Accuracy performance of an oral fluid-based HIV rapid diagnostic test to scale up the opportunity for Treatment and Prevention in Thailand

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Apisada Rasmi

ABSTRACT

Background: Rapid HIV tests increase an opportunity to access HIV testing, especially for high risk groups. One of the interesting approaches is oral HIV self-testing. However, performance of oral HIV test has not yet been evaluated in Thailand.

Objective: To evaluate the performance of an oral fluid HIV rapid test for detecting recent HIV infection

Materials and methods: Men who have sex with men (MSM), transgender (TG) and female sex workers (FSW) were recruited in Bangkok, Chonburi, and Phuket. All participants were screened HIV status by oral fluid (OraQuick), whole blood (Alere Determine HIV-1/2 Ab), and plasma (Elecsys HIV combiPT). Discordant results were confirmed by nucleic acid amplification test. Performance of oral fluid and whole blood HIV rapid tests were evaluated by MedCalc's Diagnostic test. MacNemar's exact test was used to compare the numbers of detected HIV-infected participants.

Results: Five hundred and twenty nine participants were enrolled to perform HIV testing, including MSM/TG (n=289, 54.63%) and FSW (n=240, 45.37%). There were 68, 69 and 71 reactive cases from oral fluid, whole blood and plasma, respectively. Concordant reactive results among three tests were found in 64 participants, whereas 11 participants showed discordant results. Four false positive and seven false negative cases with oral fluid test were exhibited. Among false negative participants, two cases were recent infection, by which one case has received antiretroviral drugs during last 60 days. Oral fluid test had 90.14% (95% CI 80.74-95.94) sensitivity, 99.13% (95% CI 97.78-99.76) specificity and 97.92% (95% CI 96.31-98.96) accuracy. This test could detect fewer infections than those of whole blood (p=0.0019) and plasma (p=0.0057).

Conclusions: This study demonstrated that oral fluid test could detect fewer HIV infections than blood-based HIV tests since recent HIV-infected MSM/FSW were undiagnosed. Thus, this test might be inappropriate for high risk and general populations who receiving antiretroviral therapy.

Key words: Oral fluid HIV test, HIV rapid test, diagnostic test evaluation

บทคัดย่อ

บทนำ: การทดสอบการติดเชื้อเอชไอวีด้วยชุดตรวจ แบบรวดเร็วเพื่อเพิ่มโอกาสในการเข้าถึงการตรวจโดยเฉพาะในกลุ่มที่มีความเสี่ยงสูง หนึ่งในชุดทดสอบที่น่าสนใจ คือการตรวจหาการติดเชื้อเอชไอวีจากน้ำในช่องปากด้วยตนเอง อย่างไรก็ตามประสิทธิภาพของการทดสอบการติดเชื้อเอชไอวีนี้ยังไม่ได้รับการประเมินในประเทศไทย

วัตถุประสงค์: เพื่อประเมินประสิทธิภาพของ oral fluid HIV rapid test ในตรวจหา recent HIV infection

วัสดุและวิธีการ: อาสาสมัครในการศึกษานี้เป็นกลุ่มชายรักชาย (MSM) สตรีข้ามเพศ (TG) และหญิงขายบริการจากกรุงเทพฯ ชลบุรี และภูเก็ต อาสาสมัครทุกคนจะได้รับการตรวจหาการติดเชื้อเอชไอวีจากน้ำในช่องปากด้วยชุดทดสอบ OraQuick จากเลือดด้วยชุดทดสอบ Alere Determine HIV-1/2 Ab และจากพลาสม่าด้วยชุดตรวจ Elecsys HIV combiPT ผลการตรวจที่ให้ผลไม่สอดคล้องตรงกันจะได้รับการตรวจยืนยันด้วยวิธี nucleic acid amplification ผลการตรวจของชุดตรวจจากน้ำในช่องปาก เลือดและพลาสมาจะวิเคราะห์ด้วยโปรแกรมสถิติ MedCalc's Diagnostic test และใช้ MacNemar's exact test วิเคราะห์ความแตกต่างของจำนวนที่ชุดทดสอบให้ผลบวก

ผลการศึกษา: อาสาสมัครจำนวน 529 ราย เป็น MSM/TG (n=289, 54.63%) และ FSW (n=240, 45.37%) ชุดตรวจจากน้ำในช่องปาก เลือดและพลาสมา ให้ผลบวก 68, 69 และ 71 ราย ให้ผลตรงกันทุกการทดสอบ 64 ราย ให้ผลแตกต่างกัน 11 ราย ชุดตรวจน้ำจากช่องปาก ให้ผลบวกปลอม 4 ราย ผลลบปลอม 7 ราย ในจำนวนนี้มี 2 รายที่เป็น recent HIV infection และอีก 1 รายเป็นผู้ได้รับยาต้านมาเมื่อ 60 วันก่อนตรวจ ชุดตรวจ Oral fluid มีความไว 90.14% (95% CI 80.74-95.94), ความจำเพาะ 99.13% (95% CI 97.78-99.76) และความถูกต้อง 97.92% (95% CI 96.31-98.96) ชุดทดสอบน้ำในช่องปากตรวจหาการติดเชื้อเอชไอวีได้น้อยกว่าในเลือด (p=0.0019) และพลาสมา (p=0.0057)

สรุปผล: การศึกษานี้แสดงให้เห็นว่าชุดทดสอบจากน้ำในช่องปากตรวจหาการติดเชื้อเอชไอวีได้ไวและ จำนวนน้อยกว่าชุดทดสอบที่มาจากเลือด ดังนั้นการทดสอบนี้อาจไม่เหมาะสมสำหรับกลุ่มเสี่ยงสูงและประชาชนทั่วไปที่ได้รับการรักษาด้วยยาต้านไวรัส

คำหัส: : Oral fluid HIV test, HIV rapid test, diagnostic test evaluation

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LIST OF ABBREVIATIONS

Ab	Antibody
Ag	Antigen
AIDS	Acquired immunodeficiency syndrome
ART	Antiretroviral therapy
ARV	Antiretroviral
CBO	Community-based organization
DDC	Department of Disease Control, Ministry of Public Health
DIC	Drop in Center
FP	False Positive
FN	False Negative
FSW	female sex worker
HTC	HIV testing and counselling
KPs	Key populations
MOPH	Ministry of Public Health
MSM	Men who have sex with men
NAAT	Nucleic Acid Amplification Test
NPV	Negative Predictive Value
NGO	Non-governmental organization
PLWH	Persons living with HIV
PHAMIT	Prevention of HIV/AIDS among Migrant Workers in Thailand
PLHA	People living with HIV and AIDS
POCT	Point-of care testing
PPV	Positive Likelihood Ratio
Prep and PEP	pre-exposure prophylaxis and post-exposure prophylaxis
PWID	people who inject drugs
RNA	Ribonucleic acid
RRTTR	Reach-Recruit-Test-Treat-Retain
STI	Sexually transmitted infection
TG	Transgender
VCT	Voluntary counseling and testing for HIV
UNAIDS	Joint United Nations Programme on HIV/AIDS

CHAPTER I

INTRODUCTION

HIV is one of the most frequently addressed pathogens that has been targeted in the millennium. At the end of 2016, there were approximately 36.7 million persons living with HIV (PLWH) and 3.5 million persons in South-East Asia[1].Knowing of HIV status is the key to early access to HIV treatment and prevention services. In 2014, UNAIDS announced 90-90-90 target and goal to end AIDS by 2030.[2] The strategies of this target and goal were at least 90% of HIV-infected people knew their status, and at least 90% of those who knew their status obtained antiretroviral therapy (ART), and at least 90% of those who received ART were viral suppressed. The initial step to reach the United Nations' 90-90-90 targets to end the HIV epidemic was 90% of people living with HIV to learn their HIV status. Therefore, HIV testing is essential for achieving "the first 90". Approximately 30% of people with HIV are unaware of their infection in worldwide.[1] The only way to determine a person's HIV status is the HIV testing. In many countries, critical gaps exist in HIV services, including prevention, testing and treatment. There is an opportunity to prevent 1.5 million infections per year by 2020 and reach the "fast-track" goals if we can improve prevention and testing services, as well as ensure high-quality, well-adhered-to treatment and care for all.[3] In Thailand, Reach-Recruit-Test-Treat-Retain (RRTTR) program has urged to scale up HIV prevention and treatment services among undiagnosed PLWH, especially for high risk groups, such as men who have sex with men (MSM), transgender (TG), sex workers, prisoners, people who inject drugs (PWID) and migrants. However, passive services and stigma are barriers to approach HIV testing. Mobile service at Drop in Center (DIC) and brothels using whole blood rapid HIV tests has been implemented at health care centers for professional use since 2014 in order to expand the access for HIV testing to non-clinical sites and provide an opportunity for faster linkage to treatment and care.[4-5] Moreover, rapid HIV tests have given the same-day results within 30-60 minutes. In 2004, rapid test using oral fluid (OraQuick Advance Rapid HIV-1/2 Antibody Test; OraSure Technologies, INC., Bethlehem, Pennsylvania, USA) was approved by US Food and Drug Administration (FDA) and it was approved for home use in 2012.[6] The widespread enlargement of home-based HIV testing in USA and new supervised self-testing imitates in sub-Saharan Africa have occurred since 2006. Oral fluid HIV testing has constituted as one of the most favorite point-of-care test (POCT).[7,8] It is likely to satisfy patents due to the rapid result, non-invasive and pain-free specimen collecton.[9-11] Nevertheless, HIV tests using oral fluid have not yet been approved for diagnostic purpose in Thailand.[12-13]

CHAPTER II

OBJECTIVE

The aim of this study was to compare the performance of oral fluid HIV test (OraQuick) with whole blood (Alere Determine HIV-1/2 Ab) and plasma (Elecsys HIV combiPT) in order to detect recent HIV infection.

CHAPTER III

LITERATURE REVIEW

3.1 What is HIV/AIDS ?[14]

HIV is human immunodeficiency virus, which is the virus that causes HIV infection. The abbreviation “HIV” can refer to the virus or to HIV infection. AIDS is the most advanced stage of HIV infection. HIV is spread through contact with the blood, semen, pre-seminal fluid, rectal fluids, vaginal fluids, or breast milk of a person with HIV. In the United States, HIV is spread mainly by having anal or vaginal sex or sharing injection drug equipment, such as needles, with a person who has HIV. Antiretroviral therapy (ART) is the use of HIV medicines to treat HIV infection. People on ART take a combination of HIV medicines (called an HIV regimen) every day. ART is recommended for everyone who has HIV. ART can’t cure HIV infection, but HIV medicines help people with HIV live longer, healthier lives. HIV medicines can also reduce the risk of HIV transmission.

