

March 2014

# HIV/AIDS Mobile Applications: An Assessment for At-Risk Populations in Thailand

Gabriel Solomon Isko  
*Worcester Polytechnic Institute*

Rachel Ilana Blakely  
*Worcester Polytechnic Institute*

Robert F. Mullins  
*Worcester Polytechnic Institute*

Victoria Rose Melchert  
*Worcester Polytechnic Institute*

Follow this and additional works at: <https://digitalcommons.wpi.edu/iqp-all>

---

## Repository Citation

Isko, G. S., Blakely, R. I., Mullins, R. F., & Melchert, V. R. (2014). *HIV/AIDS Mobile Applications: An Assessment for At-Risk Populations in Thailand*. Retrieved from <https://digitalcommons.wpi.edu/iqp-all/2245>

This Unrestricted is brought to you for free and open access by the Interactive Qualifying Projects at Digital WPI. It has been accepted for inclusion in Interactive Qualifying Projects (All Years) by an authorized administrator of Digital WPI. For more information, please contact [digitalwpi@wpi.edu](mailto:digitalwpi@wpi.edu).

# **HIV/AIDS Mobile Applications**

---



**Rachel Blakely**

**Kantamon Choekawong**

**Gabriel Isko**

**Victoria Melchert**

**Robert Mullins**

**Pantitra Sankatumvong**

# HIV/AIDS Mobile Applications: An Assessment for At-Risk Populations in Thailand

An Interactive Qualifying Project Report

Submitted to the Faculty of

Worcester Polytechnic Institute and

Chulalongkorn University

in partial fulfillment of the requirements for the

Degree of Bachelor of Science

in cooperation with

Population Services International (Thailand) Foundation

Submitted on March 7, 2014

**Submitted By:**

Rachel Blakely

Kantamon Choekawong

Gabriel Isko

Victoria Melchert

Robert Mullins

Pantitra Sankatumvong

**Submitted To:**

Mr. Sanya Umasa,  
PSI/Thailand

**Project Advisors:**

Prof. Gary Pollice, WPI

Prof. Creighton Peet, WPI

Prof. Orawon Chailapakul,  
Chulalongkorn University

Prof. Siripastr Jayanta,  
Chulalongkorn University

This report represents the work of four WPI and two Chulalongkorn University undergraduate students submitted to the faculty as evidence of completion of a degree requirement. WPI routinely publishes these reports on its website without editorial or peer review. For more information about the projects program at WPI, visit

<http://www.wpi.edu/Academics/Projects>.

## **Abstract**

There is not adequate case management and reporting of HIV/AIDS among the most at-risk populations in Thailand due in part to a lack of appropriate technology. The goal of this project was to determine the most effective mobile application or application features for HIV/AIDS management from the perspectives of the target populations, case managers, and Population Services International. We produced a framework for evaluating existing and future applications, developed a prototype application, and provided recommendations for related projects.

## Acknowledgements

Our group would like to express our sincere gratitude to the following individuals, organizations, and institutions for supporting us throughout the completion of this project:

- Population Services International (Thailand) Foundation for sponsoring this project and providing our team with vital guidance and resources.
- Mr. Sanya Umasa, Regional Program Manager at PSI, for supporting the team by dedicating a great deal of time and energy to providing information and guidance.
- Mr. David Valentine, Senior Technical Advisor at PSI, Ms. Srisuman Sartsara, CAP3D Program Manager at PSI, Mr. Supakorn Suesatsakulchai, E-Media/M-Health Manager at PSI, and other PSI staff for being welcoming and providing us with a wealth of knowledge.
- Staff from Sisters, Mplus, The HIV Foundation, SWING, The Poz, The Rainbow Sky Association, and Caremat for devoting time to share valuable information with the team and help us accomplish our research goals.
- Members of the target populations for contributing their opinions to our project.
- Professor Emmanuel Agu, WPI Computer Science professor, for providing us with application information in the early project stages and introducing us to MIT's *App Inventor 2* software.
- Our advisors, Professor Orawon Chailapakul, Professor Creighton Peet, Professor Gary Pollice, and Professor Siripastra Jayanta for guiding and assisting us through the completion of this project.
- Ms. Laura Hanlan, research librarian for the Worcester Polytechnic Institute Library, for providing us with helpful information and valuable research tools.

- Chulalongkorn University and Worcester Polytechnic Institute for providing this opportunity to both Thai and American students to work together.
- The Bachelor of Science in Applied Chemistry (BSAC) Department for providing a work space at the Chulalongkorn University campus.

## Authorship

Cover Page.....	Blakely
Title Page.....	Melchert
Abstract .....	Melchert
Acknowledgments.....	Melchert
Authorship .....	Mullins
Table of Contents.....	Melchert
Table of Figures .....	Chooekawong
Table of Tables .....	Chooekawong
Executive Summary .....	Blakely, Melchert
List of Acronyms .....	Blakely
Introduction .....	Blakely, Isko, Melchert, Mullins
Literature Review.....	All
Section 2.1.....	Blakely, Melchert
Section 2.1.1 .....	Blakely
Section 2.1.2 .....	Blakely
Section 2.1.3 .....	Melchert
Section 2.2.....	Isko, Mullins
Section 2.3.....	Isko, Mullins
Section 2.3.1 .....	Isko, Mullins
Section 2.3.2 .....	Mullins
Section 2.3.3 .....	Mullins
Section 2.3.4 .....	Mullins

Section 2.4.....	Chooekawong, Melchert, Mullins, Sankatumvong
Section 2.4.1 .....	Melchert
Section 2.4.2 .....	Melchert, Sankatumvong
Section 2.4.3 .....	Chooekawong, Melchert
Section 2.4.4 .....	Melchert
Section 2.4.5 .....	Chooekawong, Mullins
Section 2.4.6 .....	Melchert
Methodology.....	Blakely, Melchert, Mullins
Section 3.1.....	Melchert
Section 3.1.1 .....	Melchert
Section 3.1.2 .....	Melchert
Section 3.1.3 .....	Melchert
Section 3.2.....	Mullins
Section 3.2.1 .....	Mullins
Section 3.2.2 .....	Mullins
Section 3.2.3 .....	Mullins
Section 3.3.....	Blakely, Mullins
Section 3.3.1 .....	Blakely
Section 3.3.2 .....	Blakely, Mullins
Section 3.4.....	Mullins
Results and Analysis .....	Blakely, Isko, Melchert, Mullins
Section 4.1.....	Melchert
Section 4.1.1 .....	Melchert



Section 4.1.2 .....	Melchert, Mullins
Section 4.1.3 .....	Melchert
Section 4.1.4 .....	Blakely
Section 4.2.....	Mullins
Section 4.2.1 .....	Mullins
Section 4.2.2 .....	Mullins
Section 4.2.3 .....	Mullins
Section 4.2.4 .....	Mullins
Section 4.3.....	Blakely, Isko
Section 4.3.1 .....	Isko
Section 4.3.2 .....	Isko
Section 4.4.....	Isko, Mullins
Section 4.5.....	Mullins
Conclusions and Recommendations .....	Blakely
Section 5.1.....	Blakely
Section 5.2.....	Blakely
Section 5.2.1 .....	Blakely
Section 5.2.2 .....	Blakely
Section 5.2.3 .....	Blakely
References .....	Melchert
Appendices .....	All
Appendix A.....	Melchert
Appendix B .....	Mullins

Appendix C .....	Melchert, Sankatumvong
English Version.....	Melchert
Thai Version .....	Sankatumvong
Appendix D.....	Melchert, Sankatumvong
English Version.....	Melchert
Thai Version .....	Sankatumvong
Appendix E .....	All
English Version.....	All
Thai Version .....	Chooekawong
Appendix F.....	Chooekawong, Sankatumvong
Mplus.....	Sankatumvong
The HIV Foundation .....	Chooekawong
SWING.....	Sankatumvong
The Poz.....	Sankatumvong
Caremat .....	Sankatumvong
Appendix G .....	Chooekawong, Melchert, Sankatumvong
Sisters .....	Chooekawong, Sankatumvong
Mplus.....	Sankatumvong
The HIV Foundation .....	Melchert
SWING 1 .....	Sankatumvong
SWING 2.....	Chooekawong
The Poz.....	Sankatumvong
Caremat .....	Sankatumvong

Appendix H.....	Blakely, Mullins
Appendix I.....	Mullins
Appendix J.....	Isko
Appendix K.....	Blakely
Appendix L.....	Blakely
Appendix M.....	Melchert, Mullins

## Table of Contents

Abstract .....	i
Acknowledgements .....	ii
Authorship .....	iv
Table of Contents .....	ix
Table of Figures .....	xiv
Table of Tables .....	xv
Executive Summary .....	xvi
List of Acronyms .....	xix
1. Introduction.....	1
2. Background.....	4
2.1 HIV/AIDS .....	4
2.1.1 History .....	5
2.1.2 Prevention, testing, monitoring, and treatment .....	6
2.1.3 Current issues affecting HIV/AIDS management .....	8
2.2 Technology-based participatory health reporting .....	10
2.3 Mobile applications.....	12
2.3.1 Existing health care applications.....	13
2.3.2 Existing HIV/STD mobile applications.....	14
2.3.3 Important attributes of mobile applications .....	16

2.3.4	How to encourage downloads of mobile applications.....	18
2.4	Relevance in Thailand.....	20
2.4.1	History and overview of HIV/AIDS .....	21
2.4.2	Secondary effects of HIV/AIDS .....	21
2.4.3	Target populations.....	22
2.4.4	Barriers to HIV prevention, monitoring, and treatment .....	25
2.4.5	Technology usage.....	28
2.4.6	Current technology-based health reporting .....	29
3.	Methodology.....	31
3.1	Identify characteristics of the target populations.....	31
3.1.1	Archival research.....	32
3.1.2	Interviews with community-based organization leaders .....	32
3.1.3	Survey of target populations .....	33
3.2	Determine the necessary and desirable features of mobile applications .....	34
3.2.1	Archival research.....	34
3.2.2	Interviews with case managers .....	34
3.2.3	Survey of target populations .....	35
3.3	Create and use a framework for evaluating mobile applications and features.....	36
3.3.1	Quality Function Deployment.....	36
3.3.2	Multi-Attribute Utility Theory .....	40

3.4 Summary .....	42
4. Results and Analysis .....	43
4.1 Characteristics of the target populations .....	43
4.1.1 Access to the Internet and smartphones .....	43
4.1.2 Willingness to use HIV/AIDS applications .....	45
4.1.3 Opinions about applications.....	47
4.1.4 Barriers inhibiting healthy behaviors .....	49
4.2 Necessary and desirable features of mobile applications.....	55
4.2.1 Determining important features .....	55
4.2.2 Information .....	57
4.2.3 Community features .....	59
4.2.4 Communication with doctor .....	61
4.3 Assessment of mobile applications and their features .....	63
4.3.1 The current applications .....	63
4.3.2 Prototype application.....	65
4.4 Research limitations.....	67
4.5 Summary .....	67
5. Conclusions and Recommendations.....	69
5.1 Conclusions .....	69
5.2 Recommendations.....	70

5.2.1 Recommendations for PSI about choosing an application .....	70
5.2.2 Recommendations for PSI about refining the application .....	72
5.2.3 Recommendations for conducting a similar study .....	72
References .....	74
Appendices .....	78
Appendix A: Sponsor description .....	78
Appendix B: Interview of Emmanuel Agu, WPI computer science professor .....	80
Appendix C: Interview protocol with case managers.....	83
English Version .....	83
Thai Version .....	85
Appendix D: Interview protocol with community-based program leaders .....	87
English Version .....	87
Thai Version .....	89
Appendix E: Questionnaire for target populations.....	92
English Version .....	92
Thai Version .....	102
Appendix F: Case manager interview responses.....	115
Interview with case manager at Mplus.....	115
Interview with case manager at The HIV Foundation .....	118
Interview with case manager at SWING.....	124

Interview with case manager at The Poz.....	127
Interview with case manager at Caremat .....	130
Appendix G: Community-based organization leader interview responses.....	133
Interview with CBO leader at Sisters.....	133
Interview with CBO leader at Mplus .....	139
Interview with CBO leader at The HIV Foundation.....	142
Interview of CBO leader 1 at SWING .....	148
Interview of CBO leader 2 at SWING .....	152
Interview with CBO leader from The Poz.....	158
Interview with CBO leader from Caremat .....	161
Appendix H: Description of values for QFD .....	164
Appendix I: Description of features for QFD .....	167
Appendix J: Framework for assessing mobile applications using QFD and MAUT.....	169
Appendix K: Final QFD table .....	172
Appendix L: Final MAUT table .....	173
Appendix M: Summative team assessment.....	174



## Table of Figures

Figure 1: HIV replication process in five steps .....	5
Figure 2: Number of HIV-infected persons engaged in selected stages of the continuum of HIV care in the United States .....	10
Figure 3: Three screenshots of <i>Sugar</i> interface design and features.....	14
Figure 4: HIV rates among the three MAPs in Thailand .....	25
Figure 5: Internet and mobile phone usage among MAPs .....	44
Figure 6: MAPs experience with mobile health care applications .....	45
Figure 7: Types of mobile applications used by the MAPs.....	46
Figure 8: Willingness of MAPs to download a mobile application with “HIV/AIDS” in the title versus downloading the same application without “HIV/AIDS” in the title.....	47
Figure 9: MAPs use of mobile applications .....	48
Figure 10: Important general application attributes according to the MAPs .....	48
Figure 11: Knowledge and use of condoms, water-based lubricant, microbicides, Pre-Exposure Prophylaxis (PrEP), and Post-Exposure Prophylaxis (PEP) among members of the MAPS.....	50
Figure 12: Seven reasons that influence members of the MAPs to not go for HIV testing .....	52
Figure 13: Seven reasons that influence members of the MAPs to not receive HIV treatment ...	53
Figure 14: Ten HIV/AIDS application features ranked from highest to lowest by QFD scores...	56
Figure 15: Expected uses of health care mobile applications according to MAPs.....	57
Figure 16: Willingness of MAPs to talk to a doctor through an application.....	61
Figure 17: Fifteen existing mobile applications and prototype application ranked from highest to lowest by MAUT scores.....	64
Figure 18: Prototype screenshots showing homescreen (left) and CD4 tracker (right) .....	66

**Table of Tables**

Table 1: Step one of an example QFD .....37

Table 2: Step two of an example QFD .....37

Table 3: Step three of an example QFD .....38

Table 4: Step four of an example QFD .....38

Table 5: Step five of an example QFD.....39

Table 6: Step six of an example QFD .....40

Table 7: Example of MAUT using two applications and two attributes.....41

## Executive Summary

HIV/AIDS is a life-threatening condition that is prevalent in many countries and is an issue of increasing concern in Thailand among specific demographics. These most at-risk populations (MAPs) are often excluded from disease outreach programs and do not receive government support. As a result, HIV is transmitted at alarming rates among the MAPs, endangering the health of a significant number of Thai people. The specific problem that this project addresses is the inadequate case management, self-monitoring, testing, and reporting of HIV/AIDS cases among the general gay population (GGP), male sex workers (MSW), and transgender (TG) women in Thailand due in part to the lack of appropriate technology.

