements

This report summarises the discussion during a webinar held on use of Antigen Test Kits (ATK) to control COVID-19 held on 14 September 2021, with the aim of learning from the experience of Singapore to inform ATK policy in Thailand. The webinar was supported by the Ministry of Public Health, Thailand, the Health Systems Research Institute (HSRI), the National Research Council of Thailand (NRCT), the National Health Foundation (NHF), the Access and Delivery Partnership (ADP) and the Saw Swee Hock School of Public Health National University of Singapore (SSHSPH NUS). The report was prepared by Ms. Madison Silzle with inputs from Ms. Saudamini Dabak, Ms. Chayapat Rachatan, and Ms. Aparna Ananthakrishnan from the Health Intervention and Technology Assessment Program (HITAP). Dian Faradiba and Ms. Pitchawee Aksonchuen from HITAP helped organise the webinar along with colleagues from the Thai Ministry of Public Health.

The findings, interpretations and conclusions expressed in this report do not necessarily reflect the views of the funding or participating agencies.

Background

Many countries have incorporated antigen test kits (ATKs) into their COVID-19 control strategies for a wide range of purposes. ATKs, also called rapid antigen tests, detect molecules on the surface of the COVID-19 virus and provide results within 15 minutes. ATKs are particularly important for increasing testing capacity when polymerase chain reaction (PCR) tests cannot fulfill testing demands. While PCR tests are the gold standard for identifying COVID-19 infection, they are time and resource intensive, limiting the number of tests that can be completed, especially when cases are rising rapidly. However, ATKs are limited by their lower sensitivity and specificity compared to PCR tests [3]. As countries look towards a "post-COVID" age, both PCR and ATK tests can play important roles in social and economic reopening strategies. The most effective use of ATKs to control COVID-19 transmission therefore requires careful consideration of context – test availability, purpose of test (e.g., screening, diagnosing), COVID-19 situation, among others [1].

Given the many methods of including ATK in testing strategies, public health officials from Thailand sought to gain knowledge from Singapore's experience using ATKs. Both Thailand and Singapore are looking to re-open their economies and are using ATK as a tool to control outbreaks. On September 14, 2021, a webinar was hosted by the Thai Ministry of Public Health, with the support of the National Research Council of Thailand (NRCT), the Access and Delivery Partnership (ADP), Health Systems Research Institute (HSRI) along with the National Health Foundation (NHF) and the Health Intervention and Technology Assessment Program (HITAP) to learn from experts at the Saw Swee Hock School of Public Health National University of Singapore (SSHSPH NUS) about their experience in Singapore. The webinar featured presentations by Dr. Hsu Li Yang, Vice Dean (Global Health) and Programme Leader (Infectious Diseases), and Dr. Alex Cook, Vice Dean (Research) and Domain Leader (Biostatistics & Modelling) from SSHSPH NUS. The webinar was moderated by Dr. Surakameth Mahasirimongkol from the Thai Ministry of Public Health. Participants were invited from various institutions working on public health in Thailand. The agenda and list of participants are provided in Appendix 1 and 2, respectively.

The objective of this meeting, as explained by Dr. Somsak Chunharas, who provided opening remarks for the webinar, was for participants to learn about the COVID-19 situation and ATK use in Singapore. He expressed his hopes that learning from colleagues in Singapore will help "guide immediate action and long-term policy, as well as help devise decision making criteria" on the use of ATK in Thailand.

COVID-19 Situation and Control in Singapore

Dr. Hsu Li Yang gave an overview of the COVID-19 situation and response in Singapore. Singapore's four-pronged COVID-19 strategy used at the beginning of the pandemic included (1) enhanced surveillance, (2) containment in the form of hospitalisation or isolation, (3) active case finding, and (4) reducing importation. It proved to be successful in containing COVID-19 cases until the arrival of the Delta variant in Singapore in April 2021, at which time vaccine rollout was being organised for the general population. Lockdown restrictions were lifted as soon as vaccination reached 80% in August; however, this corresponded with a jump in COVID-19 cases. At the time of the webinar, Singapore had more than 600 new cases per day, which had not been seen since early in the pandemic.