3.2 HIV transmission

HIV is spread through contact with certain body fluids from a person with HIV. These body fluids including; blood, semen, Pre-seminal fluid, vaginal fluids, rectal fluids and breast milk. The spread of HIV from a woman with HIV to her child during pregnancy, childbirth, or breastfeeding is called mother-to-child transmission of HIV. Mother-to-child transmission is the most common way that children get HIV. HIV medicines, given to women with HIV during pregnancy and childbirth and to their babies after birth, reduce the risk of mother-to-child transmission of HIV.

In Thailand, HIV is spread mainly by:

Having anal or vaginal sex with someone who has HIV without using a condom or taking medicines to prevent or treat HIV

Sharing injection drug equipment such as needles, with someone who has HIV.

To reduce your risk of HIV infection, use condoms correctly every time you have sex, limit your number of sexual partners, and never share injection drug equipment. Also talk to your health care provider about pre-exposure prophylaxis (PrEP). PrEP is an HIV prevention option for people who don’t have HIV but who are at high risk of becoming infected with HIV. PrEP involves taking a specific HIV medicine every day.

3.3. Treatment for HIV[14]

Antiretroviral therapy (ART) is the use of HIV medicines to treat HIV infection. People on ART take a combination of HIV medicines (called an HIV regimen) every day. (HIV medicines are often called antiretrovirals or ARVs.) ART is recommended for everyone who has HIV. ART prevents HIV from multiplying and reduces the amount of HIV in the body (also called the viral load). Having less HIV in the body protects the immune system and prevents HIV infection from advancing to AIDS. ART can't cure HIV, but HIV medicines help people with HIV live longer, healthier lives. ART also reduces the risk of HIV transmission. A main goal of ART is to reduce a person's viral load to an undetectable level.

An undetectable viral load means that the level of HIV in the blood is too low to be detected by a viral load test. People with HIV who maintain an undetectable viral load have effectively no risk of transmitting HIV to their HIV-negative partner through sex.

3.4. The HIV Life Cycle[14]

HIV gradually destroys the immune system by attacking and killing a type of white blood cell called a CD4 cell. CD4 cells play a major role in protecting the body from infection.

HIV uses the machinery of the CD4 cells to multiply (make copies of itself) and spread throughout the body. This process, which is carried out in seven steps or stages, is called the HIV life cycle. HIV medicines protect the immune system by blocking HIV at different stages of the HIV life cycle.

Antiretroviral therapy or ART is the use of HIV medicines to treat HIV infection. People on ART take a combination of HIV medicines from at least two different HIV drug classes every day. Because each class of drugs is designed to target a specific step in the HIV life cycle, ART is very effective at preventing HIV from multiplying. ART also reduces the risk of HIV drug resistance.

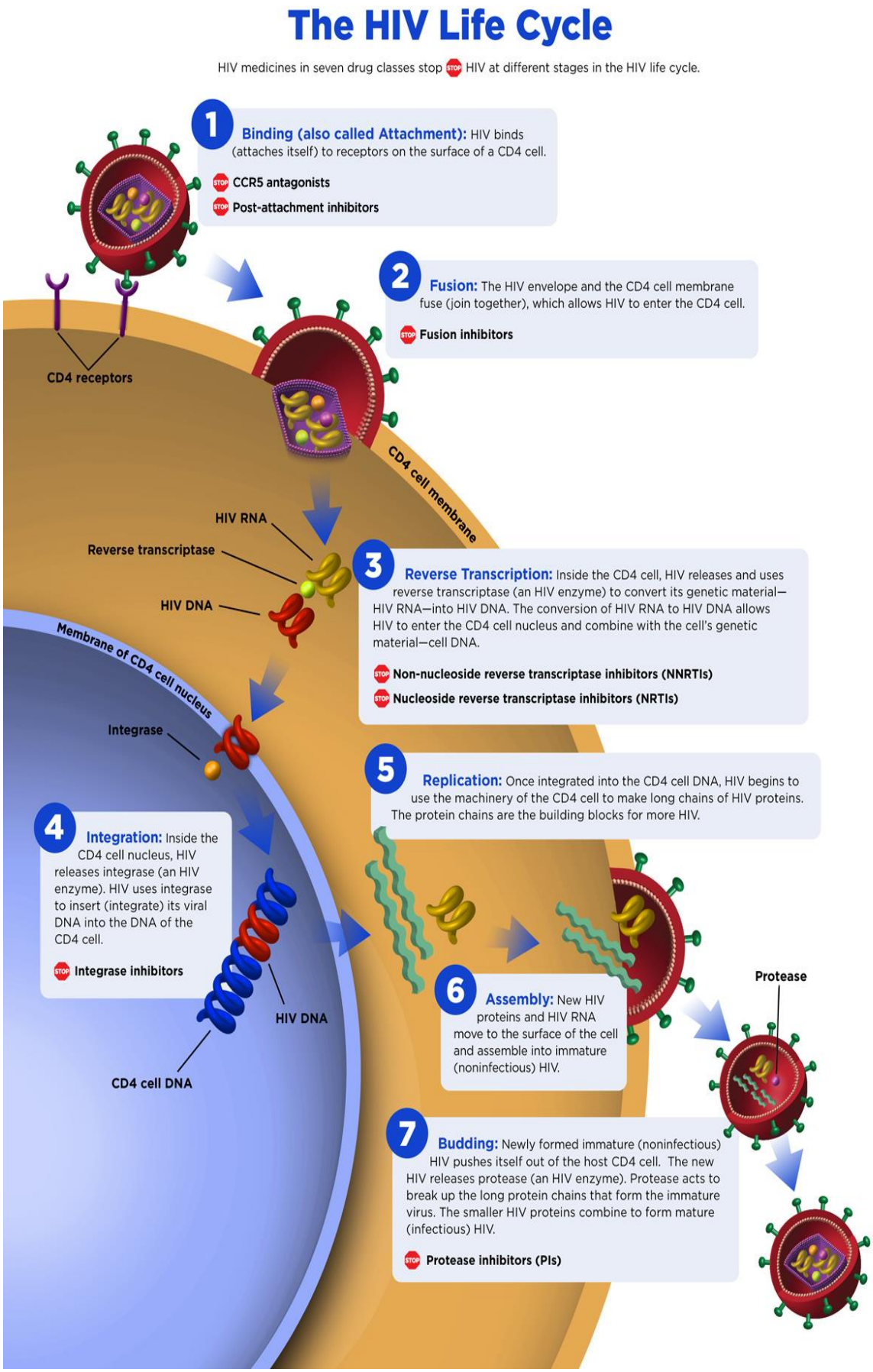
ART can't cure HIV, but HIV medicines help people with HIV live longer, healthier lives. ART also reduces the risk of HIV transmission (the spread of HIV to others).

The seven stages of the HIV life cycle

The seven stages of the HIV life cycle are: 1) binding
2) Fusion
3) Reverse transcription
4) Integration,
5) Replication
6) Assembly
7) Budding.

To understand each stage in the HIV life cycle, see figure 1.

Figure 1. The HIV Life cycle
(https://aidsinfo.nih.gov/images/factsheet/TheLifecycle.jpg)



3.5. The Stages of HIV Infection

There are three stages of HIV infection:

3.5.1. Acute HIV Infection

Acute HIV infection is the earliest stage of HIV infection, and it generally develops within 2 to 4 weeks after infection with HIV. During this time, some people have flu-like symptoms, such as fever, headache, and rash. In the acute stage of infection, HIV multiplies rapidly and spreads throughout the body. The virus attacks and destroys the infection-fighting CD4 cells of the immune system. During the acute HIV infection stage, the level of HIV in the blood is very high, which greatly increases the risk of HIV transmission.

3.5.2. Chronic HIV Infection

The second stage of HIV infection is chronic HIV infection (also called asymptomatic HIV infection or clinical latency). During this stage of the disease, HIV continues to multiply in the body but at very low levels. People with chronic HIV infection may not have any HIV-related symptoms, but they can still spread HIV to others. Without treatment with HIV medicines, chronic HIV infection usually advances to AIDS in 10 years or longer, though in some people it may advance faster.

3.5.3. AIDS

AIDS is the final, most severe stage of HIV infection. Because HIV has severely damaged the immune system, the body can't fight off opportunistic infections. (Opportunistic infections are infections and infection-related cancers that occur more frequently or are more severe in people with weakened immune systems than in people with healthy immune systems.) People with HIV are diagnosed with AIDS if they have a CD4 count of less than 200 cells/mm^3 or if they have certain opportunistic infections. Without treatment, people with AIDS typically survive about 3 years.

3.5.4. A latent HIV reservoir

HIV infects immune system cells in the body and uses the cells' machinery to make copies of itself. These infected cells can go into a resting state and stop producing HIV. A group of infected cells that are not actively producing HIV is called a latent HIV reservoir.

Latent HIV reservoirs can wake up and start making more HIV. If someone with HIV is not taking HIV medicines when this happens, the level of HIV in their body (called the viral load) will start to increase.

Latent HIV reservoirs can be found in many places throughout the body, and HIV can hide out for years inside reservoirs.

3.5.5. HIV testing

HIV testing shows whether a person has HIV. HIV stands for human immunodeficiency virus. HIV is the virus that causes AIDS. Knowing your HIV status can help keep yourself and others for safe.

The Centers for Disease Control and Prevention (CDC) recommends that everyone 13 to 64 years old get tested for HIV at least once as part of routine health care. As a general rule, people at high risk for HIV infection should get tested each year. Sexually active gay and bisexual men may benefit from getting tested more often, such as every 3 to 6 months.

Factors that increase the risk of HIV infection include:

- Having vaginal or anal sex with someone who is HIV positive or whose HIV status you don't know
- Injecting drugs and sharing needles, syringes, or other drug equipment with others
- Exchanging sex for money or drugs
- Having a sexually transmitted disease (STD), such as syphilis
- Having hepatitis or tuberculosis (TB)
- Having sex with anyone who has any of the HIV risk factors listed above

3.5.6. HIV tests

There are three types of tests used to diagnose HIV infection: antibody tests, antigen/antibody tests, and nucleic acid tests (NATs). How soon each test can detect HIV infection differs, because each test has a different window period. The window period is the time between when a person gets HIV and when a test can accurately detect HIV infection.