The goal of this project, sponsored by Population Services International (PSI), was to determine the most effective application or application features for improving HIV/AIDS management among the most at-risk populations in Thailand. To accomplish this goal we met the following objectives:

- Identify characteristics of the target populations.
- Determine necessary and desirable features of mobile applications.
- Create and use a framework for evaluating mobile applications and their features.

We interviewed 12 case managers and community-based organization (CBO) leaders and conducted a survey of the MAPs to identify their characteristics in regards to technology usage and preferences, along with HIV/AIDS knowledge and behaviors. The data revealed that members of the MAPs have sufficient access to the Internet and smartphones, even in rural areas, and especially among younger generations. Although most people were found to use mobile applications for social networking, gaming, and entertainment, the majority of people in the MAPs claimed they would be willing to use a health care mobile application. Members of the

MAPs were found to be most willing to download and use an HIV/AIDS mobile application that is entertaining and has an inconspicuous title and logo. The data collected through the interviews and survey revealed that people belonging to the MAPs do not always use prevention methods, go for routine testing, or receive treatment if they are diagnosed as HIV-positive. The primary reasons that influence this negative behavior are a lack of knowledge about risk and treatment options, along with a fear of discrimination.

To determine which features are most important in an HIV/AIDS application, we performed a Quality Function Deployment (QFD). This is an analysis tool that provided a final ranking of the applications' features based on how important they were to the stakeholders. The end result was that relevant information, a community element, and contact with a doctor would be the most valued features in an HIV/AIDS application.

Using the ranking of the features from the QFD, we performed a Multi-Attribute Utility Theory (MAUT) analysis. This method ranks the existing applications based on how well they accomplish the features. Once we performed the MAUT, we found that *HIV Connect* is the existing application that best addresses the interests of the stakeholders. We also made a prototype of an ideal HIV/AIDS application for the MAPs based on the highest-scored features based on the QFD. This prototype served as a visual example of how an ideal application should be modeled.

From these findings, we developed a set of recommendations for PSI or other parties interested in a similar product assessment to use. If PSI decides to endorse an existing HIV/AIDS mobile application for use among the MAPs, we recommend that they choose the highest-ranked application, *HIV Connect*. Although *HIV Connect* has a community feature and a doctor moderator, it lacks some necessary features such as adequate information section and a self-

monitoring feature. Therefore, we strongly recommend that PSI works with application developers to create a mobile application that contains all necessary features and most optional features to effectively manage HIV/AIDS among members of the MAPs. In order to encourage greater downloading and usage of this application, we encourage our sponsor to conduct in-depth social surveying of the MAPs to find their preferences in finalizing a design of the application interface.

PSI should also conduct a usability study in which members of the MAPs test the mobile application that they helped to develop. This will give PSI vital feedback about what people did and did not like about the application and to make sure that the application accomplishes its intended purpose. After PSI takes into account feedback from the MAPs and modifies the application to incorporate all changes, our sponsor should effectively market the application. We found that by choosing a discreet name and logo for the application or by including the HIV-related features in a general-purpose health care application, more people might be inclined to use and download it. We also recommend that PSI finds a way to target older generations in the MAPs due to their decreased familiarity and use of many forms of technology. Modifying the existing approach or finding a new method for reaching this group can result in a greater positive impact on the health of this older, at-risk population.

Our final recommendation is that parties conducting a similar study involving the evaluation of mobile applications, assessing other types of technology, or developing a product should use our framework involving the two decision-analysis tools. We hope our recommendations will help PSI and its affiliates promote a mobile application that increases HIV/AIDS prevention, testing, and treatment adherence, reduces transmission, decreases the number of AIDS-related deaths, and lessens the stigma attached to this disease in Thailand.

## List of Acronyms

AIDS	Acquired Immunodeficiency Syndrome
ART	Antiretroviral Therapy
CBO	Community-Based Organization
CCHT	Care Coordination/Home Telehealth
CDC	Centers for Disease Control
GGP	General Gay Population
HIV	Human Immunodeficiency Virus
MAP	Most At-Risk Population
MAUT	Multi-Attribute Utility Theory
MSM	Men who have Sex with Men
MSW	Male Sex Workers
PSI	Population Services International
QFD	Quality Function Deployment
SWING	Service Workers in Group Foundation
TG	Transgender

## 1. Introduction

Human Immunodeficiency Virus (HIV) is a virus that attacks cells of the immune system, eventually causing Acquired Immunodeficiency Syndrome (AIDS). Originating in Africa in the late 1800s, the first officially recognized case of AIDS was identified by American scientists in 1981 (AIDS.gov, 2012). According to the 2013 World AIDS Day Report, 35.3 million people were living with HIV in 2012 (UNAIDS, 2013b). HIV/AIDS has a high rate of prevalence in many countries, and it is increasingly becoming an issue of concern in Thailand among specific subpopulations.

The 2012 Thailand AIDS Response Progress Report explains the measures that have already been implemented in order to improve HIV management (UNAIDS, 2012b). These measures include increasing knowledge among affected people and using various networks to communicate about the disease. Special projects developed by HIV/AIDS-focused organizations, both community-based and international, attempt to target certain affected populations. However, some at-risk people are not being provided with the services they need to encourage prevention, and there is not enough emphasis on providing care for HIV-positive individuals. The most at-risk populations (MAPs) in Thailand include transgender (TG) women (people who are born male but identify themselves as female) and men who have sex with men (MSM). Male sex workers (MSW) and the general gay population (GGP) are two different at-risk groups that exist within the MSM population. The MAPs are often not reached by the efforts from HIV/AIDS-focused organizations due to economic challenges, social discrimination, and binary gender grouping (Earth, 2006). The incidence of HIV/AIDS either remains unchanged or continues to climb among these subpopulations (AVERT, 2013). Despite a number of community-based programs in place for the MAPs, there are few approaches utilizing modern

communication technologies currently being implemented to successfully lessen the impact of HIV/AIDS in Thailand.

Current research in the field of participatory health care focuses on technology-based health reporting as a way for patients and health care professionals to communicate more easily (Freifeld et al., 2010). Mobile applications are one type of technology used for encouraging doctor-patient exchanges, providing medical personnel with epidemiological data, and reminding patients of treatment schedules (Kollmann et al., 2007). A number of studies explain how to evaluate medical applications based on certain criteria (Boulos et al., 2011; Mirza et al., 2008; Muessig et al., 2013; Verkasalo et al., 2010). It is difficult to evaluate mobile applications focusing on HIV/AIDS because, in comparison with other medical issues, there are very few of them, and thus far none have been well-received (Muessig et al., 2013; D. Valentine, personal communication, January 22, 2014). Applications that do exist have not been made widely available in Thailand. The apparent lack of interest among the MAPs regarding these types of applications could be attributed to social, psychological, and environmental influences (S. Umasa, personal communication, January 23, 2014). However, research has been done by HIV/AIDS groups in Thailand which has uncovered the barriers that prevent the MAPs from adopting healthy HIV-related behaviors.

Population Services International (PSI) hopes to decrease the incidence of HIV/AIDS in Thailand among MAPs by improving case management, self-monitoring, testing, and reporting of HIV/AIDS cases through the use of a mobile application. There is still little research on the effectiveness of using mobile applications for the tracking of existing or potential HIV/AIDS cases. It remains unclear if mobile applications are useful tools that the MAPs would be willing



and able to utilize. PSI wanted research carried out to help determine if mobile applications would be useful in preventing and managing the effects of HIV/AIDS in Thailand.

The goal of this project was to determine the most effective mobile application or application features for improving HIV/AIDS management among the MAPs in Thailand. For our purposes, an effective mobile application is one that satisfies the needs and desires of the target populations, facilitates HIV/AIDS management, and is used by members of the MAPs. PSI hopes that the application will provide knowledge about prevention services, encourage repeated HIV testing, supply information about receiving treatment, and collect patient data regarding disease progress. One of our research objectives was to identify the characteristics of the target populations. This was necessary to identify demographic information, to learn the amount of knowledge they possessed regarding HIV/AIDS, and to determine their willingness and ability to use mobile applications or other media. Another objective was to determine the necessary and desirable features of mobile applications. A third objective was to create and use a framework for evaluating mobile applications and their features. To achieve these objectives we analyzed archival research, arranged interviews, conducted a survey, and used two decision-making analysis tools.

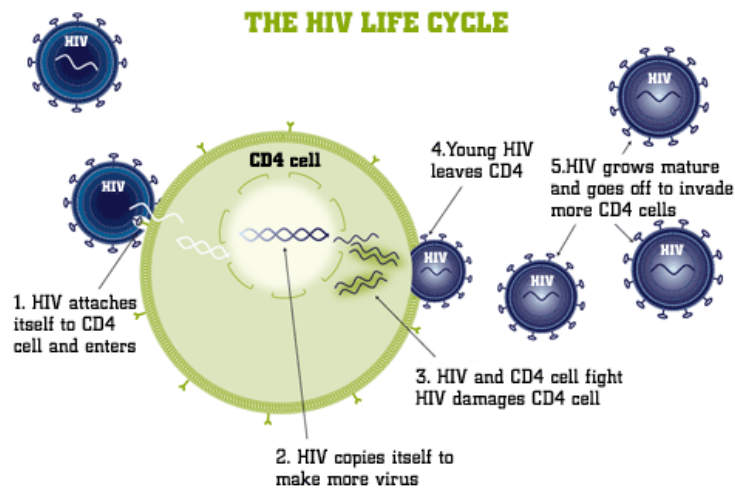
We produced a framework that can be used for assessing the capability of a mobile application to aid patients with chronic diseases such as HIV/AIDS, as well as to help their caretakers. This research will be important as a means to reduce the number of at-risk individuals becoming infected with HIV/AIDS and to improve the effectiveness of treatment and management of this life-threatening virus in Thailand and perhaps elsewhere.

## 2. Background

This chapter provides an overview of topics relevant to the problem of determining the most effective and efficient mobile application for improving prevention and monitoring of HIV/AIDS. Although AIDS is now a manageable disease, the incidence of HIV transmission among at-risk populations in Thailand has increased or remained the same over recent years. Mobile applications could be far-reaching and have the potential to improve the HIV/AIDS situation among the three most at-risk populations in Thailand addressed by this research. This chapter includes a general review of HIV/AIDS, a discussion of technology-based health reporting, an analysis of mobile applications, and an investigation of the impact of HIV/AIDS among the three most at-risk populations in Thailand.

### 2.1 HIV/AIDS

Acquired Immunodeficiency Syndrome (AIDS) is a disease of the immune system caused by a retrovirus called the Human Immunodeficiency Virus (HIV) (AIDS.gov, 2012). HIV infects a human through direct contact with bodily fluid or by sexual transmission. Once in the body, HIV invades and kills certain cells of the immune system in order to reproduce. As a result, the immune system is impaired because these cells, called CD4 cells, are required to fend off an infection in the human body. A person should consider receiving treatment once the CD4 cell count decreases below 350 copies/mL of blood (500-1000 copies/mL is normal). Once the CD4 cell count of an infected person drops below 200 copies/mL and the virus is detected in the blood, the individual is then considered to have AIDS.



**Figure 1: HIV replication process in five steps**

### 2.1.1 History

In the United States, the spread of AIDS began as a number of opportunistic infections in the gay population (AIDS.gov, 2012). In June of 1981, doctors were surprised to be presented with a number of cases of a rare strain of pneumonia, all in young gay men. In April of 1982, the Centers for Disease Control (CDC) estimated that tens of thousands of people were infected with the disease. September of that year was the first time the CDC used the term “AIDS” for the disease when they released an official description to the public. Throughout the 1980s, AIDS was discovered in infants, people who underwent blood transfusions, and more members of the gay population. During this time, the death rate on a global scale was around 80% for people with AIDS.