Singapore's current strategy to control COVID-19 cases prioritises (1) vaccination outreach, (2) expanded testing, (3) slowing re-opening plans, and (4) self-isolation over hospitalisation to prevent overwhelming healthcare facilities. There is increased outreach, especially among the elderly, to push for the "last mile of vaccination". Singapore is also looking at giving booster doses to high-risk individuals. Expanded testing has mostly come in the form of widely available rapid antigen tests and an emphasis on self testing. Antigen tests have been distributed to every household and they are available to purchase over the counter. The Ministry of Manpower has encouraged businesses to step up workplace-based testing, however the specific testing strategies used are dependent on individual businesses and organisations.

It is not clear that an 81% vaccination rate is sufficient to prevent overwhelming the healthcare system and thus re-opening efforts have slowed down. Singapore is also looking at other countries, particularly Israel, the UK, and Denmark, for guidance on their re-opening plans. He concluded his presentation by noting that more data is needed to determine both the effectiveness of vaccines over time and of booster doses.

Antigen Test Use in Singapore

Dr. Alex Cook summarised how rapid antigen tests are being used in Singapore and their impact to control COVID-19[1].

He began by giving an account of Singapore's historical use of PCR tests. At the beginning of the pandemic in 2020, Singapore had low testing capacity (around 3 tests for every positive case) and relied heavily on PCR tests. Later that year, they started to combine PCR tests with serology tests, which highlighted a lot of hidden cases among people who had already recovered from the infection but were still contagious (e.g. both the PCR and serology tests found positive).

PCR testing is still considered the "gold standard" in Singapore, but antigen tests are now accepted and used as a supplement to PCR tests. The current strategy is to use antigen tests in addition to PCR tests at borders, for suspected cases, among foreign workers, and for mass testing events. Self-administered antigen tests are also being used for regular testing of the general public. It is important to note that all confirmed cases in Singapore still come from PCR test results. Antigen tests are convenient because they provide rapid results and can be used to increase the frequency of testing. A few of the strategies being used in Singapore are detailed below:

- For individuals arriving to Singapore, antigen tests are used for repeat testing during quarantine, although a PCR test is still required on arrival and exit of quarantine.
- Every suspected COVID-19 case that arrives at a general practice will receive both a PCR and antigen test. This reduces the chance of false negatives being sent out into the community.
- Antigen tests are being used for mass testing events, such as prior to boarding a cruise ship, and frequently for routine testing, such as among foreign workers.

There is a shift to use Vaccine or Regular Testing (VORT) strategy, in which individuals who are not vaccinated get tested more frequently than vaccinated individuals. NUS, for example has mandatory testing for all students and staff coming to campus, with vaccinated individuals required a test every 20 visits to campus and unvaccinated individuals required a test every 5 days.

[1] Dr. Alex Cook and his research team received funding from Becton Dickinson, a company that manufactures antigen and PCR tests, thus presenting a potential conflict of interest.

Modelling the Impact of Various Testing Strategies

Dr. Cook and his research team developed two models to assess different testing strategies. The goal of modeling is to combine different testing strategies (e.g. timing of tests, what types of tests, quarantine time) to determine what percentage of positive cases will be undetected by that strategy. Given a percentage of acceptable undetected cases, the model can be used to recommend a testing strategy.

The first model developed was used for testing at the border, utilising variable quarantine time, test timing, test frequency, and test type. The results didn't find a large difference between the use of PCR or antigen tests when the frequency of testing was high, which was also found in other models [2]. This suggests that frequency of testing can make up for the lack of sensitivity of the antigen test.

The second model was used for routine testing in the general population, utilising variable test frequency and test type. A distribution of infection and symptom onset times between test events was generated to determine how long it takes to detect a case, and how many secondary transmissions will occur before you detect a case. The goal is to reduce secondary transmissions to less than 1.