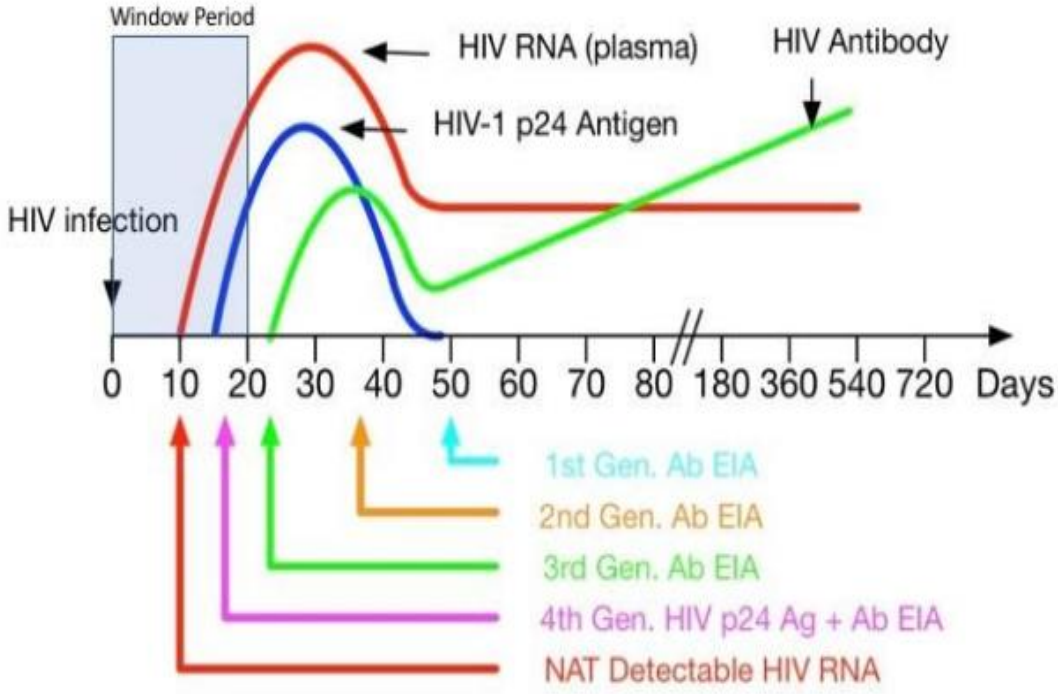
- **Antibody tests** check for HIV antibodies in blood or oral fluid. HIV antibodies are disease-fighting proteins that the body produces in response to HIV infection. Most rapid tests and home use tests are antibody tests.
- **Antigen/antibody tests** can detect both HIV antibodies and HIV antigens (a part of the virus) in blood.
- **NATs** look for HIV in the blood.

A person's initial HIV test will usually be either an antibody test or an antigen/antibody test. NATs are very expensive and not routinely used for HIV screening unless the person had a high-risk exposure or a possible exposure with early symptoms of HIV infection.

When an HIV test is positive, a follow-up test will be conducted. Sometimes people will need to visit a health care provider to take a follow-up test. Other times the follow-up test may be performed in a lab using the same blood sample that was provided for the first test. A positive follow-up test confirms that a person has HIV. Time course of HIV Detection following infection see Figure 2 and the evaluation of HIV testing see Figure 3.

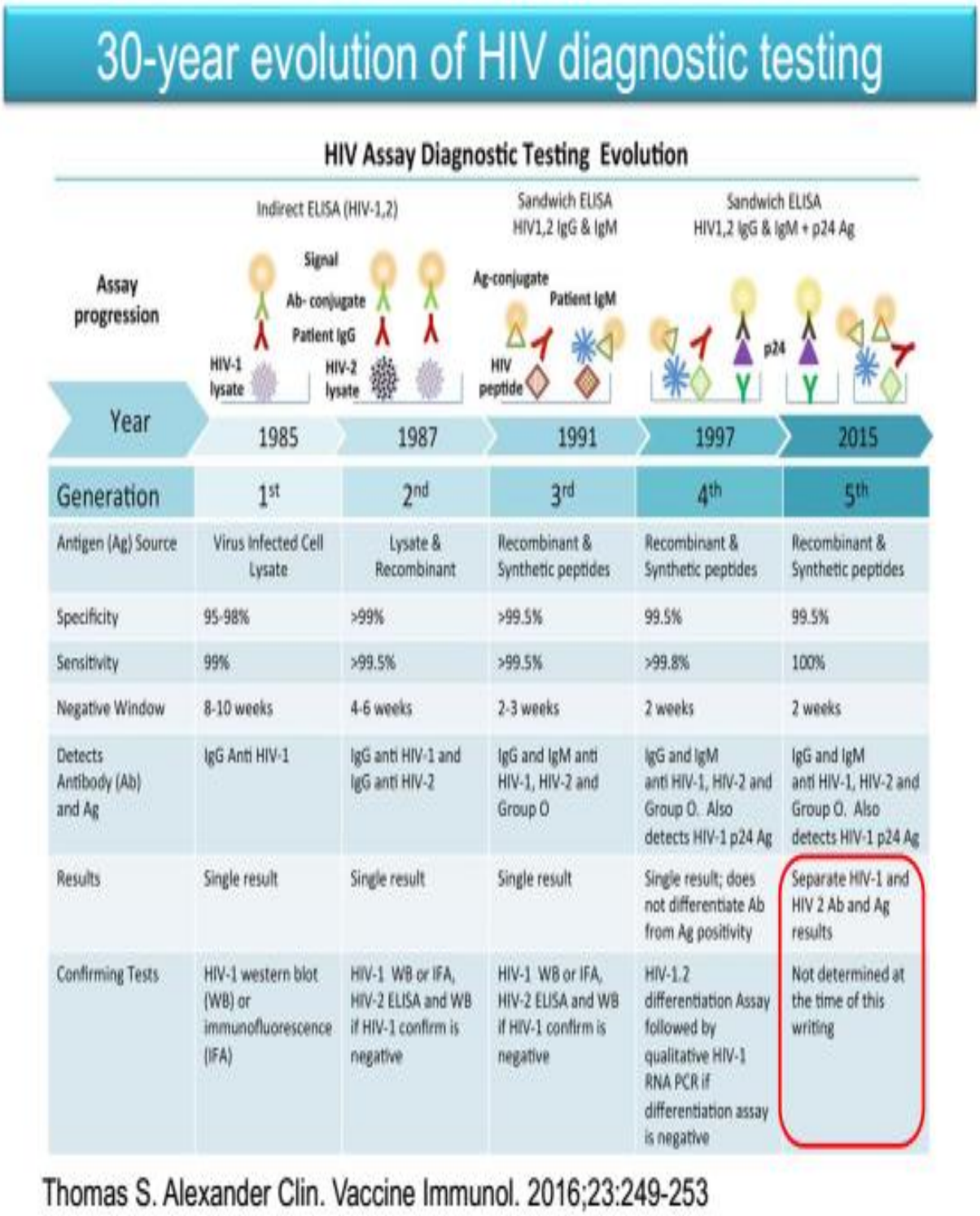
An estimated 1.1 million people in the United States are living with HIV, including about 162,500 people who are unaware of their status. Approximately 40% of new HIV infections are transmitted by people who are living with undiagnosed HIV. For those who are living with undiagnosed HIV, testing is the first step in maintaining a healthy life and reducing the spread of HIV.

Figure 2. Time course of HIV Detection following infection



https://blog.ucdmc.ucdavis.edu/labbestpractice/index.php/2017/09/15/best-practices-for-hiv-12-screening-when-to-test-and-what-to-test/

Figure 3.