AIDS was first officially diagnosed in the U.S., but within a few years there were reports of cases around the world (AIDS.gov, 2012). In fact, HIV is said to have reached the first human in Africa when a hunter killed a chimpanzee that had the virus (Chang, 2011). There were estimated 35.3 million people globally who were infected with HIV in 2012 (UNAIDS, 2013b). Although AIDS treatment measures now exist, the number of people with HIV continues

to increase in some parts of the world and AIDS remains a life-threatening virus. Roughly 97% of AIDS cases are found in low income, developing countries. Most people living with HIV/AIDS do not have access to adequate treatment and care, and there is still no cure for the disease.

Once discovered, AIDS received a lot of negative attention and was thought to be a disease strictly among gay people, even bearing the name “Gay-Related Immune Deficiency” (Hunt, 2010). It only took a few years after the discovery of AIDS for discrimination to spread (AIDS.gov, 2012). For example, the U.S. announced in 1985 that they would test all incoming military recruits for HIV and reject anyone who tested positive for fear of homosexuality. Today, in general the public is more accepting of the gay population and has become more accustomed to the disease; however, gay and transgender (TG) individuals in many parts of the world face discrimination and even less accommodation in regards to HIV/AIDS support.

### **2.1.2 Prevention, testing, monitoring, and treatment**

In order to reduce the risk of contracting HIV, knowledge about transmitting the disease and avoiding engaging in behaviors that could lead to infection is vital (AIDS.gov, 2012). HIV is most commonly transmitted through sexual activities, injection drugs, and blood transfusions. The use of a condom is an important prevention measure to avoid contracting HIV through sexual relations with an HIV-positive partner, although it is not 100% effective. Drugs have been developed that can decrease the chances of getting HIV. Pre-Exposure Prophylaxis is a pill that will prevent HIV from reproducing in the body if taken daily before engaging in high-risk activities. Post-Exposure Prophylaxis is a group of medications that work to prevent infection if taken within 72 hours after being exposed to HIV. Microbicides can be used by some people and are designed to be inserted into the vagina to kill viruses and bacteria so that people can engage in safer sex. As with condoms, these three measures are not always effective in prevention of

HIV.

There is current research into creating vaccines for a more permanent and trustworthy prevention method (AIDS.gov, 2012). One of the best methods for preventing infection by a virus is a vaccine for that virus, but there is currently no vaccine available for HIV. This virus behaves differently from other viruses for which vaccines have been created. Despite decades of research, scientists have not been successful in making a vaccine. Even so, there is still hope among scientists that a vaccine can be found, but until then condoms, Pre-Exposure Prophylaxis, Post-Exposure Prophylaxis, and microbicides are effective prevention measures.

In order to further prevent infection, medical professionals recommend getting tested for HIV before engaging with a new sexual partner (AIDS.gov, 2012). People who are considered to be “at risk” should be tested every 3-6 months. The test comes in the form of a mouth swab, urine sample, or blood test so that people can get tested in the way in which they are most comfortable. There are many programs dedicated to helping at-risk people find testing facilities in addition to pre-test and post-test counseling. In many cases, it is often difficult to convince people to get tested for HIV regularly because it forces them to confront the reality that they are at-risk of having a life-threatening illness.

Antiretroviral Therapy (ART) is the primary method for treating HIV (AIDS.gov, 2012). It requires a person to take a number of antiretroviral drugs that attack the virus at different stages of its life cycle. Typically, an HIV-positive patient will take three different drugs that attack the virus at two different stages. Currently, a single HIV-curing drug does not exist, so a patient must adhere to the ART regimen to stay healthy. For people living with HIV/AIDS, it is possible to survive for approximately 6-19 months without receiving ART treatment; therefore, treating the disease is imperative for a long life.

People infected with HIV/AIDS also need to make a few changes to their daily routines in order to take care of themselves in their more fragile state (AIDS.gov, 2012). Patients should be sure to have frequent check-ups with their physicians, which may involve a CD4 and viral load (amount of HIV present in the blood) count check every 3-6 months. Infected people may need to change their daily habits to incorporate more exercise, plenty of rest, and a proper diet. People living with HIV/AIDS should also avoid alcohol and addictive drugs, especially while participating in ART, due to these substances' weakening effects on the immune system. AIDS impairs the immune system, so it is important to stay as healthy as possible in order to avoid contracting any additional illnesses. Due to the many different actions required to maintain a healthy life for at-risk or HIV-positive individuals, innovative ways to facilitate and encourage HIV reporting and management are needed. One of these innovations is the use of advanced technologies, such as smartphones. The practice of technology-based health reporting through the use of mobile applications has the potential to increase HIV/AIDS prevention, testing, monitoring, and treatment.

### **2.1.3 Current issues affecting HIV/AIDS management**

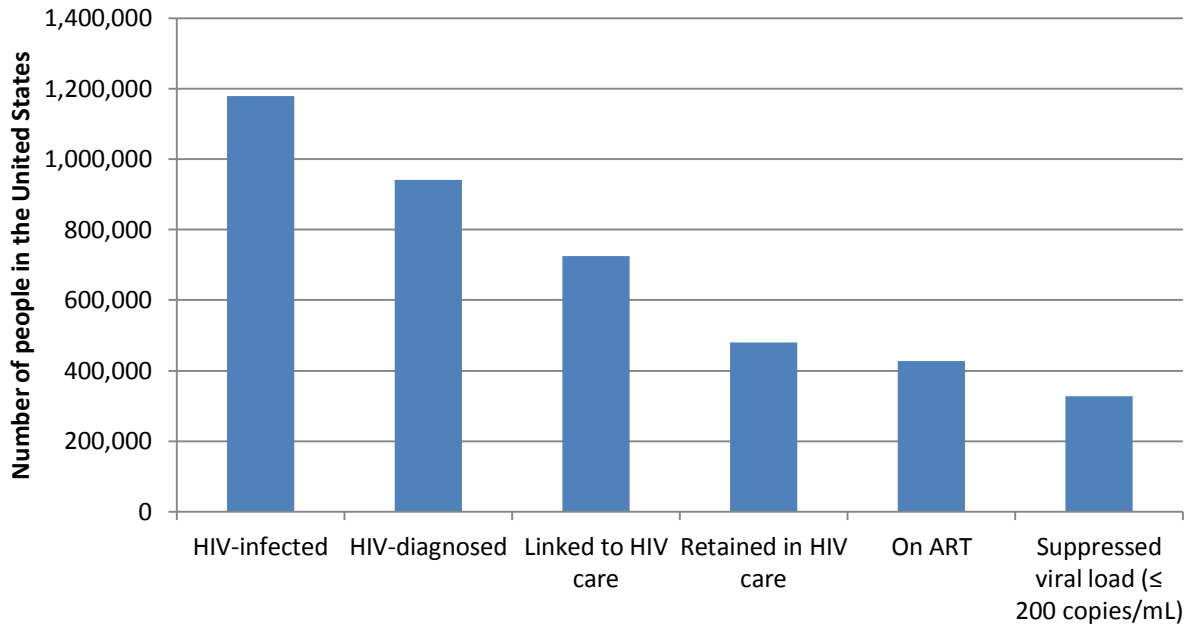
Scientists are currently in the process of developing a vaccine that can prevent HIV/AIDS (AIDS.gov, 2012). Research is also being focused on spreading knowledge and developing new strategies for prevention, monitoring, and treatment. Since the discovery of HIV/AIDS, scientific advancements coupled with the work of HIV/AIDS-focused organizations have decreased the impact of the disease globally. Today, nearly all people, even those in developing nations, are aware of HIV and possess at least some knowledge about prevention, monitoring, and treatment (UNAIDS, 2013b). As a result, HIV transmission rates and the number of annual AIDS-related deaths continue to decrease every year in most countries. Despite this improvement, 2.3 million new HIV infections and 1.6 million AIDS-related deaths were reported for 2012. These data

indicate that HIV/AIDS management strategies are not universal, not effective enough, or not adopted by all people.

Several known reasons account for why the disease continues to be a global issue. First is that people in developing nations and minorities are often excluded from relief efforts (UNAIDS, 2013b). For example, recent trends in HIV/AIDS prevalence among sex workers, men who have sex with men, and injection drug users indicate that there are insufficient transmission prevention efforts targeting these populations. Therefore, in order to control the threat of HIV/AIDS, efforts must focus on these at-risk groups in which the disease continues to be a serious problem.

Another primary problem preventing the suppression of HIV/AIDS is that not all people are able to obtain treatment and care services (UNAIDS, 2013b). According to the 2013 World Health Organization HIV treatment guidelines, ART coverage in low- and middle-income countries represented only 34% of the 28.6 million people eligible for treatment. Free universal ART does not exist in every country, and many people are unable to afford treatment. Some people are unable to access ART due an inadequate number of facilities or the inability to travel to an HIV/AIDS treatment facility.

One final problem that is preventing the impact of HIV/AIDS from being mitigated is that many people are not adhering to ART after being diagnosed with HIV (Wilton & Broeckert, 2013). ART treatment consists of a series of steps that must be completed in order for the person living with HIV to have a long and normal life. This sequence of steps is referred to as the HIV treatment cascade and includes HIV-diagnosis, linkage to care, care retention, ART, and reducing one's viral load. Throughout the entire HIV treatment cascade, the number of people participating in each sequential step decreases. The figure below demonstrates this trend in the United States.



**Figure 2: Number of HIV-infected persons engaged in selected stages of the continuum of HIV care in the United States (CDC, 2011)**

Many countries globally experience a similar trend in decreasing HIV treatment compliance throughout the entire cascade (S. Umasa, personal communication, January 23, 2014). These data indicate that only a small percentage of people infected with HIV actually achieve an undetectable viral load in their blood, which means that their HIV case is under control (Wilton & Broeckart, 2013). The decrease in HIV treatment adherence throughout the cascade is due to a number of reasons, including stigma and discrimination, mental health and addiction issues, and financial instability. By improving HIV programs, spreading knowledge, and aiming to engage people at-risk for or living with HIV with health care and social services, it is possible to maintain compliance in ART throughout the entire HIV treatment cascade. As a result, there may be a decrease in the number of new HIV cases and deaths caused by unmonitored AIDS cases.

## 2.2 Technology-based participatory health reporting

With the rise of technology, there are more opportunities for improved doctor-patient



communication as opposed to traditional health care. This method, called technology-based health reporting, is focused around participatory health care – the practice of enabling patients to share their medical information with their doctors outside of an office (Freifeld et al., 2010). By turning non-compliant or passive patients into active health reporters, the value of the information available to health care providers is increased (E. Agu, personal communication, December 6, 2013).

Cloud storage, telecommunication, and automated care associated with participatory health care provide multiple benefits (Boulos et al., 2011). Encouraging patients to put their health information in cloud storage gives health experts instant access to data that could allow them to analyze the spread of a disease and prevent outbreaks. For individual patients, participatory health care allows users to remotely initiate contact with a doctor for immediate medical attention, instead of having to go to a hospital or doctor's office (E. Agu, personal communication, December 6, 2013). The software used to gather this health information can also provide automated services to the patient. For example, a program might notify patients to see a doctor or take their medication based on their activities or symptoms (Boulos et al., 2011). Technology-based health care also has the potential to reach a wide number of people (E. Agu, personal communication, December 6, 2013). Certain countries or areas might have access to technology but not have direct access to doctors. Mobile applications can help people in those areas contact health professionals to receive information and help with disease monitoring.

The drawbacks to participatory health care mostly involve privacy and non-compliance. Concerns exist about transmitting medical information over the Internet, violating some of the patient's privacy if handled incorrectly (Freifeld et al., 2010). There are privacy and anonymity issues in regards to tracking the spread of a disease using self-reported data, as much

of that includes personal information. In addition, participants are often non-compliant with using technology-based health care for several reasons including age, denial, and lack of motivation (E. Agu, personal communication, December 6, 2013). In this case, it is often wise to incorporate incentives into the program.

Technology-based participatory health reporting works to turn otherwise passive patients into managers of their own health and well-being. An example is the Care Coordination/Home Telehealth (CCHT) program (Darkins et al., 2008). This program provides a framework for patients to transmit their health information to their hospitals by answering health-based questions via text message as well as monitoring themselves through biometric sensors. Hospitals involved with the CCHT program were able to either give active care or provide case management for the patient based on the telecommunicated data related to their afflictions. The targets of this program were veterans, so many of the ailments were either age-related or psychosocial, ranging from diabetes and heart failure to posttraumatic stress disorder and depression. The benefit of this program is that patients can save money by independently living at home while still managing their conditions, as opposed to being housed in an institution. There are an increasing number of aging veterans, so this system allows for a larger number of patients to receive treatment in a cost-effective manner while allowing them to maintain their independence.

### **2.3 Mobile applications**

Mobile health care applications are developed with the intent to facilitate communication between medical workers and their patients, as well as to store and convey information about the condition of the user (Kollmann et al., 2007). Currently, there are thousands of medical mobile applications that exist to help users monitor various aspects of their health, however very few

HIV/AIDS applications are available. Many have received poor reviews or have not been adequately reviewed. Therefore, traditional mobile application assessment techniques need to be employed to evaluate the features of health care reporting applications and HIV/AIDS-specific applications.

### 2.3.1 Existing health care applications

Many mobile applications currently exist that cover a wide variety of medical problems. The *Outbreaks Near Me* application (Freifeld et al., 2010) was released in 2009 for use with the iPhone in order to combat the spread of the H1N1 virus. One of its functions is collecting user submissions about outbreaks and publishing them to other users. Submissions are filtered to remove identifying features of the people involved, including names, locations, and personal information. One of the drawbacks of the application is that filtering must be done manually.

Datadyne's *Magpi* (2013) is an example of an application that serves as a tool for the user to create, share, edit, manage, distribute, and preview questionnaire forms via a web browser or mobile application. Once forms have been filled out, submissions can be sorted, edited, visually displayed, and organized. *Magpi* is easy to use and inexpensive, but it is reported to be slow, unstable, and prone to error.