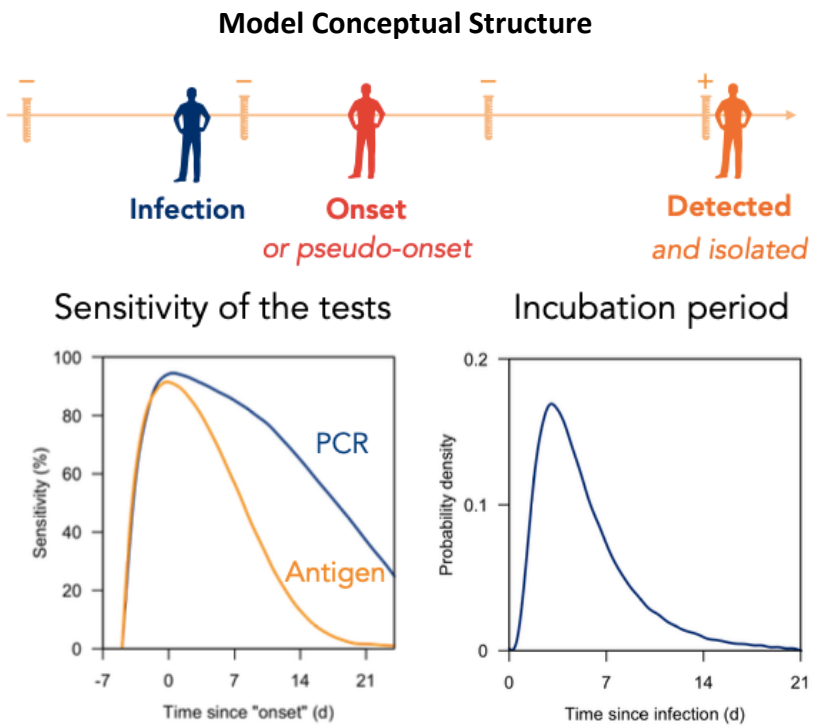

Figure 1. (1) the % sensitivity of PCR versus Antigen tests over time; (2) the probability of testing positive over time

Source: Presentation by Dr. Alex Cook

The results showed that antigen tests are not as good as PCR tests at slowing transmission, but the difference between them lessens as the frequency of testing increases. It also showed that weekly testing could reduce COVID-19 transmission by 80-85%.

There are limitations to these models. The distribution of PCR and antigen test sensitivity curves over time may be optimistic as they were derived from symptomatic cases only, and pre-symptom onset times were extrapolated due to a lack of data (see Figure 1.). Additionally, the models

were run on an unvaccinated population and need to be modified for highly vaccinated populations, as vaccinated individuals shed less virus.

There was a question on how lowering the sensitivity of the antigen test would change the model results. Several Thai colleagues expressed concern that some antigen tests used in Thailand are less sensitive than those used in Singapore. Dr. Cook said he thinks the finding that frequent testing can reduce transmission will still hold even with a lower test sensitivity. He advised focusing on what test is most practical for each situation, rather than what test is the most sensitive.

It is important to consider the COVID-19 context. For low COVID-19 settings (in which outbreaks can be controlled), the number of cases from travel can be carefully calibrated for good use of testing and quarantine, whereas in high COVID-19 settings the number of cases from travel is small compared to community transmission and thus less important.

ATK Moving Forward

In discussion around Singapore's COVID-19 control strategies, it was noted that further follow up will be needed to determine the success of antigen test use in minimising COVID-19 transmissions, as many of these strategies are recent. The reliability of self-testing is of particular interest, as there are concerns about individuals not administering the test properly, or not reporting positive cases due to the burden of quarantine.