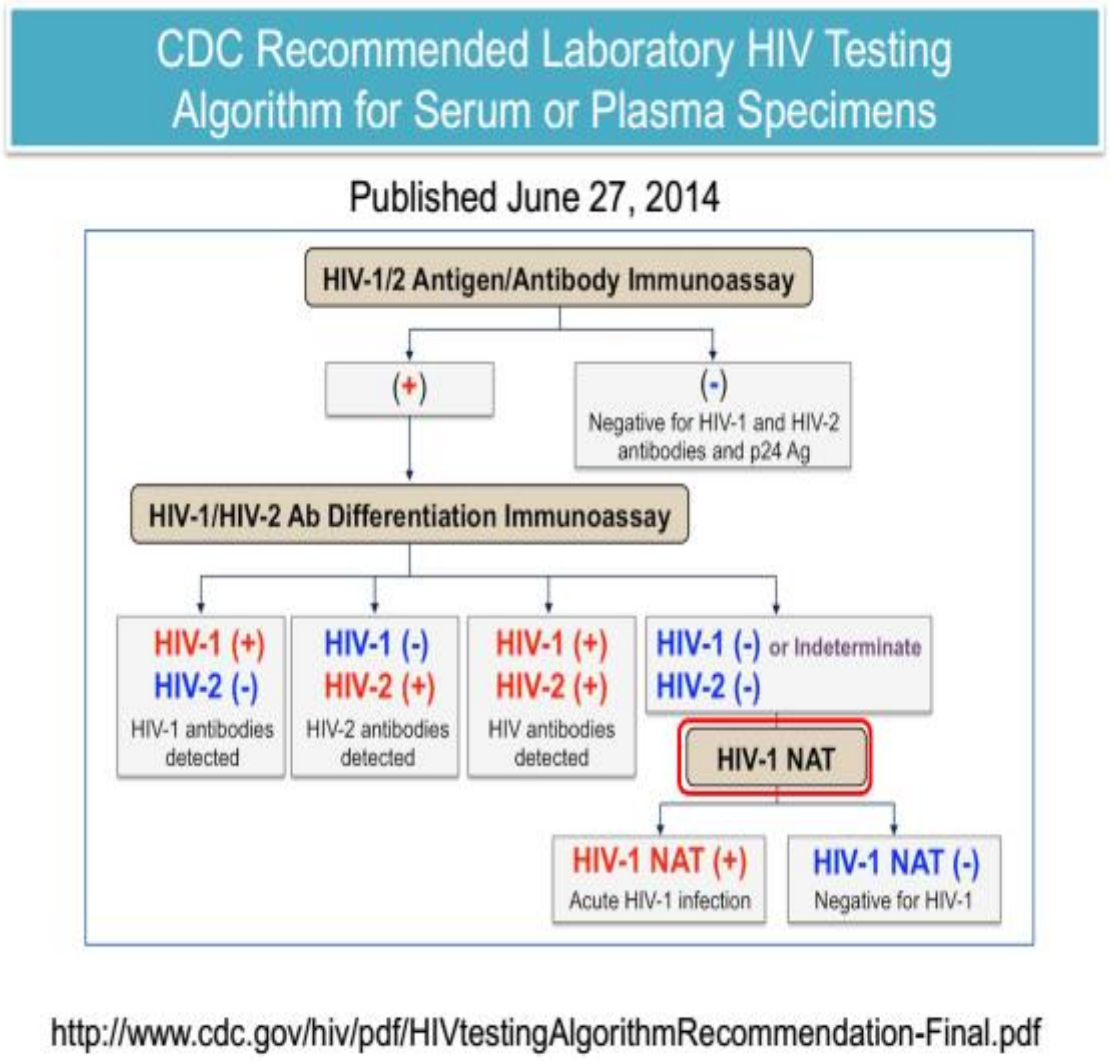


Thomas S. Alexander Clin. Vaccine Immunol. 2016;23:249-253

Update HIV testing Algorithm/strategies

- CDC Laboratory testing for the Diagnosis Of HIV infection updated Recommendation (2014) Updated 2018 (Figure 4)
  First screening with 4th generation HIV assay
- WHO New Guidelines on HIV Testing in low prevalence setting below 5% (2015) Figure 5.
- Thailand Updated Guideline on HIV Testing (2017) figure 6.

Figure 4. CDC Laboratory Testing Guidance



http://www.cdc.gov/hiv/pdf/HIVtestingAlgorithmRecommendation-Final.pdf

Figure 5.

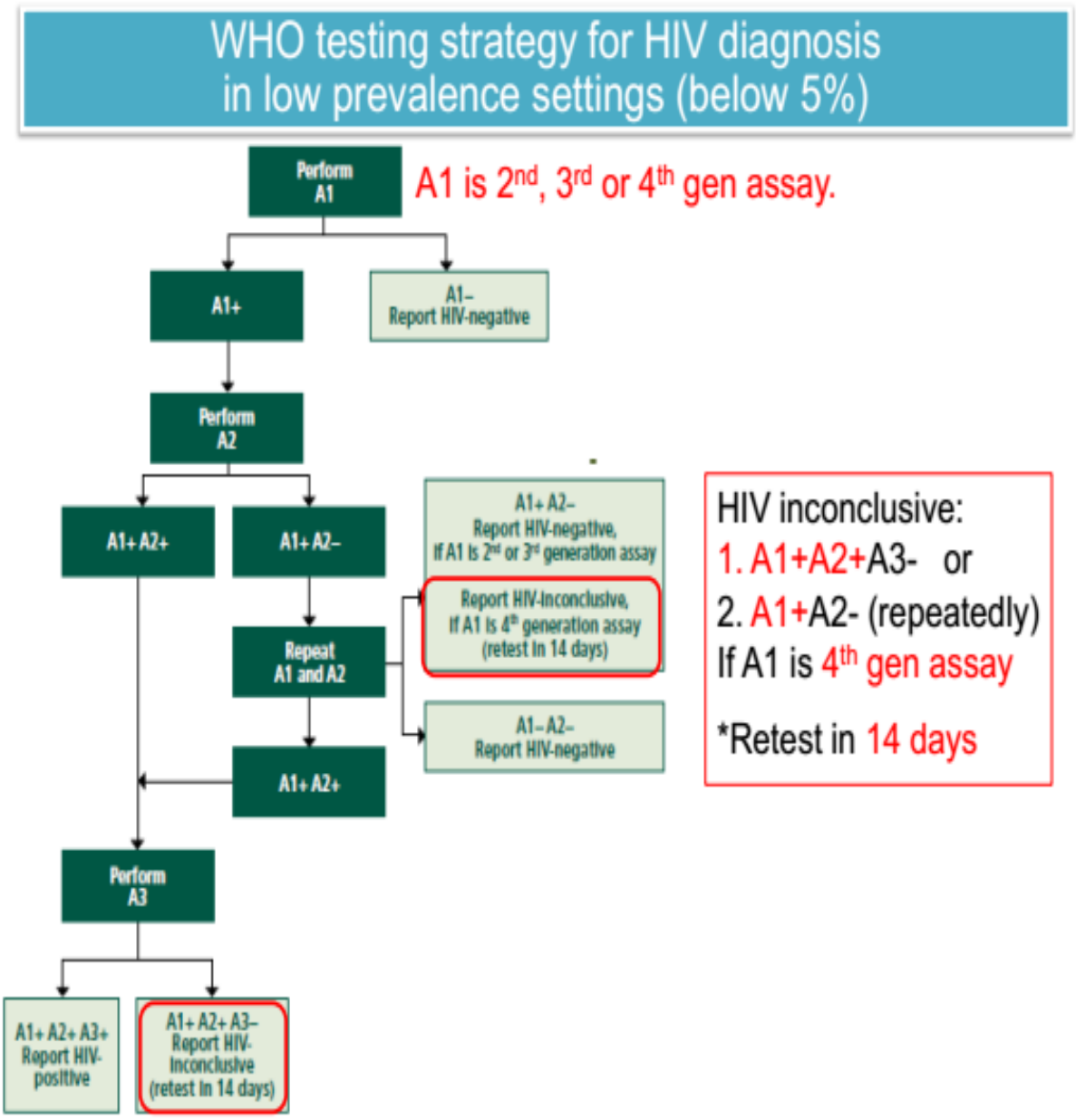
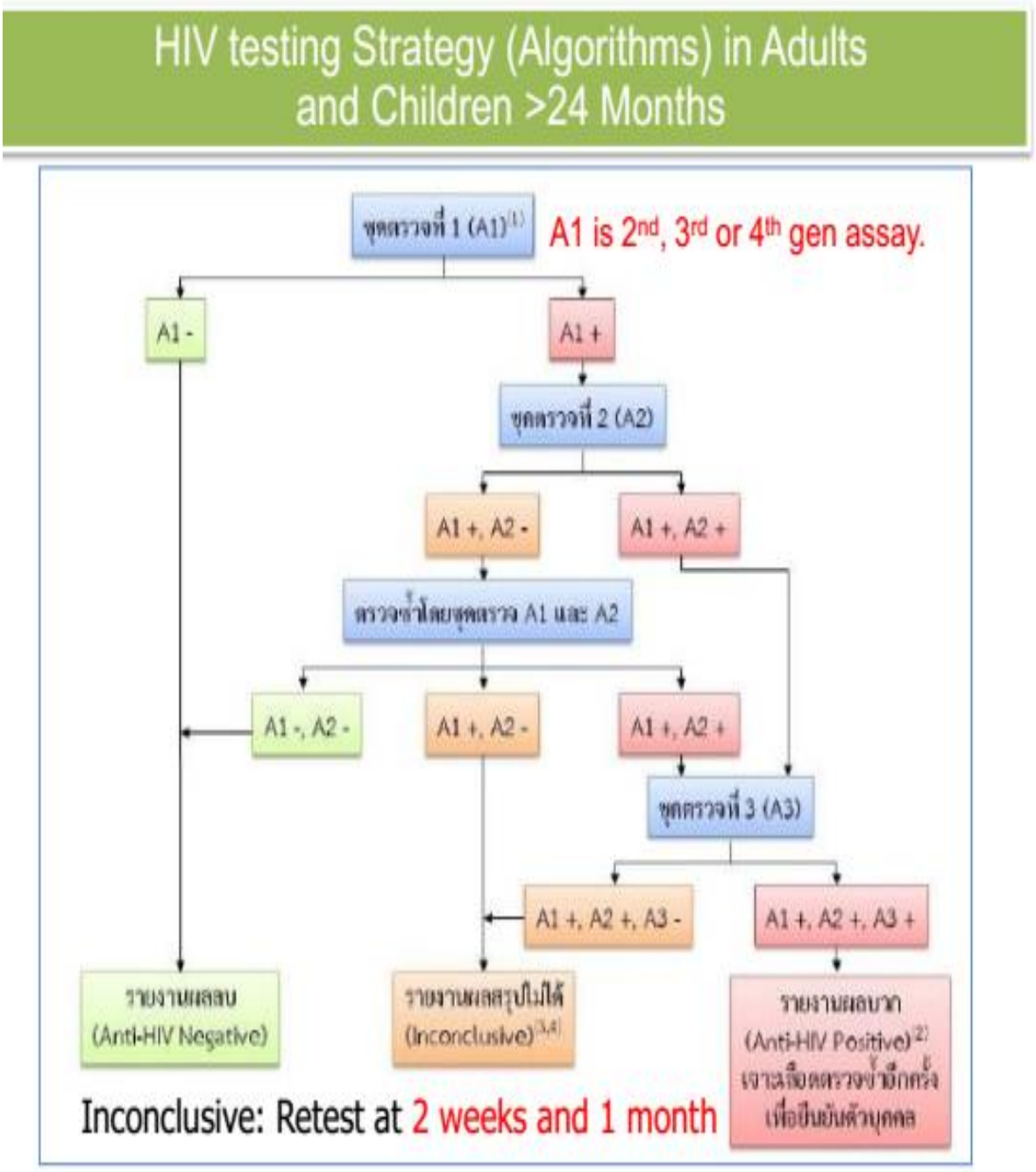

WHO testing strategy for HIV diagnosis in low prevalence settings (below 5%)
Perform A1
A1 is 2nd, 3rd or 4th gen assay.
A1+
A1–
Report HIV-negative
Perform A2
A1+ A2+
A1+ A2–
A1+ A2–
Report HIV-negative,
If A1 is 2nd or 3rd generation assay
Report HIV-Inconclusive,
If A1 is 4th generation assay
(retest in 14 days)
Repeat A1 and A2
A1– A2–
Report HIV-negative
A1+ A2+
Perform A3
A1+ A2+ A3+
Report HIV-positive
A1+ A2+ A3–
Report HIV-Inconclusive
(retest in 14 days)
HIV inconclusive:
1. A1+A2+A3- or
2. A1+A2- (repeatedly)
If A1 is 4th gen assay
*Retest in 14 days

Figure 6. Thailand Guideline



Home test

Currently there are only two home HIV tests: the Home Access HIV-1 Test System and the OraQuick In-home HIV test. If you buy your home test online make sure the HIV test is US-FDA-approved.