An additional health care application being developed is *Sugar* (E. Agu, personal communication, December 6th, 2013). *Sugar* aims to monitor diabetes cases and wounds resulting from the disease, and it is being designed by Professor Emanuel Agu and a team of developers to meet the needs of individuals around 55 years old, which is its target demographic. The application takes into account the potential disabilities and non-compliance of its users. Furthermore, *Sugar* will store its information in the cloud to provide health care professionals with convenient access to the information.



**Figure 3: Three screenshots of *Sugar* interface design and features**

*Nike+* is an example of a different style health application, with its goal being to motivate people to exercise and be healthy (Zichermann & Cunningham, 2011). The application primarily functions as a pedometer, but by taking advantage of a smartphone’s capabilities, it also provides social incentives to run. *Nike+* allows a user’s friends to give instant support for getting healthy by publishing exercise statistics to social media. Amateur runners can earn application medals and achievements, providing a sense of progress as they get healthier. Competitive athletes can also use the application to compare themselves against others through leaderboards. *Nike+* proposes that a lack of participation can usually be traced back to a lack of engagement in the activity. In this case, people aren’t exercising because they don’t find it fun, which *Nike+* works to address.

### 2.3.2 Existing HIV/STD mobile applications

There are a limited number of HIV/AIDS-related medical applications, with those available generally being of poor quality (Muessig et al., 2013). Of the 29,000 health applications found on the iPhone and Android marketplaces, less than 0.03% were found to be related to HIV/AIDS. Reviews thus far for current HIV/AIDS applications from the target demographics have largely been negative. In a study of 55 of the best applications chosen for

assessment, only 6 had the key topics of providing knowledge, reducing risk, promoting condoms, and encouraging testing. Some applications had other interactive features such as games, quizzes, and activities that would reward the user with a prize. However, very few of the applications contained descriptions of biomedical HIV prevention options. The applications also had many problems ranging from ineffective interfaces to a lack of interesting features. These problems are suspected to be a result of failing to analyze the target audience as well as ineffective marketing.

Several HIV/AIDS mobile applications provide only informational content to the user. The *AIDSinfo HIV/AIDS Glossary* (National Library of Medicine, 2010) is a free application developed by the United States federal government that offers a glossary containing over 700 HIV/AIDS-related terms in both English and Spanish languages. It provides the user with HIV-related research information and gives health care providers the latest medical practice guidelines and prevention and treatment strategies. *AIDS Journal* (Wolters Kluwer Health, 2013) is another application that provides doctors, researchers, and other users with the latest knowledge about HIV/AIDS. *HIV & AIDS Animated Pocket Dictionary* (Focus Medica, 2013) defines over 100 HIV/AIDS medical-related terms and provides the user with 3D animation and videos of complicated medical terms and processes.

Other HIV/AIDS mobile applications and technologies contain interactive features and even allow the users to monitor and report the current conditions of their health. For example, *Smartscope* is a new technology being developed to target rural areas of Africa where current HIV tests are difficult to access and expensive (Autonomous Nonprofit Organization “TV-Novosti,” 2012). The program employs the use of a microscope that attaches to the user’s smartphone camera and a chip with a blood sample slide that attaches to the device underneath

the microscope. This mobile application has the ability to photograph, count, and record the CD4 cells of the user and inform them when their counts are too low. However, there is insufficient research available into *Smartscope*'s effectiveness.

### **2.3.3 Important attributes of mobile applications**

For an application to be effective, it must be perceived by the client as being enjoyable, useful, easy to operate, easy to install, and stable (Verkasalo et al., 2010). Research has shown that applications that are not entertaining or purposeful tend to be left unused when downloaded and ultimately are uninstalled (Muessig et al., 2013). Several studies have been performed to establish key principles for application developers to keep in mind when designing a program (Boulos et al., 2011; Mirza et al., 2008; Muessig et al., 2013; Verkasalo et al., 2010).

One important feature of an application is that it should be interesting and understood by the user as being engaging to use (Muessig et al., 2013). An application that does not bore the user, even if it is not supposed to be entertaining, is more likely to have persistent use. Providing factoids related to the topic of the application is an example of a subtle way to hold the interest of the user (E. Agu, personal communication, December 6, 2013). Many popular mobile applications achieve a higher level of user enjoyment through “gamification” techniques (Zichermann & Cunningham, 2011). These applications are designed with game principles that make using the application a rewarding experience. Points and awards are awarded to players for displaying proficiency at using these applications, which can give players a higher status in a community, or be redeemed for other benefits.

Another necessary quality of mobile applications is to be useful. An effective application has a clearly observable purpose that it efficiently serves in a timely manner (Muessig et al., 2013). This purpose could be a task that a client has done in the past that now is made easier through use of the application. One way for an application to appear useful is providing positive

feedback based on the actions of the user. Letting the clients know that their input is being valued allows them to feel that their time is not being wasted in using the application (Mirza et al., 2008). Feedback empowers the users, allowing them to feel that they have some control over the process (E. Agu, personal communication, December 6, 2013). Additionally, certain applications may gather information by and from its user to be presented to professionals for analysis (Mirza et al., 2008). In situations like this, for an application to be useful it must be able to gather and communicate its findings in a timely manner, while presenting them in a readable fashion.

It is crucial for an application to be easy and convenient to use. Users should be able to determine how to operate an application without outside help, and any help they may need should be readily available (Muessig et al., 2013). The application should build its structure around the expected skills and abilities of its target demographic, thus allowing itself to be intuitive (Mirza et al., 2008). The entirety of the program should be able to perform on a single device. Requiring a secondary phone, computer, or other medium to access key features may annoy the user. The application should not disrupt an individual's daily routine. Any potentially bothersome notifications should be able to have their settings modified to adjust to a person's schedule.

Applications should be easy to locate, setup, and install. Difficulties in initial configuration of the application will discourage the client, most likely leading to decreased usage or total non-usage (Muessig et al., 2013). Updates should not be excessively frequent or require a total system shutdown. The user may get annoyed and simply not update the application, causing new features to be absent, software bugs to persist, and usage to decrease (Boulos et al., 2011).

Another desirable feature of applications is reliability. The application should be able to

run in the background for extended periods of time with minimal difficulty (Boulos et al., 2011). An application that slows down the system it is installed on will most likely be removed. If a software error occurs, it should not interrupt the user with a pop-up notification or any other visual cue. The application should report the error directly to the developer, not the user. Many applications gather information over time, so any critical problem along the way may jeopardize important data, such as a person's medical records.

#### **2.3.4 How to encourage downloads of mobile applications**

There are several strategies that can be employed in order to encourage the user to download a mobile application. These include being directed at a community, being supported on the most appropriate media, having a trial version, and being inexpensive (Xu et al., 2011, Verkasalo et al., 2010, Kim et al., 2011, Meussig et al., 2013, Kim et al., 2011). Strategies such as these, coupled with the attributes described in section 2.3.3 and other factors such as marketplace rankings and word of mouth, have the potential to influence a customer's decision to download an application or not (Kim et al., 2011).

Having a community element is a desirable feature in a mobile application. A program is more enticing to download if it includes the user in a group. The community element can be part of an application's functionality in various ways, such as allowing the user to connect with others nearby. Applications that are directed at a specific local community tend to be more widely adopted by people in the targeted area (Xu et al., 2011). An example of this would be an application that gives the user access to a neighborhood radio or news program.

Applications should be supported on the devices most used by the target audience. Application developers should focus on the preferred operating system or technological medium from which the target demographic downloads and uses mobile applications (Muessig et al., 2013). It is also important to consider if the target demographic has access to any potentially



supported technologies. If none of the technologies are appropriate, then a different approach for the program must be pursued.

If an application is not free, it is typically a good practice for the application to support a trial version, which is a free variant of the application with limited features. As mentioned in section 2.3.3, two attributes users tend to value in an application are ease of use and usefulness. Application trials allow the user to evaluate those attributes for themselves and be assured that there are no technological barriers that might cause frustration (Verkasalo et al., 2010). Supporting a trial version is good practice for any application that can use its functionality as a selling point (Kim et al, 2011).

The price of an application has a large impact on whether or not a user purchases it (Kim et al., 2011). Lower priced applications generally receive more downloads, with people often saying that their purchase of the application was directly related to its low cost. Inexpensive applications that support many different functions are attractive to users in that they believe they are getting a deal by gaining access to many services for one low price. However, more expensive applications tend to have higher quality functions that customers are often willing to pay for (West et al., 2012, Kim et al., 2011). People are also more willing to pay for expensive applications if they can replace non-digital purchases. For example, an expensive encyclopedia application may be seen as a more desirable purchase compared an even more expensive physical encyclopedia (West et al., 2012).

Some key factors that influence application purchases are the application's ranking in its marketplace and word of mouth (Kim et al., 2011). A highly-ranked application allows buyers to feel more confident in their decision to purchase it. A high ranking in the marketplace can be generated by community support, promotion, and monetary endorsement. Applications that are

directed at a small market tend to rely on their number of downloads to receive a high ranking. An application with a high ranking in its marketplace suggests to the customer that others have deemed the application purchase-worthy. Word of mouth consists of recommendations from family and friends as well as online reviews provided by communities and users (Kim et al., 2011). Users are more likely to purchase programs that are used or recommended by friends and family as their opinions hold the most weight (Verkasalo et al., 2010). Often, a customer will value word of mouth higher than other factors when researching an application to purchase (Kim et al., 2011). That is, positive reviews or recommendations will influence people enough to purchase a more expensive application or an application that does not have a trial version. Rankings and word of mouth are used by consumers to not only find first-rate applications, but to avoid bad ones as well; to achieve a high ranking and generate positive word of mouth the application must earn it through good design.

## **2.4 Relevance in Thailand**

Thailand is a country that in recent years has made measurable improvements to its economy and health care system (PSI, 2010b). As a result, the country reported only a 1% prevalence of HIV among the general population at the end of 2011 (AVERT, 2013). However, HIV remains an issue of concern among at-risk subpopulations (UNAIDS, 2012b). Particularly, the general gay population, male sex workers, and transgender women report substantially higher transmission rates (S. Umasa, personal communication, January 23, 2014). The Thai government, international HIV/AIDS organizations, and private groups have developed programs to encourage prevention, monitoring, and treatment among the at-risk subpopulations.

Despite these programs, many barriers still exist that do not allow for the improvement of the problem of HIV/AIDS among members of the target populations (UNAIDS, 2012b).

Specifically, there is an increased need for repeated testing and reporting of HIV in order to lessen the impact and spread of HIV/AIDS (S. Tuler, personal communication, November, 11, 2013). Through the work that Population Services International is doing through a program exploring the use of mobile applications geared towards the GGP, MSW, and TG women, HIV/AIDS can be better managed among the target populations in Thailand.

#### **2.4.1 History and overview of HIV/AIDS**

HIV/AIDS has been present in Thailand for the past 30 years. The first case of AIDS in Thailand was documented in 1984 as a result of unprotected sex (UNAIDS, 2012b). Initially, those predominantly affected by HIV included sex workers, tourists, gay men, and injecting drug users. Because of this, the government targeted its first prevention programs towards these groups and not the general public. The National Strategic Plan was enacted in 1992, which resulted in a drastic decrease in transmission of the virus due to adequate funding, successful condom education campaigns, and a 50% reduction in visits to commercial sex workers (AVERT, 2013).

At the start of the new millennium, the incidence of HIV began to climb among the population as a whole, eventually approaching 2% in 2003 (AVERT, 2013). Reduced government funding by nearly one-fourth of the total allocated during the late 1990's accounts for the increase in diagnoses during this time. In 2006, over 1 million people were infected with HIV and 510,000 people died. Today, estimates show that approximately 490,000 people are living with HIV in Thailand, and the highest HIV incidence rates are once again recorded among at-risk subpopulations.

#### **2.4.2 Secondary effects of HIV/AIDS**

Besides the obvious health burden that HIV/AIDS places on an infected individual, the

disease also causes economic and social secondary effects. The patient's economic situation is one area that is heavily impacted by having HIV/AIDS (Chiengkul, 2008). Although ART treatment is free for all Thai people, this excludes many workers who travel to Thailand from surrounding countries to participate in the sex trade. Foreign workers in Thailand are able to receive access to the health care system for a fee of 2,000 baht; however, this must be done before diagnosis with HIV in order to receive ART (D. Valentine, personal communication, January 22, 2014). There is a high cost associated with maintaining health as well as other expenses related to treating the disease (Chiengkul, 2008). For example, periods of time in which the patient is especially ill can result in time away from work, resignation, dismissal by the employer, and unemployment. Consequently, these changes to the patient's financial stability may result in greater troubles for the patient's family as well. Economic blows are especially debilitating as many families do not have a steady source of income.

A patient may also undergo social difficulties as a result of HIV/AIDS infection (Li et al., 2009). These difficulties include the perceived stigma associated with HIV, mental health diseases like depression, and a lack of support from family, friends, and society in general. There have been cases where people commit suicide immediately following a positive HIV diagnosis. Because of this, HIV testing needs to be done at a clinic where a medical professional can explain that it is possible to live a long and healthy life with proper treatment (D. Valentine, personal communication, January 22, 2014). In addition to the external social challenges that people living with HIV/AIDS face in Thailand, many people experience a degree of internalized shame and low self-worth. As a result, these challenges often alienate them from the rest of society and may even lessen the patient's adherence to ART therapy and safe practices.