As this is a topic of great importance, Thailand sought to learn about ATK testing in other countries as well. A survey was shared with members of COVID-19 Vaccination Policy Research and Decision Support Initiative in Asia (CORESIA): a regional study on vaccination certificates in early September. Responses from India, Malaysia, and Lao PDR to the survey on ATK use provided an overview of how ATK tests are priced, distributed, and used to inform decision making around COVID-19 response efforts in each country. While Lao PDR did not use ATK, both India and Malaysia used ATK to inform economic and social reopening of the country. This was commonly done through ATK use in (1) field disease surveillance, (2) screening and diagnosis of cases, and (3) routine monitoring of staff in service sectors. It was also more common for ATK to be used by trained personnel, rather than for self-testing.

Additionally, exploring how ATK can be used in tourism is of considerable interest for Thailand. In November 2021, an impact assessment study on ATK use in tourism between Thailand and Singapore found that PCR testing of new arrivals is not economically beneficial compared to ATK testing when PCR testing has been used prior to arrival. PCR testing pre-arrival and ATK testing post-arrival is effective at reducing cases while also reducing the burden of quarantine, which can facilitate tourism, given that long quarantine time is associated with a significant reduction on the number of individuals entering the country. For example, number of tourists from Singapore arriving in Thailand is reduced to less than half when quarantine is increased from 3 to 5 days, according to estimates [7]. Thailand has continued to require PCR testing pre-arrival throughout the pandemic and taken steps to shorten quarantine length. The "Test and Go" programme was introduced in November to allow vaccinated individuals to bypass quarantine after testing negative by PCR. Although the programme was suspended amidst increasing number of Omicron cases, it was reinstated as of February 2022 [13].

Since this webinar, Thailand's COVID-19 strategy has included more ATK test use. ATK tests are allowed to be sold at shops, pharmacies, and online for public use [5] and the Food and Drug Administration (FDA) has approved over 200 brands of ATK for self-testing [6]. The FDA has encouraged the use of ATK as a screening tool but are not being used to confirm diagnosis [5]. Other sectors have begun to allow ATK test results as a means of entry, for example to enter a national park one must provide either proof of vaccination or a negative PCR or ATK test result [8].

The rise of the Omicron variant has further raised questions and concerns about sensitivity to this variant and the role of ATK in surveillance strategies. In Thailand, ATK for screening of the

population remains a key strategy. Although the Centre for COVID-19 Situation Administration (CCSA) approved replacing PCR tests with ATK tests for international arrivals in December, this was quickly removed due to concerns over Omicron cases [4].

Singapore has continued to employ ATK in the strategy to contain COVID-19 cases since Omicron was first detected in the country [9]. The Ministry of Health (MOH) has piloted several projects to support ATK use in the public, including ATK vending machines to increase distribution [10], and a virtually supervised ATK test to facilitate higher frequency and more accurate testing [11]. Both unsupervised and supervised self-administration of ATK are used to detect cases among new arrivals in Singapore [12].

The dynamic nature of COVID-19 requires continual evaluation of ATK use in response to new outbreaks, rising variants, and changing priorities. Although there is no “one size fits all” testing strategy, one can continue to share knowledge, learn from other countries, and adapt our strategies to best fit the context.

Appendices

Appendix 1: Agenda

Webinar on use of Antigen Test Kits (ATK) to control COVID-19

Background:

Antigen Test Kits (ATKs) are a means of diagnosing COVID-19 cases. In Thailand, ATKs are now readily available in the market and are relatively cheap compared to polymerase chain reaction (PCR) tests, which remain the gold standard for testing for COVID-19. However, the sensitivity and specificity of these tests vary and the Thai government is interested in understanding the impact of using ATKs to control COVID-19 in a range of scenarios including screening of people in high-risk groups as routine testing.

Singapore has implemented a policy to use self-test kits for its population and its experience would be relevant to Thailand as it explores deployment of ATK to control its COVID-19 cases. The Saw Swee Hock School of Public Health at the National University of Singapore (SSHSPH NUS) has conducted modelling studies to determine the impact of using ATK for controlling COVID-19. This webinar offers an opportunity for knowledge exchange between Singapore and Thailand on the use of ATK to control COVID-19 as well as to identify lessons for policymaking in Thailand.