The **Home Access HIV-1 Test System** is a home collection kit, which involves pricking your finger to collect a blood sample, sending the sample to a licensed laboratory, and then calling in for results as early as the next business day. This test is anonymous. If the test is positive, a follow-up test is performed right away, and the results include the follow-up test. The manufacturer provides confidential counseling and referral to treatment. The tests conducted on the blood sample collected at home find infection later after infection than most lab-based tests using blood from a vein, but earlier than tests conducted with oral fluid.

The **OraQuick In-Home HIV Test** provides rapid results in the home. The testing procedure involves swabbing your mouth for an oral fluid sample and using a kit to test it. Results are available in 20 minutes. If you test positive, you will need a follow-up test. The manufacturer provides confidential counseling and referral to follow-up testing sites. Because the level of antibody in oral fluid is lower than it is in blood, oral fluid tests find infection later after exposure than do blood tests. Up to 1 in 12 infected people may test false-negative with this test.

HIV testing can be done in a variety of nonclinical or community-based settings, as well as outreach sites, or in a person's home. Nonclinical settings are easy to access and useful for people who might not be willing or able to access medical services regularly. Nonclinical settings typically provide same-day rapid HIV testing and might offer other HIV prevention services. They may also do outreach and recruitment to get high-risk populations in for HIV testing. Offering HIV testing in these settings is an effective way to bring HIV testing to the community. This section provides key references and information for persons conducting HIV testing in nonclinical settings.

CDC Guidance on HIV Testing in Nonclinical Settings

CDC issued program guidance for HIV testing providers called *Implementing HIV Testing in Nonclinical Settings: A Guide for HIV Testing Providers.* This guide supports the implementation of HIV testing services in nonclinical settings in the United States. The purpose of the guide is to familiarize providers with key programmatic issues that impact delivery of HIV testing services in nonclinical settings. Although this guidance is intended for CDC-funded nonclinical HIV testing providers, non-grantees may also find the content useful.

OraQuick have not yet been approved for diagnostic purpose in Thailand.

Figure 7. Structure of OraQuick test kit

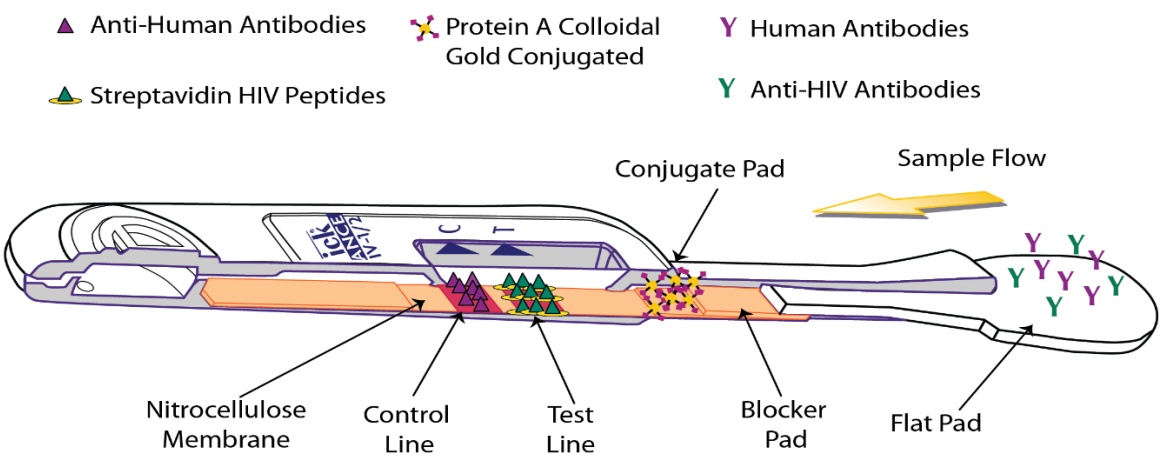
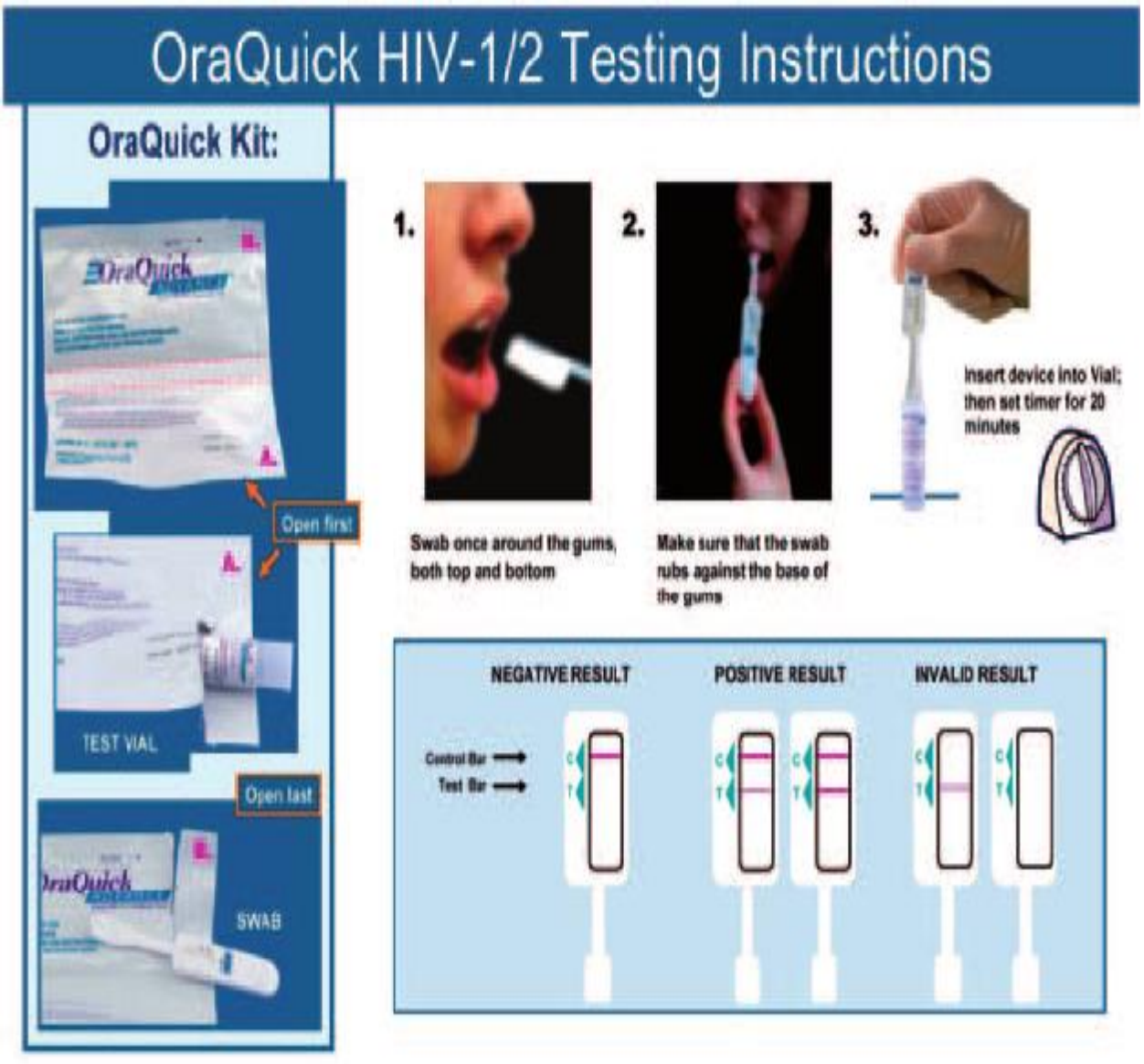


Figure 8. OraQuick HIV-1/2 Testing Instructions



Thailand National Operational Plan Accelerating Ending AIDS[15]

Thailand has been successful in preventing and controlling the HIV/AIDS epidemic during the previous 3 decades. Its HIV/AIDS success stories are acknowledged worldwide, for instance, 100 percent condom use promotion, prevention of mother to child transmission of HIV, expansion of anti-retroviral treatment coverage, HIV vaccine research, effective partnerships with civil society organizations and PLHIV networks for improvement of HIV/ AIDS care and treatment services.

At present, new HIV infections and AIDS deaths have greatly decreased compared to the situation earlier. However, HIV/AIDS is still a challenge for public health and social security, in Thailand and in the whole world. In 2014, the estimated PLHIV cases are 446,154 cases. Out of this estimated figure, 438,629 cases are adults and 7,525 cases are children aged less than 15 years. The estimated new adult HIV infection cases are 7,695 cases and 104 cases of the new children HIV infections annually or in total about 22 new HIV infection cases per day. These infections are entirely preventable and we have the means and knowledge to reduce these to negligible levels. It is our duty to ensure that we continue to provide a focused, effective and equitable response, not only to control but to end AIDS epidemics.

During the UN assembly in 2011, world leaders made a promise to the prevention and control of HIV and were committed in getting to 3 zeroes:

1) Zero new HIV infections;
2) Zero deaths from AIDS; and
3) Zero stigma and discrimination.

The challenging goal was set to cut by half new HIV infections by 2015 which would lead to the success of ending AIDS epidemic by 2030. Abiding by this promise, Thailand was committed itself to ending the AIDS epidemic by 2030. The goal is that vertical transmission should be virtually zero; the number of new HIV infections among adults should be fewer than 1,000 cases per year; all people living with HIV have access to ART services; and there is no stigma and discrimination against people living with HIV and key populations (KPs).

At the National AIDS Committee meeting conducted on November 28, 2014, Ending AIDS was set as a national target and all organizations at the central, regional and local levels share responsibility for meeting this goal. In order to support the implementation of the Ending AIDS Policy, the health and community service system will be strengthened by integration of treatment and prevention services using the approach of Reach, Recruit, Test, Treat, and Retain (RRTTR) among key populations.

Reach-Recruit-Test-Treat-Retain

Given very high reported rates of ‘last time’ condom use and sterile injecting during the last five years, there are concerns that a saturation point may have been reached for behavioral interventions in Thailand. Specially, while the proportions among KPs who report safe behaviors are high, the rates of HIV counseling and testing (HCT) are typically low. Despite HCT being provided as part of universal health coverage to all Thai nationals, uptake is poor. In addition to saturation levels being achieved in behavioral change, and limited HCT, Thailand needs to address transmission among sero-discordant couples (over a third of new infections are estimated in this population). Targeted provision of HCT to this population in and out of PMTCT settings, and the provision of early ART to the infected partner will be fundamental to controlling transmission in this group.