### **2.4.3 Target populations**

Although the number of HIV cases is especially common among a number of at-risk

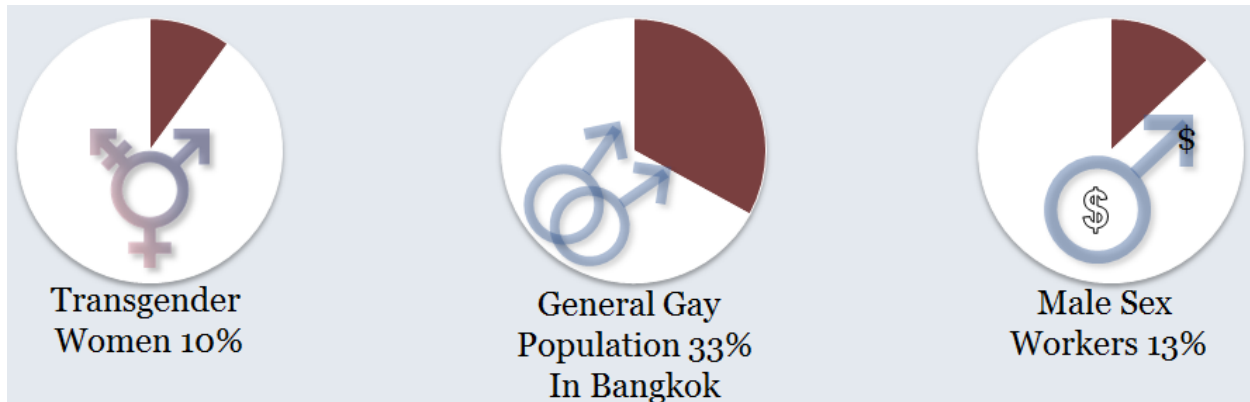
groups, this project focuses primarily on three target populations: the general gay population, male sex workers, and transgender women. The MSM population includes the GGP and MSW, while TG women comprise a separate but similar category. In 2010, there were estimated to be over 550,000 people in these three subpopulations living in Thailand (UNAIDS, 2012a). These groups are especially vulnerable to transmitting HIV because they typically engage in more risky sex behaviors and are often not reached by HIV/AIDS programs.

Men who have sex with men have the highest incidence of HIV/AIDS among all at-risk groups in Thailand (UNAIDS, 2012b). This particular subpopulation is comprised of men who classify themselves as gay, bisexual, or straight. According to data from 2010, about 20% of MSM have HIV (UNAIDS, 2012a). For some time, MSM faced a great deal of legal discrimination, resulting in major setbacks to the country's HIV response (UNAIDS, 2012a). In 2003, managers of gay venues were prosecuted for providing condoms and lubricant through the enactment of the Law and Order Campaign. Until 2007, national strategic plans excluded MSM from HIV/AIDS surveillance measures. Upon inclusion in HIV/AIDS plans, researchers noticed that rapid spread of HIV among MSM occurs most frequently in large tourist-oriented cities (UNAIDS, 2012b). A 2010 survey reported 31.3% HIV infection among MSM in Bangkok and a slightly lower rate in Chiang Mai and Phuket. Since 2007, approximately 8.1% of Thailand's HIV prevention budget goes towards providing MSM with resources (UNAIDS, 2012a). In the population of MSM, the subcategory of the GGP has the highest estimated HIV infection rate of 33% in Bangkok (D. Valentine, personal communication, January 22, 2014). A high incidence of HIV transmission among this population can be attributed to unprotected sex, inadequate funding, and an unwillingness to seek HIV testing and treatment (UNAIDS, 2013a).

A subgroup of MSM are the MSW, who are people who engage in sexual intercourse for

money with both men and women (Sawa et al., 2012). There are many commercial sex establishments in operation, and MSW work in both the venue-based and street-based locations. The most popular cities for sex work include Bangkok, Chiang Mai, Phuket, and Pattaya. Though sex work is illegal in Thailand, there is a low risk of arrest due to cooperation between sex workers and law enforcement officials since the enactment of the “100% Condom Use” policy. However, this group has a higher transmission rate than the national average (13% in 2012) due to unsafe practices such as unprotected anal intercourse and multiple partners. Research shows almost all MSW claim to use condoms with clients, but only 38.6% in Bangkok and 58% in Pattaya use condoms with their regular partner, who is often a member of the at-risk populations as well.

Besides MSM, the transgender community, referred to as *kathoey* in Thai, are significantly impacted by HIV/AIDS. People who identify as TG typically classify themselves as a kind of man or a kind of woman different from traditional binary gender demographics (Winter, 2003). In Thailand, the prevalence of HIV among TG individuals was estimated to be about 10% in 2010 (UNAIDS, 2012b). Although Thai society is more accepting of TG individuals today compared to in the past, many face stigmatization or discrimination from their families or employers. In a study conducted in Pattaya, many TG individuals stated that they rarely use condoms with regular partners because they either trust their partner or they do not want their partner to suspect them of having sexual relations with someone else (Pawa et al., 2011). Additionally, 66.6% of TG people surveyed reported that they had never been tested for HIV, and only 50.3% said they had received a test in the past 6 months.



**Figure 4: HIV rates among the three MAPs in Thailand**

More recently, community-based organizations (CBOs) have been developed to specially target MSM, MSW, and TG women (UNAIDS, 2012a). Mplus is a program based in Chiang Mai that promotes sexual health among MSM but also reaches out to MSW, gay, lesbian, bisexual, and TG communities. The Rainbow Sky Association is another organization that has similar target populations. The Service Workers in Group Foundation (SWING) works to educate MSM about HIV/AIDS through a wide range of services (S. Tuler, personal communication, November 11, 2013). Community-based organizations targeting TG people, such as the Sisters Program, have helped to provide knowledge, care, and support to this population (S. Tuler, personal communication, November, 11, 2013). These and other CBOs provide peer outreach and support for people living with HIV/AIDS, drop-in centers, condom distribution, testing referral, and counseling (UNAIDS, 2012a). Despite the development of these programs, data collected from 2010 estimates that only 50% of MSM are reached with HIV prevention programs (UNAIDS, 2012b). According to the Asian Epidemic Model, 62% of new HIV infections transmitted during 2012-2016 will be among MSM. These data suggest that more must be done in order to reduce HIV transmission rates among these three at-risk populations.

#### **2.4.4 Barriers to HIV prevention, monitoring, and treatment**

A great deal of research has been done to uncover the reasons why proper HIV

prevention, monitoring, and treatment strategies have not been adopted by at-risk or infected people in Thailand (S. Umasa, personal communication, January 23, 2014). One barrier to healthy living is incorrect or inconsistent condom usage. Members of the target populations have attributed poor condom usage to reduced sexual pleasure from wearing a condom, poor condom quality, and not having a condom when needed. People have reported that if a condom has broken during previous sexual encounters then they are less likely to use a condom in the future. Another cause of this barrier is that many people do not consider themselves at-risk for contracting HIV, especially if they only have one regular partner. In monogamous sexual relationships people report low condom usage because using a condom can imply distrust in a partner. Specifically, poor condom usage among the subpopulation of MSW can be attributed to potentially losing a client or money from insisting on a condom during intercourse. However, employers of sex workers generally mandate condom use and HIV testing every 3 months.

A second barrier to adopting healthy HIV-related behaviors is infrequent, delayed, or a total lack of HIV testing (S. Umasa, personal communication, January 23, 2014). This is primarily attributed to a lack of knowledge about the test itself and locations of testing facilities. People often avoid HIV testing because they do not think that they are at risk or they are fearful of negative test results. Testing facilities are frequently not open during hours that are convenient for members in the target populations. Other factors also exist that are more specific to the target populations due to their sexual orientation. In particular, people in these groups avoid HIV testing because they are fearful of discrimination from health care providers, embarrassed to enter a gay- or HIV- specific facility, or worried about the confidentiality of their HIV-status or sexual orientation.

Inadequate CD4 testing and ART adherence are other barriers stopping people from



adopting healthy behaviors related to HIV (S. Umasa, personal communication, January 24, 2014). There is insufficient research as to why people do not receive sufficient CD4 testing or have appropriate participation in ART, but one reason that has been determined is a lack of knowledge. Many people in the target populations are unsure of what the test and treatment actually entail and are unaware of the effectiveness of ART. Aside from this reason, people do not go for CD4 testing or ART because they do not know that it is covered under the universal coverage (“30 baht”) plan. If a person lives outside of their home province it is often difficult to receive access to the universal coverage, preventing them from receiving CD4 testing and ART treatment.

An issue that inhibits members of the target populations from following healthy behaviors related to HIV is the perceived and external stigma associated with HIV/AIDS (S. Umasa, personal communication, January 23, 2014). Research shows that people living with HIV/AIDS often experience self-hatred and low levels of confidence. They often think that friends, family, co-workers, employers, and even strangers will discriminate against them if their HIV status becomes known due to the stigma connected with the disease. People living with HIV/AIDS worry that others will make false assumptions about their sexual orientation and lifestyle if it becomes known that they have HIV/AIDS. In some cases, this discrimination against HIV-positive persons does occur, and one may experience psychological distress as a result.

One newly-discovered barrier that prevents members of the target populations from adopting healthy HIV-related behaviors is easy access to a multitude of sexual partners through geosocial networking applications (D. Valentine, personal communication, January 22, 2014). These applications allow the user to contact other users near their current location in order

to chat over the application and even meet in person. Existing applications such as *Grindr* and *Hornet* along with other websites are geared towards gay people, and many members of the target populations in Thailand use these services. Typically, users of these applications go farther than just chatting or meeting in person. Relationships established through geosocial networking applications often become sexual, as people sometimes participate in drug-fueled, unsafe sex with multiple partners through the use of these applications. As a result, it is possible to contract HIV from the sexual intercourse that is facilitated by geosocial networking applications. Discouraging the use of these popular applications is unlikely due to the positive outcomes a user receives from using them. For that reason, it is necessary to work with these applications to provide HIV-related information to the user in order to encourage the adoption of healthy HIV-related behaviors by members of the target populations.

#### **2.4.5 Technology usage**

There are 90 million mobile phones being used among the 67 million people in Thailand (*Komchadluek, 2013*). Smartphones account for 36% of that figure, a 17% increase since 2012. In the third quarter of 2013 the number of smartphones in Thailand increased from 7.1 million to 8 million, with an increase rate of 29.1%. The most common operating systems on these smartphones are Android and iOS respectively. However, the Telenor Group states that these numbers may decrease with a rise in Windows OS and Blackberry usage in 2013.

In Thailand, 44% of users were reported to have used their mobile phone to browse the Internet (*Komchadluek, 2013*). Of these users, 39% visit websites to search for information on websites. Smartphone users in particular reportedly like to use their device to upload and download pictures, listen to music, play games, and access bank accounts. Users between the ages of 16 and 30 accounted for about 20% of the smartphone users in Thailand. These people in particular, along with 19% of all mobile phone owners, reportedly use their smartphones and

features phones to check social media websites daily.

In Thailand, there is a noted preference for using Wi-Fi to connect to the Internet (*Komchadluek, 2013*). Internet usage via LAN lines increased by 26.5% in 2012, a significant increase compared to the 18.2% rate in 2008. This increase can be attributed to the increasing number of people using ADSL in order to achieve a faster wire-based connection. Over the past few years, technology usage has been increasing steadily in Thailand and is projected to continue the same trend in the future.

#### **2.4.6 Current technology-based health reporting**

Various countries throughout the world rely on technology-based health reporting for a number of reasons. The main purposes are to share data with world health organizations, track the epidemiology of disease, and evaluate the success of current prevention and treatment programs (Freifeld et al., 2010). Recently, PSI/Thailand developed a program with support from the United States Agency for International Development (USAID) called CAP-3D (S. Tuler, personal communication, November 11, 2013). This program intends to help prevent transmission of HIV, improve quality and cost-effectiveness of community outreach programs, and improve access to testing and treatment facilities. Current strategies employed by CAP-3D are inconvenient and ineffective; for example, local partners call patients by telephone in order to track HIV monitoring and treatment.

Consequently, PSI/Thailand is looking to adopt sustainable and effective health information technologies and mobile health systems as a means of collecting patient data and distributing it to health care professionals. There is an increased amount of smartphone penetration in Thailand, especially among metropolitan populations (*Komchadluek, 2013*). To date, insufficient research exists that assesses the use of technology-based media, specifically mobile applications, for improving communication among at-risk populations, HIV-infected

people, case managers, and health care providers in Thailand (S. Tuler, personal communication, November 11, 2013). PSI/Thailand aims to explore the use of mobile applications while partnering with existing community-based organizations in order to improve case management and encourage self-monitoring and reporting of HIV/AIDS among MSM and TG women through CAP-3D.

### **3. Methodology**

The goal of our project was to aid Population Services International in determining the most effective and efficient mobile applications or application features for improving HIV/AIDS management among the most at-risk populations in Thailand. For an application to be effective and efficient it must satisfy the needs and desires of the MAPs, facilitate HIV/AIDS management, and be adopted by the target populations. In order to achieve our goal, we established several objectives: to identify characteristics of the target populations, to determine the necessary and desirable features of mobile applications, and to create and use a framework for evaluating mobile applications and their features. The following sections outline the methods that we utilized to achieve these objectives.

#### **3.1 Identify characteristics of the target populations**

This section discusses how we determined the characteristics of the general gay population, male sex workers, and transgender women. This was important information for determining if mobile applications could be a suitable tool for the target populations and if they would actually use them. We accomplished this by performing archival research to learn about the three different target populations and how they have been impacted by HIV/AIDS in Thailand. We interviewed community-based organization (CBO) leaders with programs addressing HIV/AIDS and asked them to distribute survey questionnaires to people in our target populations. These data were then supplemented with online responses we received via Facebook by posting the link to the electronic survey on HIV/AIDS or CBO pages. We used this survey information mentioned in 3.1.3 in our final analysis of the mobile applications and features.