Date: Tuesday, 14 September 2021
Time: 13:00 **–** 14:30 Thai time/14:00 - 15:30 Singapore time
Location: Online, on Zoom:
Link: https://zoom.us/j/93429878122?pwd=Y0hNb1JJaVYwQUh5a3FwcTFUZ25PUT09
Meeting ID: 934 2987 8122
Passcode: 12345

Objective:

- To learn about the use of Antigen Test Kits (ATKs) for living with COVID-19 in Singapore and identify potential lessons for Thailand

Participants:

Representatives from the Saw Swee Hock School of Public Health, National University of Singapore (SSHSPH NUS); Thai Ministry of Public Health's Department of Medical Sciences (DMSc), Department of Disease Control (DDC), Department of Health (DoH), Food and Drug Administration (FDA) and the Health Intervention and Technology Assessment Program (HITAP); National Health Security Office (NHSO); National Health Foundation (NHF); Health Systems Research Institute (HSRI); Universities; and Access and Delivery Partnership (ADP).
The meeting will be conducted in English and Thai. Simultaneous translation will be provided.

Agenda:

Moderator: Dr. Surakameth Mahasirimongkol

Time	Particular	Responsible Person(s)	Remarks
13:00 – 13:10	Opening remarks	Dr. Somsak Chunharas, President, NHF	
13:10 – 13:25	Overview of COVID-19 situation and response in Singapore	Dr. Li Yang Hsu, Vice Dean of Global Health and Programme Leader of Infectious Diseases, SSHSPH NUS	
13:25 – 13:55	Impact of using ATK to control COVID-19 in Singapore	Dr. Alex Cook, Associate Professor and Vice Dean (Research), SSHSPH NUS	
13:55 – 14:25	Discussion	Representatives from NHSO, MoPH, Thai FDA, DMSc, DMS, DDC, Others Moderated by Dr. Surakameth Mahasirimongkol	Open discussion - Clarification on model used in Singapore - Lessons for Thailand
14:25 – 14:30	Summary and closing remarks	Moderated by Dr. Surakameth Mahasirimongkol	

The meeting will be recorded for reference purposes.

Key questions for use of ATK in Thailand:

Priority questions

1. What is the health impact of conducting follow-up tests of incoming travellers every few days using ATK instead of PCR?
2. Is there any benefit to apply ATK for those working in the service sector (e.g. department stores, restaurants, etc) routinely (e.g. weekly)?

Additional questions

3. Is there any difference in terms of potential health impact of using ATK to screen COVID-19 infections among those that are high-risk and symptomatic, comparing those vaccinated and that are not?
4. What is the health impact of using ATK instead of PCR to test international travellers arriving at the airport?
5. What is the potential health impact of using ATK to routinely monitor students and staff at schools and universities?
6. What is the role of using ATK for disease surveillance?
7. What is the potential role of ATK in a setting with a fully vaccinated population?

Resources:

1. Determining quarantine length and testing frequency for international border opening during the COVID-19 pandemic: https://academic.oup.com/jtm/advance-article/doi/10.1093/jtm/taab088/6295067
2. United States Centers for Disease Control and Prevention (US CDC) Interim Guidance for Antigen Testing for SARS-CoV-2 (Updated June 14, 2021): https://www.cdc.gov/coronavirus/2019-ncov/lab/resources/antigen-tests-guidelines.html
3. Ministry of Health, Singapore, notice on use of Antigen Self-test Kits: https://www.moh.gov.sg/covid-19/selftestart