In order to action this, there is a realization that one needs to move beyond the provision of health 'hard-ware' and information, to actual service provision by taking a more active and case-finding approach, with adequate linkages to treatment initiation and retention. Thailand now needs to introduce a new form of 'combination prevention', with a strong focus on community led approaches to identify the most at risk KPs (such as younger MSM). Innovation in outreach service delivery models and demand creation for HCT, with tight linkages into early initiation of ART and adherence support are also vital.

Acknowledging the need for targeting at both the population and geographical level, this plan uses a five-pronged strategic approach focused on **reachin**g high risk populations, **recruiting** those at highest risk into prevention, care, and treatment services; **testing** those at risk; **treating** all those found positive regardless of CD4 levels; and **retainin**g both negative and positive KPs in the prevention, care, and treatment continuum. The Reach-Recruit-Test-Treat- Retain (RRTTR) approach to HIV diagnosis and treatment is in line with the WHO endorsed approach to HIV diagnosis and treatment using a cascade approach. The RRTTR approach also has direct relevance to the control of TB in Thailand, as early detection and universal quality treatment of co-infected patients will contribute to decreased incidence of TB. On the basis of this analysis Thailand has revised its current ART guidelines to ensure ART for all HIV patients irrespective of CD4 cell count. Reaching Key gaps in reaching: Thailand has had a large outreach programme which has successfully reached out to KPs in community settings to provide information and health 'hardware'. Condoms and IEC materials have been successfully provided at a large scale as part of these outreach efforts. However, the focus on promotion of HIV testing was limited. Outreach activities also focused on face to face communication only, and were not designed to use the many opportunities offered by social media and mobile phone technology.

Reaching

Key gaps in reaching: Thailand has had a large outreach programme which has successfully reached out to KPs in community settings to provide information and health 'hardware'. Condoms and IEC materials have been successfully provided at a large scale as part of these outreach efforts. However, the focus on promotion of HIV testing was limited. Outreach activities also focused on face to face communication only, and were not designed to use the many opportunities offered by social media and mobile phone technology

Outcomes: increased risk perception; consistently use of condoms; safe injection; increased knowledge about the importance of testing, the benefit of ART and STI screening and case management; increases in intention to HCT; increased knowledge about service availability

Core principles: Reaching KP at higher risk in priority sites to create demand for HCT and STI services

Key innovations: Scaling up reaching KPs through their social networks and use social media including websites, group as well as individual electronic communication. Create pharmacy network as the outlet for HIV information and where to get the HCT services.

Recruiting

Key gaps in recruitment: Even though all Thai citizens are eligible for free HTC, STIs and opioid substitution therapy (OST) services, the inconvenience and KPs-unfriendly services are main barriers for KPs to be recruited for services. Fear of positive results also brings about the reluctant of KPs to seek for the services.

Outcomes: increased recruitment of target populations to needed services; including pre-HIV test counselling, or STI screening, diagnosis and treatment; or OST

Core principles: Recruitment at scale into pre HIV-test counseling, STI, OST at scale by focusing in priority provinces and KPs.

Key innovations: Branding of services; peer- driven intervention using incentive schemes and Respondent Driven Sampling (RDS) to target those at highest risk; integration of the private sector; online appointment services, QR-code based membership cards.

Testing

Key gaps in testing: Services are available only at the facility level; perception of stigma and discrimination; lack of widespread availability of same-day result testing services; limited numbers of KP friendly service sites. Core principles: Under the testing approach efforts will focus on early diagnosis, regular testing, and decentralized same day result testing. HCT services will be expanded to include strengthened hotline-based pre-test counseling; mobile testing (intensified in target provinces but periodically in other provinces in an effort to normalize testing among the population at large); and expanding access through making testing available within communities through private and CBO sites (community-based HCT); and home testing (operational research in Bangkok). Testing sites that meet established standards will be branded and provider initiated counseling and testing will be strengthened within TB and STI services. Within enclosed settings, pre- and post-test counseling along with self-administered (but supervised) oral testing will be introduced (pilot in selected prisons).Couples counseling to reach partners of KPs will be strengthened through training of counselors on discussing disclosure and ways of encouraging clients to bring in their partners. In addition, efforts will be made to assure pre-test counseling is appropriate for KPs in terms of addressing special issues the first time they are tested but then tailoring this component of the testing process for those who are re-testing in order tailor messages and content more efficiently. To achieve this new guidelines and SOPs will be developed to assure that counseling is appropriate and that new service sites- private clinics and NGO-sector sites- are able to meet the established standards.

Outcomes: Increased HIV (re-) testing coverage, knowledge of sero-status among KPs, and early diagnosis, and also referred for treatment

Core principles: Increased availability at the community level, scale up of same day testing results, and KP friendly services.

Key innovations under testing: Same day rapid testing at the community level through CBOs and mobile sites and within health care facilities; hotline pre-test counselling; operational research on home-based testing; branding of high quality, KP-friendly services.

The Bureau of AIDS TB and STIs will work with hospitals to promote ‘same day result’ HIV testing. This is to reduce attrition and improve patient convenience. As part of Thailand’s End AIDS Strategy, it is planned that HTC with same day results will be further decentralized - to ensure that diagnosis can be achieved at the sub-district level. The recent evolution to include HCT in drop in centers (DIC) run by peers has been successful in increasing testing, but more needs to be done. Traditionally provided by CBOs, these groups have the experience and relationship with KPs to reach them with prevention messages and information on service delivery; they are trusted and the provision of HCT services by these groups has reduced barriers often faced within government sector facilities where concerns over stigma and discrimination and perceptions around service quality and confidentiality are barriers often reported by KPs.

Communication services will focus on the importance of early testing within one month of a likely exposure and promoting retention within the system regardless of test results. SMS messages and incentive programs will be put into place to encourage retention in the recruit, test, treat and retain continuum. This will involve encouraging KPs to retest every six months and refer them to CBO supported recruitment services, and referring positive people to ART services and support services provided at the community level.

Within government facilities, holistic care centers will be strengthened and consideration will be given to patient flows so that clients who are informed about testing services within primary health care services are not lost when moving to different department or service areas to receive an HIV antibody test.

Across the government and NGO/CBO sector a joint referral system will be developed including guidelines, tools, and training in order to assure that the system is able to refer clients who are tested at the community level through peer-led interventions and mobile sites can access health care services and for HIV counselors within health care facilities can refer KP who test positive to support services, and those who do not test positive to sites where they can access additional information and receive peer-led support in order to stay negative. This joint referral system will incorporate TB services in order to assure all HIV positive clients are tested for TB. Through the process decentralizing testing, quality assurance and a functional referral system services can then be branded and recruitment efforts can promote service efforts by assuring that HCT services are user friendly, of high quality and meet their needs.

Treating

Key gaps in treatment: lack of knowledge about the effectiveness of ART and fears of costs associated with the treatment of opportunistic infections and laboratory tests; reliance on facility based treatment which may be inconvenient for clients; late uptake which compromises treatment efficacy. Core principles: Under the treating approach efforts will focus on early ART initiation, access to treatment for KPs, and task shifting.

Outcomes: Higher CD4 at entry into care and early ART initiation among KPs

Core principles: early ART initiation, task sharing and decentralized treatment services for KP-friendly services

Key innovations under treatment: Task sharing to decentralize ART to sub districts; Introduction of CD4 at point of service; integration of HIV into TB/HIV and Hepatitis C services; collaboration across insurance schemes to cover treatment costs

Retaining

Key gaps in retention: Limited use of new technologies and approaches to encourage treatment adherence; weak linkages at the community level for follow up; reliance on facility-based services which may be inconvenient for clients; lack of follow up for HIV negative KPs.

Outcomes: Viral load suppression, higher retention rates within treatment services, higher levels of re-testing for negative KPs

Core principles: case management at the community level; innovations to promote adherence, retention of negative and positive KPs in the HIV cascade

Key innovations under retention: Leveraging mobile technologies to remind individuals to be re-tested, and for those who are positive, to adhere to their treatment; treatment literacy at scale though

a network of trained providers within health care facilities and within the community; case management at the community level.

Priority Populations Key populations (KPs) and their partners targeted in this Operational Plan include Thai and non-Thais:

• MSM and transgender people (including ≥18 years of age, who are in and out of school as well);
• Male, female and TG sex workers (venue and non-venue based sex workers; explicit and non-explicit sex workers);
• People who inject drugs (PWID; including MSM/TG/sex workers/prisoners);
• Prisoners and youth in detention centers (including MSM/TG/sex workers/PWID);
• Partners of People living with HIV infection (PLHI) and KPs, and
• High risk migrants, particularly those in professions that make them more likely to practice risky behaviors (such as those working in fisheries, sea food processing).

Interventions will be tailored for these populations, and different approaches as well as service delivery packages for each KP will be delivered at the required intensity and coverage.

Previous study of OraQuick performance

Studies from Connell[18]**,** Choko[19] and Mavedzenge[20] found that non-reactive results of oral fluid test in participants taking antiretroviral drugs were found to be HIV-positive afterward**.** Stekler and colleagues showed the accuracy of oral fluid HIV tests among Seattle men who have sex with men less than HIV tests in serum and whole blood[21]. A study in PWID from Thailand has indicated that oral fluid test in participants who received pre-exposure prophylaxis took longer to develop the reactive result. Then blood-based HIV tests might thus be more appropriate.[22] Recently, the manufacturer of OraQuick Advance Rapid HIV-1/2 antibody Test improved the quality of product, then performance of OraQuick should be approved in high risk populations.

90-90-90: AN AMBITIOUS TREATMENT TARGET TO HELP END THE AIDS EPIDEMIC[2]

Ending the AIDS epidemic is more than a historic obligation to the 39 million people who have died of the disease. It also represents a momentous opportunity to lay the foundation for a healthier, more just and equitable world for future generations. Ending the AIDS epidemic will inspire broader global health and development efforts, demonstrating what can be achieved through global solidarity, evidence-based action and multisectoral partnerships.

Although many strategies will be needed to close the book on the AIDS epidemic, one thing is certain. It will be impossible to end the epidemic without bringing HIV treatment to all who need it.