### **3.1.1 Archival research**

PSI provided us with research they had conducted identifying the target populations who are most at-risk for HIV in Thailand. PSI also provided statistical evidence on the impact HIV/AIDS has had on these populations (see section 2.4.3). Research done by PSI also exposed the reasons why members of the target populations have not adopted healthy HIV-related behaviors (see section 2.4.4). We uncovered information regarding technology usage in specific regions of Thailand as well as where the target populations are primarily located (see section 2.4.5). By having this background knowledge, our group was able to contribute our own research that may help combat the issues preventing the target populations from managing HIV/AIDS cases.

### **3.1.2 Interviews with community-based organization leaders**

We interviewed seven CBO leaders and staff to obtain information on the characteristics of the target populations. We learned about the different community programs and the services they provide to members of the target populations. Talking to CBO leaders who are in close contact with the target populations gave us insight into the attitudes of the GGP, MSW, and TG women towards HIV/AIDS and technology-based health care. We interviewed five leaders of Sisters, Mplus, The Poz, SWING, and Caremat over the phone. Two leaders of SWING and The HIV Foundation programs were interviewed in person (see Appendix D for interview protocol). We asked about the target populations' awareness of the existing HIV/AIDS programs because research had shown that a technological approach was more effective when used in conjunction with a community program (Verkasalo et al., 2010; Xu et al., 2011).

### 3.1.3 Survey of target populations

We conducted a survey with the target populations to determine vital information about the GGP, MSW, and TG women in Thailand (see Appendix E for survey questionnaire). We asked demographic information, such as the gender, sexuality, and age of the participant, in order to analyze differences in responses among people belonging to different target populations. Through this survey we determined three primary characteristics of the target populations: their familiarity with and adherence to HIV/AIDS programs, their degree of impact by HIV/AIDS, and their beliefs about the stigma regarding the disease. Knowledge of these characteristics is necessary to know what HIV/AIDS-related information is important to include in an application. Since sensitive information was recorded by the survey, such as a person's HIV/AIDS status and sexual orientation, all people who participated in the survey remained anonymous, and their answers were kept confidential. Additionally, survey participants were not required to answer any questions that they were not comfortable responding to.

The survey we carried out aimed to reach as many people as possible. We used convenience sampling and due to time constraints we were able to obtain 127 total responses to our survey. In order to reach the target populations while maintaining anonymity, PSI helped connect us with leaders and staff of CBOs to provide the target populations with access to the questionnaires. PSI helped us locate Internet communities in which we posted links to our survey questionnaire. CBO leaders informed our group of how our questionnaire could be distributed, whether it be in electronic or print form. They also were able to give us an estimate of the number of possible respondents who were available, as well as suggest other organizations that would be willing to participate in carrying out our survey.

## **3.2 Determine the necessary and desirable features of mobile applications**

This section discusses how our team determined what makes a health care mobile application effective. We learned about the positive attributes of mobile applications, the details of existing health care and HIV/AIDS mobile applications, and how to evaluate an application based on certain criteria. Our team determined the features that are necessary and typically sought after in a mobile application by considering the points of view of the users as well as the case managers (CMs) who would receive data from the application. The research techniques we utilized to reach this objective included archival research, interviews with CMs, and a survey of the target populations (previously mentioned in 3.1.3). We aimed to determine what makes a health care reporting mobile application effective and useful from the perspective of the user as well as the case manager.

### **3.2.1 Archival research**

PSI provided us with information that their researchers compiled in regards to existing HIV/AIDS mobile applications. By reviewing PSI's previous research, we learned about features that are specific to HIV/AIDS mobile applications. In addition, we performed our own literature review on general, medical, and HIV/AIDS mobile applications. By reading relevant studies, we determined the positive attributes of mobile applications as well as the factors that contribute to persistent usage of an application. We have presented the results of our own literature review in Chapter 2, section 2.3.

### **3.2.2 Interviews with case managers**

We determined the benefits and drawbacks of technology-based health care in terms of the opinions of case managers. PSI leaders informed us about the case management group with whom they wanted mobile applications to communicate patients' data. Once this group was identified, we then conducted interviews with five of its members that PSI contacted for us (see



Appendix C for interview protocol). Three case managers from The Poz, SWING, and The HIV Foundation were interviewed in person, while two case managers from Caremat and Sisters were interviewed over the phone. We learned their opinions on existing and possible future mobile applications and about the specific features or attributes this group of people is looking for in a mobile application. This knowledge informed our team of the necessary features of a health care application that will help the users manage HIV/AIDS more easily. CMs were also asked for their opinions about the target populations' attitudes towards technology-based health care and mobile applications. Conducting these interviews was paramount in determining if a mobile health care application could effectively satisfy the user as well as those who will manage the generated data.

### **3.2.3 Survey of target populations**

The survey questionnaire, outlined in section 3.1.3, was used to find out about the target populations' usage of existing general and health care applications, with the goal being to determine what they found appealing or unfavorable in a mobile application. Members of the target populations provided information about their access to different types of technology. Besides mobile applications, we asked about their degree of access to computers and text messaging to determine if the target populations were willing or able to use another type of technology-based system. The survey was also used to gather any thoughts about improvements that could be made to mobile applications based on how they expected to use them. Participants were asked to specify the features they value most in mobile applications, both general and health-related, along with what encourages them to use an application. The questionnaire also asked for the participants to select features they would want in an HIV/AIDS mobile application. The survey results were used along with previously published research and customer reviews of

the same or similar mobile applications (see section 2.3) in order to help our team evaluate how mobile applications could more specifically address the needs and desires of the MAPs.

### **3.3 Create and use a framework for evaluating mobile applications and features**

A final section of our research was to create and use a framework for evaluating the mobile applications that we, PSI, and other researchers have considered. We performed a Quality Function Deployment (QFD) and used Multi-Attribute Utility Theory (MAUT). These two analytical tools were utilized in order to take into account the different perspectives of all groups of people involved in the project and lead to a recommendation of the most effective mobile applications and features.

#### **3.3.1 Quality Function Deployment**

Quality Function Deployment is a system for determining the true needs of the stakeholders when developing a product (Akao, 1990). This tool was used to determine the most effective and efficient features that should be included in an HIV/AIDS application based on the opinions of all of our stakeholders: the MAPs, CMs, and PSI. The process we followed involved six steps and was a modified version of the original system recommended by WPI Professor of Computer Science, Gary Pollice (personal communication, February 11, 2014). Doing this revealed a total that showed which of the features were most important. Tables 1 through 6 outline an example of the six steps that we followed in our QFD.

The first step was to determine the values. Table 1 shows how these values would be incorporated into an example QFD table.

**Table 1: Step one of an example QFD**

<b>1)</b>										
Track progress										
Find out risk level										
Find clinics										
Read about AIDS										

A value is defined as an end result that a stakeholder would like to have, such as a person getting tested for HIV or tracking CD4 counts. We determined what the values would be by using our knowledge acquired through performing archival research, interviews, and the survey to brainstorm all possible values. We grouped similar values into 18 final values to be used in our QFD. The example QFD shows only four values in the yellow section on the left.

The second step was to listen to the stakeholders. Table 2 shows an example of how the stakeholders and the weights they give to the values would be added to the QFD table.

**Table 2: Step two of an example QFD**

<b>2)</b>						<b>PSI</b>	<b>MAP</b>	<b>CM</b>	<b>Total</b>	<b>Normalized</b>
Track progress						4	3	4	11	4
Find out risk level						2	2	3	7	2
Find clinics						3	4	2	9	3
Read about AIDS						1	2	1	4	1

We determined the stakeholders in this project to be PSI, the MAPs, and CMs, as seen in the blue row at the top-right section of Table 2. These stakeholders are each given their own column for their weights of each value. We used the information gathered from the stakeholders in our interviews and survey to establish these weights, which reflect how important each of the stakeholders consider each of the values to be. The weights were assigned on a scale of one

through four, with one meaning little to no importance and four meaning great importance. An example of this is shown on the right in the green columns of Table 2. The numbers from all of the stakeholders were totaled and normalized. In the hypothetical example above the final weights for each value are in the last column on the right in bold.

The third step was to determine the features. Table 3 demonstrates this step of the QFD table by including the features.

**Table 3: Step three of an example QFD**

**3)**

	Maps to Clinics	Risk Calculator	Graph for CD4 Tracking	Information About Risks	Make Appointments	PSI	MAP	CM	Total	Normalized
Track progress						4	3	4	11	<b>4</b>
Find out risk level						2	2	3	7	<b>2</b>
Find clinics						3	4	2	9	<b>3</b>
Read about AIDS						1	2	1	4	<b>1</b>

We brainstormed a list of every relevant feature that we could think of to go into an HIV/AIDS application based on our research. The features were then organized by relevance into 10 groups. Examples of some possible features are shown in the top row in red in Table 3.

The fourth step was to determine the relevance of features to values. Table 4 gives an example of how the relevance could be given values and placed in the table.

**Table 4: Step four of an example QFD**

**4)**

	Maps to Clinics	Risk Calculator	Graph for CD4 Tracking	Information About Risks	Make Appointments	PSI	MAP	CM	Total	Normalized
Track progress	1\	0\	10\	0\	3\	4	3	4	11	<b>4</b>
Find out risk level	1\	10\	0\	3\	3\	2	2	3	7	<b>2</b>
Find clinics	10\	0\	0\	0\	1\	3	4	2	9	<b>3</b>
Read about AIDS	1\	1\	0\	3\	1\	1	2	1	4	<b>1</b>

We gave each feature a score for each value based on how well it helps to accomplish that value. The scores could be 0, 1, 3, or 10, with 0 meaning no relation, 1 meaning a weak relation, 3 meaning some relation, and 10 meaning a very strong relation. This way of scoring was used to show a clear separation between features that are necessary in realizing a stakeholder value from the features that are less important in realizing that value. These values can be seen in use on the left side of each orange box in the middle of Table 4.

The fifth step was to multiply the relevance scores by weights for each value. This can be seen being done in our example in Table 5.

**Table 5: Step five of an example QFD**

<b>5)</b>	<b>Maps to Clinics</b>	<b>Risk Calculator</b>	<b>Graph for CD4 Tracking</b>	<b>Information About Risks</b>	<b>Make Appointments</b>	<b>PSI</b>	<b>MAP</b>	<b>CM</b>	<b>Total</b>	<b>Normalized</b>
<b>Track progress</b>	1\4	0\0	10\40	0\0	3\12	4	3	4	11	4
<b>Find out risk level</b>	1\2	10\20	0\0	3\6	3\6	2	2	3	7	2
<b>Find clinics</b>	10\30	0\0	0\0	0\0	1\3	3	4	2	9	3
<b>Read about AIDS</b>	1\1	1\1	0\0	3\3	1\1	1	2	1	4	1

We applied the weights assigned by the stakeholders to the scores we calculated in step four by multiplying them. This was done because it is important to consider both how well a feature realizes a value and how important each feature is to each stakeholder. By multiplying the weights and scores it becomes evident which features are most important and contribute to the most values. These numbers are shown on the right side of the orange boxes in the middle of Table 5.

The sixth and final step was to total up the weighted numbers. Table 6 is a completed QFD example table showing all the steps including the final totals. Totals for the example are shown in the purple row at the bottom of Table 6.

**Table 6: Step six of an example QFD**

6)	Maps to Clinics	Risk Calculator	Graph for CD4 Tracking	Information About Risks	Make Appointments	PSI	MAP	CM	Total	Normalized
Track progress	1\4	0\0	10\40	0\0	3\12	4	3	4	11	4
Find out risk level	1\2	10\20	0\0	3\6	3\6	2	2	3	7	2
Find clinics	10\30	0\0	0\0	0\0	1\3	3	4	2	9	3
Read about AIDS	1\1	1\1	0\0	3\3	1\1	1	2	1	4	1
	37	21	40	9	22					

By looking at these final numbers, we were able to see which of the features were most valued by the stakeholders. This information allowed us to assign weights appropriately to features that we evaluate in existing mobile applications through the use of MAUT. After we have these final weights for each feature, we classified them into three categories: necessary, optional, and unnecessary. The purpose of doing this is to help define what the numbers mean when it comes time to develop an application with these features. In our hypothetical example of a QFD, the result shows that a graph for CD4 tracking and a map to clinics are the most important features to include in an HIV/AIDS application so these would be labeled as necessary. Including the optional features to make appointments or calculate risks would also be good, however, in this example, the unnecessary feature is information about risks.

### 3.3.2 Multi-Attribute Utility Theory

Once we determined the most beneficial and preferred features of technology-based health care systems designed for HIV/AIDS, we used a multivariable assessment tool to decide which of the existing mobile applications are most effective and efficient. The specific tool we employed was Multi-Attribute Utility Theory, which is a mathematical system used to analyze possible decisions and create an evaluation process (Tzeng & Huang, 2011). We took into

account the information gathered from our archival research, interviews, and survey in order to base our assessment on the opinions of the potential stakeholders and users.

When developing a framework for assessing options we identified 15 relevant HIV/AIDS mobile applications available on the iOS or Android marketplace. We assigned the final weights from the QFD to each application feature. Each application was given a score of one through four for each of the features based on how well it met that consideration. The scores were multiplied by the weight of that feature and then the products were added for each feature to find an overall score for each application. The application with the highest score was the recommended choice.