Appendix 2: Participant List

No.	Name	Country
1	Alex Cook	Singapore
2	Aparna Ananthakrishnan	India
3	Archawin	Thailand
4	Artit Ungkanont	Thailand
5	Athiwat dmsc	Thailand
6	Boonsong	Thailand
7	Cecilia Oh	Thailand
8	Chalo Sansilapin	Thailand
9	Chayanit Mahasing	Thailand
10	Cherdchai Nopmaneejumruslers	Thailand
11	Dian Faradiba	Thailand
12	Dimple Butani	India
13	Dr. Sarawut Booksuk	Thailand
14	Ekawat Pasomsub	Thailand
15	Guntipich Jaiboon	Thailand
16	Hsu Li Yang	Singapore
17	Kanchana Srichomphu	Thailand
18	Katika Akksilp	Singapore
19	Khomkrit Rammanakitja	Thailand
20	Kongkiat	Thailand
21	Krittinan Boonrumpai	Thailand
22	Kumnuan	Thailand
23	Leslie Ong	Thailand
24	Narisa Mantharngkul	Thailand
25	Natchalaikorn	Thailand
26	Natthadanai	Thailand
27	Nithirat	Thailand
28	Phoom Pentrakul	Thailand
29	Pitchawee Aksonchuen	Thailand
30	Pongthep Wongwatcharapaiboon	Thailand
31	Prida Malasit	Thailand
32	Santi Lapbenjakul	Thailand
33	Saran	Thailand
34	Saran Sujinpram	Thailand
35	Saudamini Dabak	Thailand
36	Sawitree Visanuyothin	Thailand
37	Supharerk Thawillarp	Thailand
38	Surachoke Tangwiwat	Thailand
39	Surangrat Jiranantanagorn	Thailand

No.	Name	Country
40	Suttiwat	Thailand
41	Suwit Wibulpolprasert	Thailand
42	Thaksaphon (Mek) Thamarangsi	Thailand
43	Titiporn Tuangratananon	Thailand
44	Wanrudee Isaranuwatchai	Thailand
45	Wiroj	Thailand
46	Yot Teerawattananon	Thailand
47	Yupadee Sirisinsuk	Thailand
48	Unknown	Thailand

Appendix 3: References

1. Mina MJ, Andersen KG. COVID-19 testing: one size does not fit all. *Science*. 2021;371(6525):126–7. https://doi.org/10.1126/science.abe9187
2. Nash B., Badea A., Reddy A. *et al*. Validating and modeling the impact of high-frequency rapid antigen screening on COVID-19 spread and outcomes. *medRxiv*. 2021. https://doi.org/10.1101/2020.09.01.20184713
3. Ricks S., Kendall E.A., Dowdy D.W. et al. Quantifying the potential value of antigen-detection rapid diagnostic tests for COVID-19: a modelling analysis. BMC Med 19, 75 (2021). https://doi.org/10.1186/s12916-021-01948-z
4. Thailand's Centre for COVID-19 Situation Administration (CCSA) approved the measure to maintain temporary suspension of the Thailand Pass system for new registrations under the Exemption from Quarantine (TEST & GO) until further notice. *Tourism Authority of Thailand Newsroom.* 7 January 2021. https://www.tatnews.org/2022/01/thailand-reopening-exemption-from-quarantine-test-go/
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10. Antigen rapid test kits vending machines deployed island wide and updates to home recovery and travel classifications. *Ministry of Health Singapore.* 17 September 2021. https://www.moh.gov.sg/news-highlights/details/antigen-rapid-test-kits-vending-machines-deployed-islandwide-and-updates-to-home-recovery-and-travel-classifications_17Sep2021
11. Singapore tries out supervised COVID-19 rapid test via teleconsultation. *Healthcare IT News.* 18 January 2022. https://www.healthcareitnews.com/news/asia/singapore-tries-out-supervised-covid-19-rapid-test-teleconsultation
12. Simplified testing protocols for Vaccinated Travel Lane (VTL) travellers. *Gov.sg.* 21 January 2022. https://www.gov.sg/article/enhanced-testing-for-arrivals-and-border-measures
13. Updated! Test and Go scheme resumed from 1 February 2022. *Tourism Authority of Thailand Newsroom.* 3 February 2022. https://www.tatnews.org/2022/02/thailand-reopening-exemption-from-quarantine-test-go/