As the world contemplates the way forward following the 2015 deadline for the targets and commitments in the 2011 UNAIDS-Political Declaration on HIV and AIDS, a final target is needed to drive progress towards the concluding chapter of the AIDS epidemic, promote accountability and unite diverse stakeholders in a common effort. Whereas previous AIDS targets sought to achieve incremental progress in the response, the aim in the post-2015 era is nothing less than the end of the AIDS epidemic by 2030.

Powerful momentum is now building towards a new narrative on HIV treatment and a new, final, ambitious, but achievable target:

* By 2020, 90% of all people living with HIV will know their HIV status.

* By 2020, 90% of all people with diagnosed HIV infection will receive sustained antiretroviral therapy.

* By 2020, 90% of all people receiving antiretroviral therapy will have viral suppression

CHAPTER IV

MATERIALS AND METHODS

Study design: A cross-sectional study**,** was performed from January to June 2015 on AIDS ZERO Plan of Thailand at Drop in center and mobile service in Bangkok, Chon buri and Phuket province.

Participants: Criteria of included participants were

1) Thai people in high risk groups (MSM, Transgender and female sex worker (FSW)

2) age > 15 years old,

3) do not know their HIV status: never test or their last HIV test was negative

4) no antiretroviral uptake (ART, Prep and PEP) last two months because to prevent false negative results by using oral fluids.

Writing or verbal consent was given by all participants. They were received counseling before getting the HIV test in oral fluid, whole blood and EDTA plasma.

5) Volunteer for HIV testing for Oral fluids and 9 ml EDTA blood

The study on RRTTR program approved by Department of Diseases Control (DDC), Ministry of Public Health, Thailand.

HIV testing

Study procedures included one rapid HIV test for oral fluids (OraQuick Advance Rapid HIV-1/-2 antibody Test, OraSure technologies, Bethlehem, PA, USA, 5 µl) and three whole blood HIV POCTs were used. Alere Determine HIV-1/2 (Inverness Medical Japan Co., Ltd, Japan, 50 µL) was used for screening. Any HIV-reactive whole blood specimens were confirmed by using DoubleCheckGold Ultra HIV1&2 (Organics LTD., Israel, 25 µL) and SD Bioline HIV-1/2 (Standard Diagnostics, Inc. Korea, 10 µl). All EDTA plasma specimens were also tested by 4thgen EIA (Elecsys HIV Combi PT, Electrochemiluminescence Immunoassay, Roche Diagnostics GMBH, Germany, 40 µL). Any HIV-reactive plasma specimens were tested by using Alere Determine HIV-1/2, DoubleCheckGold HIV1&2 and SD Bioline. Discordant result cases were confirmed by HIV Ag EIA (Elecsys HIV Ag, Electrochemiluminescence Immunoassay, Roche Diagnostics GMBH, Germany, 40 µL) and nucleic acid amplification test (NAAT, Cobas ampliPrep/Cobas TaqMan HIV-1 test, version 2.0, Roche Molecular Systems, Inc., USA, 1,000 µL). For the participants who had discordant HIV results among three specimens, new EDTA plasma were collected within 14 days in order to identify recent infection by using HIV Ag EIA, Determine HIV-1/2 Ag/Ab Combo (Determine Combo, Alere Inc., Japan, 50 µL) and NAAT. Technical Characteristic of tests in this study show in Table 1. Quality control measurements of HIV tests were done. Medical technologists who performed OraQuick were well-trained on biological principles of the test, kit storage, specimen collection, testing, interpretation and quality control by OraSure personnel staffs. Other HIV tests were assayed together with internal quality control (IQC) panels provided by Department of Medical Sciences, Ministry of Public Health. The OraQuick and Determine Combo have not yet been approved in Thailand. Therefore, method verification is needed before use. Both test kits passed our verification with in-house panels (three known HIV status volunteers) including HIV-negative antigen/antibody, HIV-positive antigen and HIV-positive antibody.

Statistical analysis

The diagnostic performance of oral fluid and whole blood HIV rapid tests were comprised of accuracy, sensitivity, specificity, false positive (FP), false negative (FN), positive predictive value (PPV), and negative predictive value (NPV) by using MedCalc's Diagnostic test evaluation calculator (free statistical calculators).[16] McNemar's exact test was used to compare the numbers of detected HIV-infected partcipants.[17]

Table 1 Technical characteristic of HIV tests in the study

Test	Manufacturer	Specimen	Principle and HIV antigens	Turn Around Time
OraQuick Advance Rapid HIV-1/2 antibody Test	OraSure technologies, USA	Oral fluid,5 µl (crevicular fluid)	Immunochromatography HIV-1 (gp41) HIV-2 (gp36)	20-40 min
Alere Determine HIV -1/2	Inverness Medical Co.LTD., Japan	Whole blood (EDTA blood), 50 µl	Immunochromatography HIV-1 (r-gp41,p-gp41) HIV-2 (r-gp36,p-gp36)	15-60 Min
Elecsys HIV Combi PT	Roche Diagnostics GMBH, Germany	EDTA plasma, 40 µl	Electrochemiluminescence Immunoassay HIV-1 (r-gp41,p-gp41) HIV-2 (r-gp36,p-gp36) Monoclonal anti HIV p24 (mouse)	1 hr.
Supplementary test for whole blood reactive results				
DoubleCheckGold Ultra HIV1&2	Organics Ltd., Israel	EDTA blood, 25 µl	Immunochromatography HIV-1 (r-gp120,r-gp41,r-p24) HIV-2 (r-gp36)	15-25 Min
SD Bioline HIV-1/2	Standard Diagnostics, Inc. South Korea	EDTA blood, 10 µl	Immunochromatography HIV-1 (r-gp41,r-p24) HIV-2 (r-gp36)	5-20 Min
HIV-1/2 Ag/Ab POC test				
Determine HIV-1/2 Ag/Ab Combo	Determine Combo, Alere Inc.,	Whole blood (EDTA blood), 50 µl	Immunochromatography HIV-1 (r-gp41,p-gp41) HIV-2 (r-gp36,p-gp36) HIV Ag: anti HIV p24	15-60 Min
HIV Antigen assay				
Elecsys HIV Ag	Roche Diagnostics GMBH, Germany	EDTA plasma, 40 µl	Electrochemiluminescence Immunoassay Monoclonal anti HIV p24 (mouse)	1 hr.
Nucleic Acid Amplification Test (NAAT) viral load				
Cobas ampliPrep/ CobasTagman HIV-1 test, version 2.0	Roche Molecular Systems, Inc., USA	EDTA plasma, 1000 µl	Real Time PCR	5-6 hrs

r = recombinant protein, p = synthetic peptides

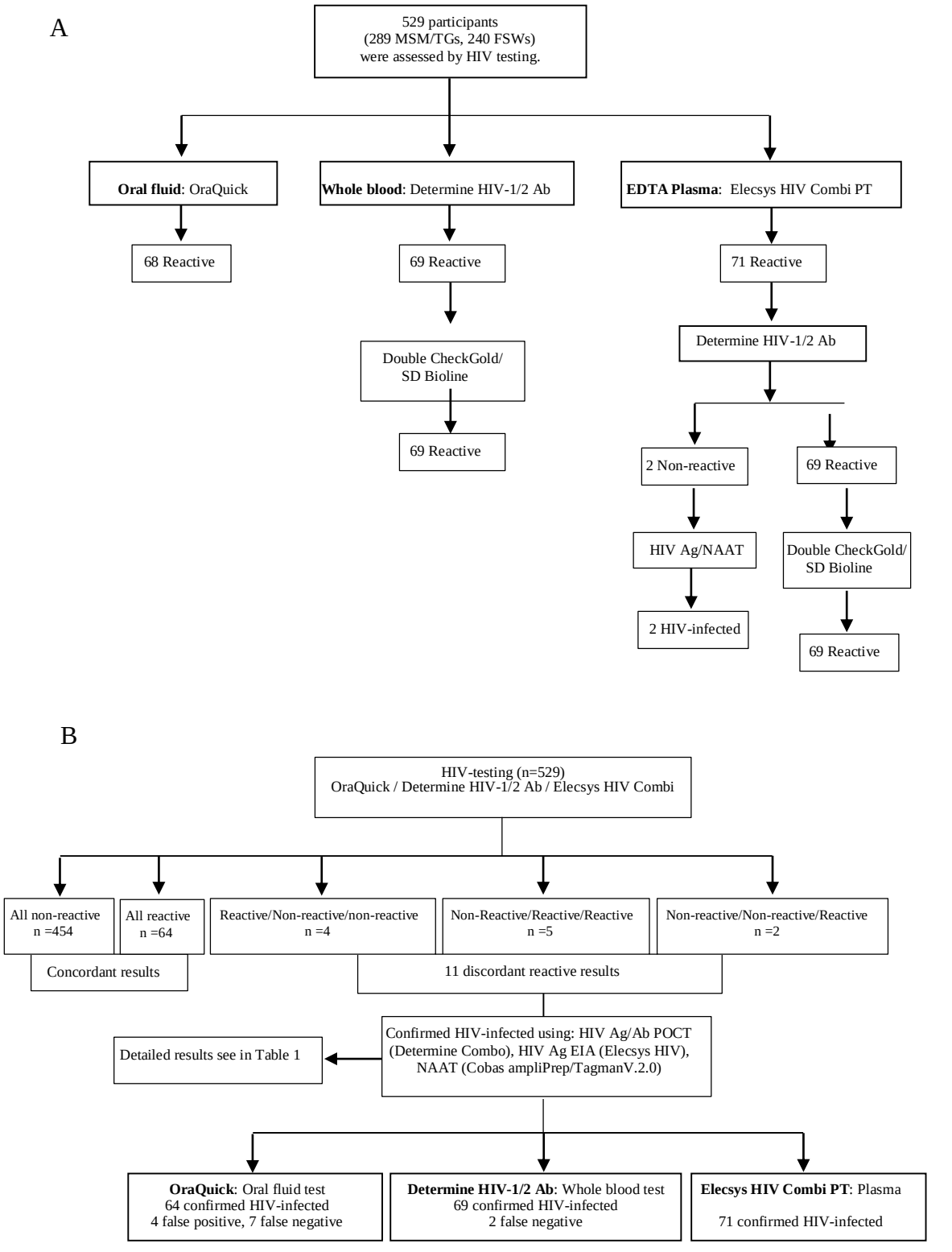


Figure 9. The algorithm and HIV testing results in this study A) The HIV results of oral fluid, whole blood and plasma-based HIV testing. B) Eleven discordant results were identified for early HIV infection.