**Table 7: Example of MAUT using two applications and five features**

<b>Feature</b>	<b>Weight</b>	<b>Application 1</b>	<b>Application 2</b>
<b>Graph for CD4 Tracking</b>	40	1	4
<b>Maps to Clinics</b>	37	2	3
<b>Risk Calculator</b>	21	3	1
<b>Make Appointments</b>	22	1	3
<b>Information about Risk</b>	9	4	2
<b>Totals</b>		<b>235</b>	<b>376</b>

A hypothetical example of this process where two applications are being compared is illustrated in Table 7. Five features, a graph for CD4 testing, maps to clinics, a risk calculator, a tool to make appointments, and information about risk, were chosen for consideration and given weights determined through the example QFD (see section 3.3.1). These applications were assessed and scored based on how well they included the five features. Multiplying their scores by the weight of the features and then adding those values gave a total score for each of the applications. The application with the highest final score was deemed the most appropriate application based on the selected criteria.

### 3.4 Summary

To accomplish our research goal we employed several social science techniques, including archival research, interviews, a survey, and two decision analysis tools. We examined research to learn about desirable features of general and HIV/AIDS applications, along with the behaviors and characteristics of the target populations. Interviews with CMs informed us of their views on technology-based health care and the features that they believe are necessary in an HIV/AIDS mobile application. By interviewing CBO leaders we learned more about the characteristics of the target populations and their access to HIV/AIDS programs. From the results of the survey questionnaire we determined the target populations' knowledge and use of HIV/AIDS prevention, monitoring, and treatment strategies. The questionnaire also provided insight regarding the target populations' views and opinions of mobile applications and their features.

The data gathered from archival research, interviews, and the survey allowed us to perform Quality Function Deployment and use Multi-Attribute Utility Theory, which comprised the framework we used to assess mobile applications and their features. The results and analysis of our findings are discussed in the next chapter.



## **4. Results and Analysis**

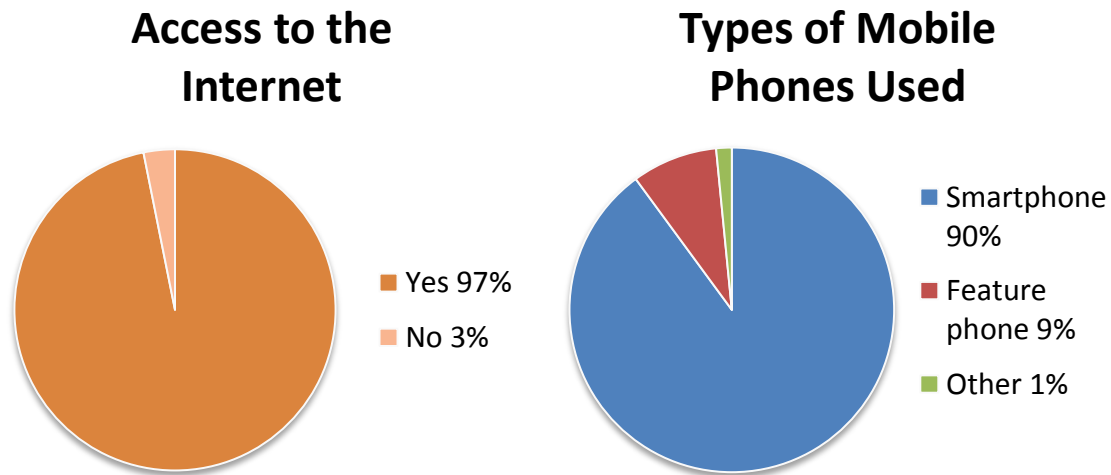
This chapter discusses the results of our research that realized our three objectives: to identify characteristics of the target populations, to determine the necessary and desirable features of mobile applications, and to create and use a framework for evaluating mobile applications and their features. We also discuss the limitations of our project that can be addressed by future research and evaluation.

### **4.1 Characteristics of the target populations**

The results collected from interviews with case managers and community-based organization leaders, along with data gathered from our survey of the most at-risk populations enabled us to achieve our objective of identifying characteristics of the target populations. The results of our research informed us about the MAPs' access to the Internet and smartphones, their willingness to use an HIV/AIDS application, their opinions about applications, and the barriers that inhibit them from practicing healthy HIV/AIDS behaviors.

#### **4.1.1 Access to the Internet and smartphones**

Through archival research we found that about 75% of all Thai people have mobile phones, and 36% of those people are smartphone users (see section 2.4.5). We inferred that this number would be even higher among the most at-risk populations, since they primarily live in large cities where there is even greater technology penetration. The results from our survey supported our inference by showing that 97% of respondents have access to the Internet while 90% use smartphones. From the survey we also found that the preferred operating systems for smartphones were Google Android and Apple iOS. The data from the survey results regarding Internet and mobile phone usage among the MAPs is shown in Figure 5.

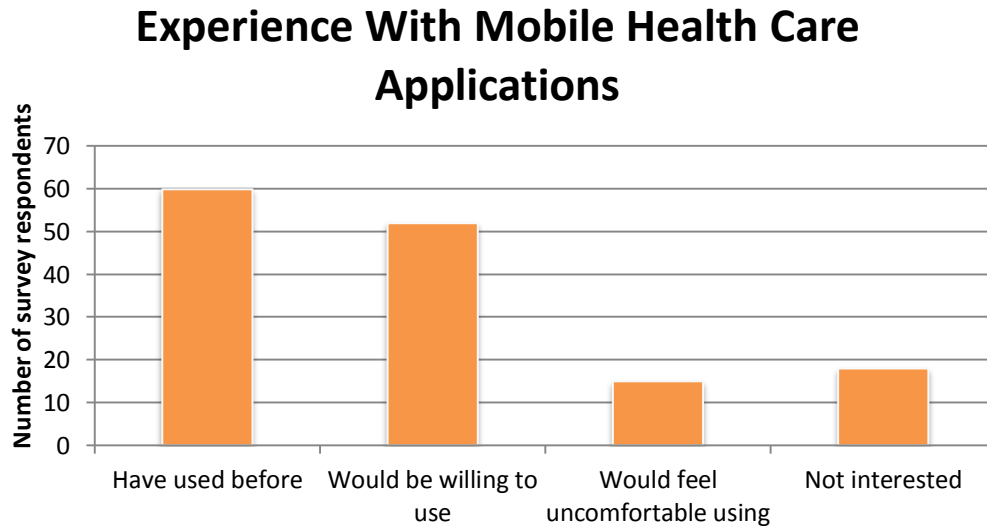


**Figure 5: Internet and mobile phone usage among MAPs**

Our results were supported by statements from case managers and community-based organization leaders, who both strongly believe that most male sex workers, transgender women, and members of the general gay populations have access to smartphones and the Internet. One CBO leader stated, “Even people in rural areas have access to smartphones, so by using an application these people can get information and communicate with other people.” This means that even people in the target populations who live outside of large cities could utilize a mobile application via their smartphone. A CM from Mplus and CBO leaders from Mplus and Sisters all agreed that many members of the target populations have smartphone access and already use mobile applications for other purposes. Unfortunately, older generations of the MAPs tend to have less smartphone penetration and may be less able to utilize a health care application, according to interviews. However, this portion of the target population is not the primary focus for this project since the highest HIV transmission rates are among younger gays, transgenders, and male sex workers. These results mean that younger members of the MAPs are able to use a mobile application because of their sufficient access to smartphones and Internet.

#### 4.1.2 Willingness to use HIV/AIDS applications

We found that in general the most at-risk populations are willing to use an HIV/AIDS application. Figure 6 shows the experience that survey respondents have with mobile health care applications.

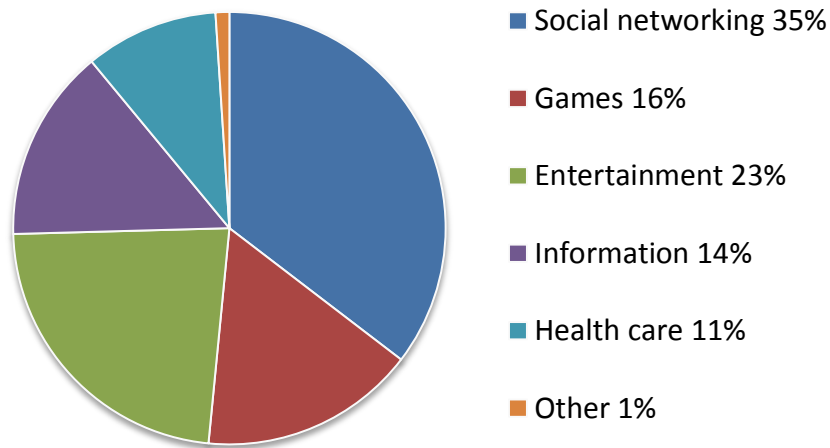


**Figure 6: MAPs experience with mobile health care applications**

We found that 77% of those surveyed have either used or would be willing to use a health care application. Only 10% said they would feel uncomfortable using an application for this purpose, while 12% said they were uninterested in using a mobile health care application.

Most people claimed to prefer using mobile applications for purposes other than monitoring their health. Figure 7 shows the other types of mobile applications that survey respondents reported using.

## Types of Mobile Applications Used



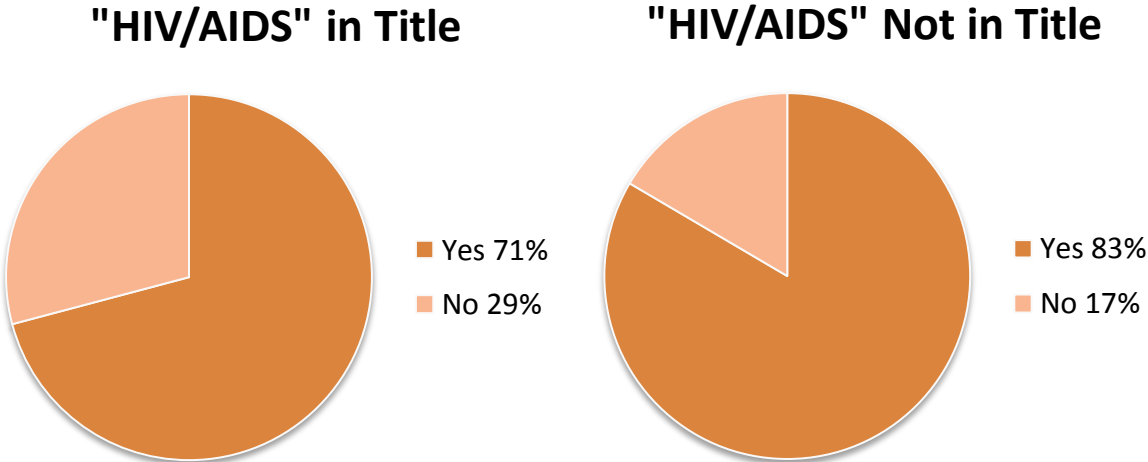
**Figure 7: Types of mobile applications used by the MAPs**

We found that members of the MAPs primarily download applications for the purposes of social networking, games, and entertainment. About 35% of respondents reported using social networking applications, 16% reported using games, and 23% reporting using entertainment applications.

Case managers and community-based organization leaders suggested that implementing entertaining features in an HIV/AIDS application would increase the willingness for the target populations to download and use it. Some features that might attract more people would be HIV/AIDS-related quizzes and games. A simple example of a game could be a crossword puzzle or word search with HIV-related terms. A community features in which you can talk with others is another attractive feature. A case manager from Mplus stated “...only a few people will download and use it if it’s an application about health care. More people are interested in chatting. I’m afraid that people will not be interested [in a health care application].” By providing entertainment as an incentive, more people will download the application and have a chance to benefit from it.

The target populations would be most willing to download a general health application

that has HIV/AIDS features instead of an application that is marketed as an HIV/AIDS application. We found from our interviews that this is because the MAPs typically aim to avoid any potential social stigma brought upon them by using such an application. The results of our survey, shown in Figure 8, supported this statement, showing that 71% of people would download an application with HIV/AIDS in the title while 83% of people would download the same application under a different, more discreet name.



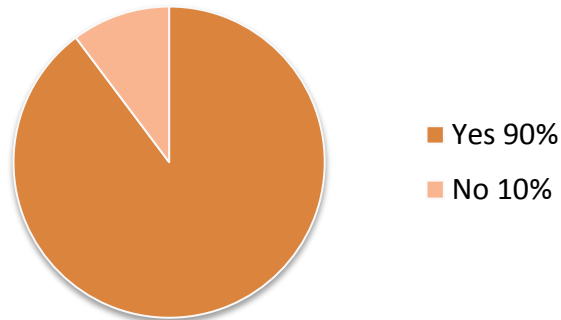
**Figure 8: Willingness of MAPs to download a mobile application with “HIV/AIDS” in the title versus downloading the same application without “HIV/AIDS” in the title**

A CBO leader from Mplus stated, “I think they might be less [willing to download an HIV/AIDS application] because loading an application about HIV/AIDS onto the phone might be something that society will question. People will wonder if you are infected.” Our results show that the members of the MAPs are willing to use an HIV/AIDS application, especially if it has a discreet name and logo.

**4.1.3 Opinions about applications**

The target populations use applications and have preferences about their general characteristics. The results about whether or not the survey respondents have used mobile applications are seen in Figure 9.