OraQuick, OraQuick Rapid HIV-1/2 antibody test; 4th gen EIA, 4th generation Electrochemiluminescence Immunoassay - Elecsys HIV Combi PT; HIV Ag EIA, Electrochemiluminescence Immunoassay - Elecsys HIV Ag; HIV Ab POCT, HIV antibody point of care test, NAAT, Nucleic-acid amplification test - Cobas AmpliPrep/Tagman V.2.0; For screening test, Determine HIV-1/2 Ab; For supplementary tests, Double CheckGold and SD Bioline.

CHAPTER V

RESULTS

A total of 529 participants were recruited including 289 MSM/TGs and 240 FSWs. Results of OraQuick, Determine HIV-1/2 and Elecsys HIV Combi PT tests were shown in Figure 9 A. OraQuick was found to be reactive in 68 cases. Sixty-nine HIV-reactive cases by Determine HIV-1/2 had concordantly reactive results with doubleCheckGold, SD Bioline HIV-1/2 tests and Elecsys HIV Combi PT. Two participants, who were HIV- reactive with Elecsys HIV Combi PT

Concordant reactive results among three specimen types were found in 64 (12.10%) cases, whereas 11 (2.08%) cases had discordant results as shown in Figure 9 B and Table 2. Four out of 11 cases were only reactive by OraQuick (false positive), while seven cases were non-reactive (false negative). Only five participants were concordantly reactive by Determine HIV-1/2, Elecsys HIV Combi PT and NAAT. Interestingly, two participants that were non-reactive by both OraQuick and Determine HIV -1/2, were positive by Elecsys HIV Combi PT, Elecsys HIV Ag and NAAT. Overall, 71 (13.42%) HIV-infected participants were detected. There were significantly different between OraQuick compared to 4th gen EIA, Elecsys HIV Combi PT (p=0.0057) and Alere Determine HIV -1/2 (p=0.0019) (Table 2).

Performance evaluation of OraQuick and Alere Determine HIV-1/2 compared with HIV status was shown in Table 3. OraQuick sensitivity (90.14%, 95% CI 80.74-95.94) was lower than Alere Determine HIV-1/2 (96.97%, 95% CI 89.48-99.63), while Alere Determine HIV-1/2 specificity (100%, 95% CI 99.21-100.00) was slightly greater than OraQuick (99.13%, 95% CI 97.78-99.76). The PPV of OraQuick (94.12%, 95% CI 85.74-97.71) was lower than Alere Determine HIV-1/2 (100.00%) although the NPV of OraQuick (98.48%, 95% CI 96.98-99.24) and Alere Determine HIV -1/2 (99.57%, 95% CI 98.34-99.89) were comparable. Accuracy of OraQuick and Alere Determine HIV-1/2 were 97.92% (95% CI 96.31-98.96)and 99.62% 95% CI 98.64-99.95), respectively. Additionally, there were 0.87% FP and 9.86% FN with OraQuick, as well as 0% FP and 3.03% FN with Alere Determine HIV-1/2.

Table 2. Discordant results of HIV testing among participants in this study.

No.	Risk groups	POC HIV testing[a]						4th gen EIA, Elecsys HIV Combi PT	EIA, HIV Ag Elecsys HIV	HIV RNA Copies/mL
		OraQuick[b] OF	Determine WB	Double check gold WB	SD Bioline WB	Determine combo				
						Ag	Ab			
1	MSM	-	+	+	+	+	+	+	+	380,000
2	MSM/TG	-	+	+	+	+	+	+	+	474,000
3	MSM	-	+	+	+	-	+	+	+	291,000
4	MSM	-	+	+	+	-	+	+	-	49,200
5	MSM/TG[c]	-	+	+	+	-	+	+	-	29,800
6	MSM[d]	-	-	ND	ND	+	-	+	+	10,000,000
7	FSW[e]	-	-	ND	ND	-	-	+	+	117,800
8	MSM	+	-	ND	ND	-	-	-	-	ND
9	MSM/TG	+	-	ND	ND	-	-	-	-	ND
10	MSM/TG	+	-	ND	ND	-	-	-	-	ND
11	MSM	+	-	ND	ND	-	-	-	-	ND

Ag, antigen; Ab, antibody; EIA, enzyme Immunoassay; ND, Not done; MSM, men have sex with men; TG, transgender; FSW, female sex worker

[a] Oral fluid-based test: OraQuick; Whole blood-based test: Determine HIV-1/2 Ab, Double check gold, SD Bioline.

[b] Significant differences were found when compared to Elecsys HIV Combi PT (p=0.0057) and Determine HIV-1/2 Ab (p=0.0019).

[c] This participant had the history of antiretroviral drug uptake (Prep and PEP) for several times during last 60 days.

[d] This participant was acute Infection that OraQuick and Determine HIV-1/2Ab gave the non-reactive results but Determine Combo antigen was reactive.

HIV RNA was >10,000,000 copies/mL and EIA HIV Ag/Ab was reactive. After two weeks, all HIV Ab tests were reactive, while oral fluid test was still non-reactive.

[e] OraQuick and Determine HIV-1/2 Ab had the non-reactive results. HIV RNA was 117,800 copies/mL and HIV Ag/Ab EIA test was reactive. After two weeks, all HIV Ab tests were reactive, while oral fluid test was still non-reactive.

Table 3. Performance evaluations of oral fluid rapid HIV test and whole blood HIV test compared with HIV status.[a] (n=529)

Statistic	OraQuick Advance Rapid HIV-1/2 (OF) [b]	Alere Determine HIV - 1/2 (WB)
	Value (95%CI)	Value (95%CI)
Sensitivity	90.14% (80.74-95.94)	96.97% (89.48-99.63)
Specificity	99.13% (97.78-99.76)	100% (99.21-100.00)
Positive Likelihood Ratio	103.21 (38.79-274.66)	-
Negative Likelihood Ratio	0.10 (0.05-0.20)	0.03 (0.01-0.12)
Disease prevalence	13.42% (10.63-16.63)	12.48% (9.78-15.60)
Positive Predictive Value	94.12% (85.74-97.71)	100.00%
Negative Predictive Value	98.48% (96.98-99.24)	99.57% (98.34-99.89)
Accuracy	97.92% (96.31-98.96)	99.62 (98.64-99.95)
False Positive	0.87%	0%
False Negative	9.86%	3.03%

OF = Oral Fluid WB = Whole blood EIA = enzyme Immunoassay

[a] HIV status: diagnosed by physical examination and risk behavior in the past. More than two-thirds of HIV Ab tests were reactive. HIV RNA was detected by NAAT and HIV Ag tests were reactive.

[b] Oral fluid-based test

[c] Whole blood-based test

CHAPTER VI
DISCUSSION

This study demonstrated that performance (sensitivity, specificity, PPV, NPV, accuracy) of oral fluid HIV test was lower than those of whole blood HIV test. In contrast, FP and FN of HIV test with oral fluid were greater than whole blood. Oral fluid test was unable to diagnose in seven HIV-infected MSM/TG/FSWs, by which early infection was found in two cases. One of them was acute infection confirmed by HIV Ag test and NAAT (HIV RNA 10,000,000 copies/ml). However, this participant was able to be detected by rapid HIV Ag/Ab test (Determine Combo). The other participant seemed to be in window period since it could not be detected by all rapid HIV tests (Table 2). The NPV of oral fluid HIV test was 98.48%, suggesting that the non-reactive result with oral fluid was more correct in high risk populations (MSM/TG/FSW) when no recent HIV infection has occurred. Moreover, the infected participants who had several antiretroviral drug uses (Prep and PEP) for last 60 days (No. 5, Table 2) showed the false non-reactive result with oral fluid test. Similarly, the previous studies have found false-negative results in participants who had ART.[18-23] Nevertheless, non-reactive results of oral fluid test in participants taking antiretroviral drugs were found to be HIV-positive afterward.[18-20] One study has explained that antiretroviral drugs might decrease glycoprotein (gp) 41 production, which used as the target antigen to detect HIV Ab in OraQuick test.[18] In fact, the quantity of HIV Ab in oral fluids was lower than whole blood and plasma, especially who had effective antiretroviral drugs.[21] A study in PWID from Thailand has indicated that oral fluid test in participants who received pre-exposure prophylaxis took longer to develop the reactive result. Blood-based HIV tests might thus be more appropriate.[22]

The PPV of 94.12% in these high risk populations also suggested that the oral fluid HIV test was beneficial for screening because it could provide the rapid result with non-invasive handing. However, the reactive result was needed to be confirmed by other HIV tests.[24] In this study, rapid HIV testing in whole blood using Alere Determine HIV-1/2 showed the comparable performance with Elecsys HIV Combi PT (EIA). No false reactive and two false non-reactive were observed in participants who had HIV antigen positive. Antigen reactive band was detected by whole blood HIV Ag/Ab test in one case (No. 6, Table 2). Whole blood HIV Ag/Ab test would thus be suitable for rapid screening in high risk and hard accessible groups.

According to our study, the performance of oral fluid HIV test was less accurate than blood-based tests that have also been shown in several studies.[25-28] In high HIV prevalence populations, the rapid HIV testing are appropriate for enhancing epidemic HIV control in mobile setting. If possible, whole blood rapid HIV Ag/Ab test should be the first screening test since it is able to detect both HIV antigen and antibody. In addition, it is ease of use, quick turnaround time, no requirement of cold chain and specialized equipment. However, confirmation at HIV care centers is still required for rapid HIV tests. Those who have

sexual risk behavior or negative HIV test should be regularly followed up until 3 months after post-exposure. Mobile setting and decentralization of laboratory services may be useful to scale up the opportunity to detect HIV-infected population and approach them to treat with antiretroviral drugs in order to reduce transmission. Nonetheless, rapid HIV tests should be confirmatory tested by supplementary tests, e.g., HIV antigen-antibody combination assays, HIV antigen test and NAAT.[29]

CHAPTER VII

CONCLUSION

Our findings suggested that whole blood rapid HIV tests should be used for high risk populations. If non- invasive practice is required, oral fluid tests would be one of the tools of choice but window period and ART uptake must be concerned. Furthermore, rapid HIV tests should be confirmed by other HIV tests.

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