## Use of Mobile Applications

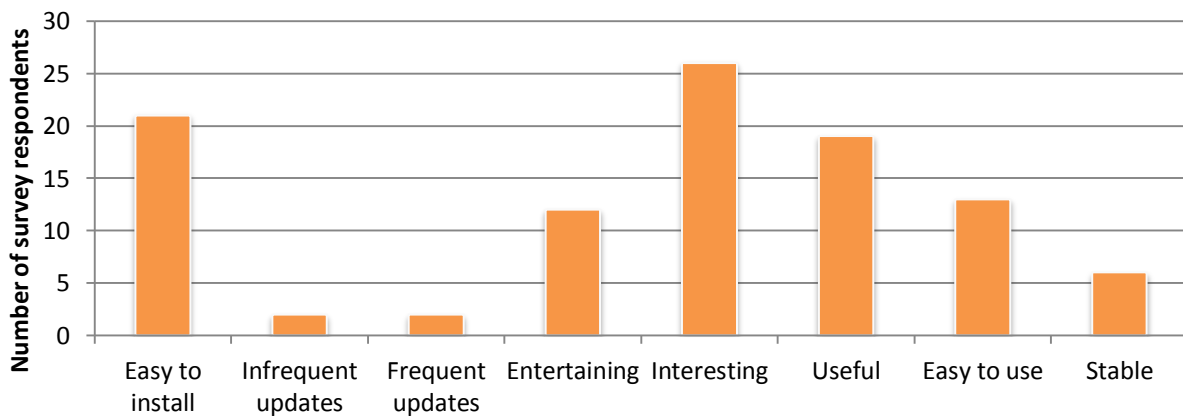


**Figure 9: MAPs use of mobile applications**

Our survey showed us that 90% of the target populations surveyed use mobile applications. This means that members of the target populations are already familiar with using mobile applications.

The background research in section 2.3.3 presented our team with a list of attributes that all general applications should have. This list included easy installation, frequent of updates, high entertainment value, high level of interest, usefulness, ease of use, and stability. The results of our questionnaire found that these attributes are all valued by the target population.

## Important Application Attributes



**Figure 10: Important general application attributes according to the MAPs**

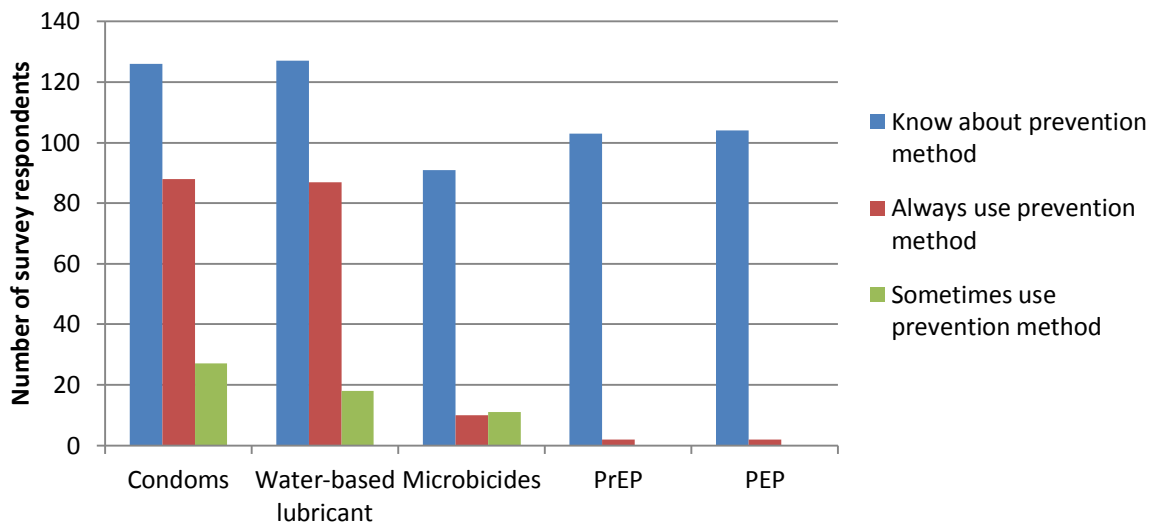
When ranked on a scale of one to four, with one meaning “unimportant” and four meaning “important”, all attributes achieved an average score of about three. Figure 10 shows that how interesting an application is, how easy it is to install, how useful it is, and how easy it is to use were seen as the most valued attributes. The number one reason for someone to stop using or uninstall an application was that the application was boring.

The majority of the members of the target populations were found to widely prefer free applications. Many case managers and community-based leaders stated that most people would be more willing to download free or very inexpensive applications. These statements are supported by our survey results; 76% of participants said they are only willing to download an application if it is free. An application being free was also found to be the most influential reason for someone to download an application. About half of the respondents said they would only download a health care application if it were free. Those that claimed to be willing to purchase applications predominantly stated a low price, usually around \$0.99 USD, as the maximum they would be willing to pay. If an application is not free, then a trial version should be available so that the potential user may test the application before they purchase it.

#### **4.1.4 Barriers inhibiting healthy behaviors**

Members of the target populations have an understanding of HIV/AIDS prevention, monitoring, and treatment strategies but do not employ them because of several barriers, which include negative social influences, environmental influences, and a lack of access to good information. These barriers were reported to us by PSI. Most members of the MAPs have sufficient knowledge about HIV/AIDS prevention strategies, especially condoms. However, these strategies are not always utilized, as seen in Figure 11.

## Prevention Method Knowledge and Use Among MAPS



**Figure 11: Knowledge and use of condoms, water-based lubricant, microbicides, Pre-Exposure Prophylaxis (PrEP), and Post-Exposure Prophylaxis (PEP) among members of the MAPs**

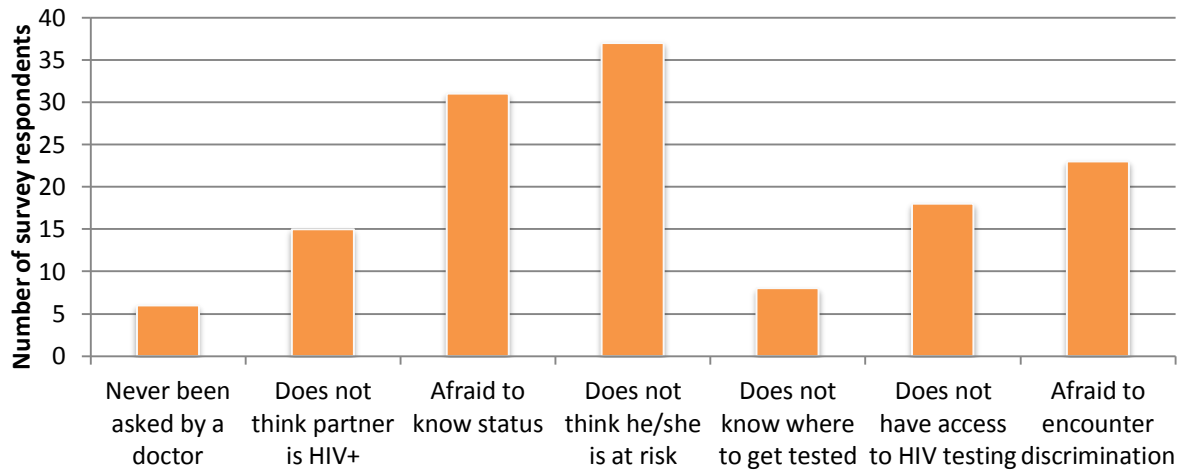
We found from the results of the survey that 126 out of the 127 respondents know about condoms, while only 88 always use them and 27 sometimes use them. The survey respondents are mostly people who have received services from CBOs, so we suspect that people in the MAPs who have not been in contact with CBOs would have considerably less knowledge and use of condoms and other prevention strategies. The findings are similar for water-based lubricant knowledge and use, but far fewer respondents reported knowing about or using microbicides, Pre-Exposure Prophylaxis, or Post-Exposure Prophylaxis. Through interviewing a case manager we found that the reason for this is that many Thai people, including doctors, do not know about these three prevention methods. The main HIV/AIDS prevention tool that is known, available, and used in Thailand, is the condom. These results show that it is important to incorporate information about prevention methods into an HIV/AIDS mobile application while also encouraging the use of prevention.



From speaking with PSI, case managers, and CBO leaders we found that one cause of HIV transmission is the lack of condom usage with regular partners. One CBO staff said, "...trust issues, too, like they don't think they're at risk by being with a regular partner, like a husband or wife. Some who have been living together for 9, 10 years also don't use a condom. So trust is one obstacle to work with; it's very hard for us [the CBOs]." Another related issue is that MAPs often do not use condoms with casual partners who do not physically appear to have HIV/AIDS. One CBO leader said, "They [the MAPs] think, 'He doesn't look like he has HIV so it's probably okay to not wear a condom with him.'" It was also found during interviews that members of the MAPs do not always use condoms because they do not perceive themselves to be at-risk for HIV/AIDS. They think that if they only have unprotected sex occasionally they will not get HIV. Through the use of a mobile application it could be possible to present members of the MAPs with accurate information that combats these misconceptions that they currently have, and instead encourage correct and consistent use of prevention.

Another issue among the members of the MAPs is that they do not always go for HIV testing. This topic was frequently mentioned by case managers as a major barrier preventing at-risk people from maintaining healthy lives. These statements were supported by the results of our survey. Of the people surveyed, 19% reported never having an HIV test before, while 35% reported only getting tested once each year or even less often. Through our survey we found the reasons why members of the MAPs do not go for HIV testing on a regular basis, as seen in Figure 12.

## Reasons Why MAPs Do Not Get Tested for HIV

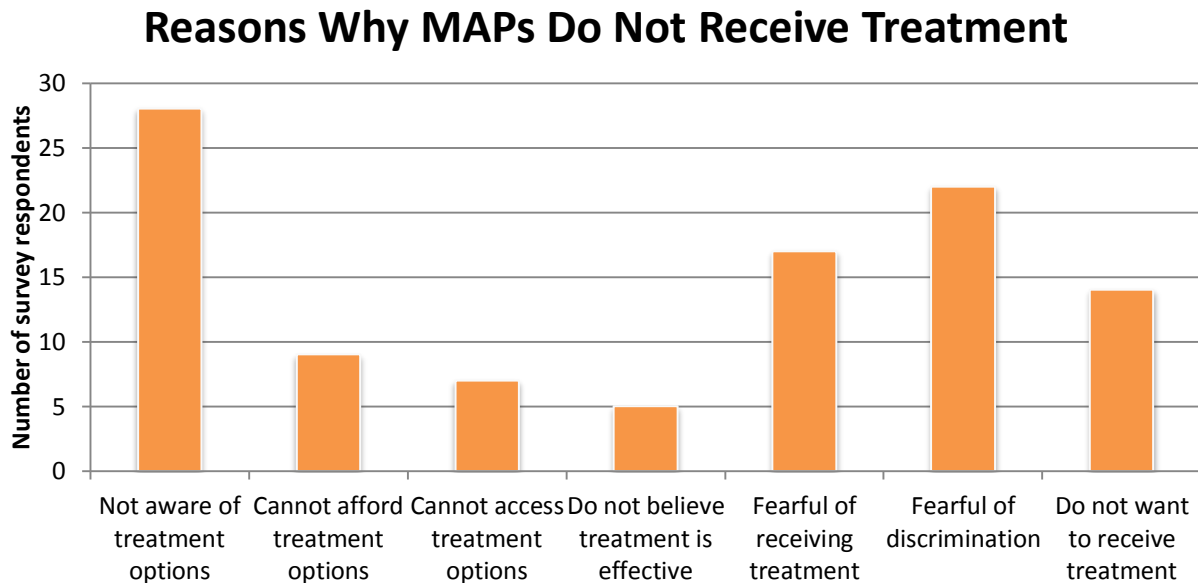


**Figure 12: Seven reasons that influence members of the MAPs to not go for HIV testing**

These results show that 23% of survey respondents, who are members of the MAPs, do not think that they are at-risk for HIV, and as a result do not get tested as often as they should. A mobile application with information about risky HIV-related behaviors could provide the MAPs with accurate information and encourage them to go for testing more often. Another reason that 19% of respondents reported not getting tested for HIV was that they are afraid to know their status. This was also supported by statements from case managers and CBO leaders who said that many members of the MAPs do not go for testing because they fear that the result will be HIV-positive and think that they will then die in the near future. With the help of a mobile application, these at-risk people could be better informed about what happens after HIV diagnosis in regards to medical treatment and support. Another highly reported reason that members of the MAPs do not go for HIV testing is that they are afraid to encounter discrimination, both from health care professionals and the public. A CBO leader from Sisters said that many doctors, especially those who are more traditional, are not sensitive to transgender women, gay men, or male sex workers. He also reported that people often stare while in the

waiting room and address the person going for testing by a title different than that by which they identify. By using a mobile application that can connect a member of the MAPs to a medical professional from any location through chat services, a user could reduce the fear of discrimination preventing them from going for HIV testing.

After being diagnosed with HIV, many people in the MAPs fail to adhere to a treatment regimen or do not receive treatment at all. Our interviews uncovered many different reasons as to why this occurs. The survey respondents reported several different reasons as to why HIV-positive people do not receive treatment, and the results are seen in Figure 13.



**Figure 13: Seven reasons that influence members of the MAPs do not receive HIV treatment**

We found that the primary reason why members of the MAPs do not receive HIV/AIDS treatment if they are positive is because they are not aware of treatment options. They do not know that ART is the primary treatment method for HIV and that they can live a long and relatively healthy life if they adhere to this treatment regimen. Interviews showed us that members of the MAPs also might not know where to receive treatment. A mobile application

could provide the target populations with this vital information and help to increase the number of HIV-positive people receiving treatment.

Another reason that makes people less inclined to get tested or reveal their status is the fear of being officially labeled HIV-positive and the negative societal pressures that follow. Many case managers and CBO leaders interviewed strongly believe that there is a stigma that exists in Thailand towards HIV/AIDS. A CBO leader from The HIV Foundation said, “There’s a really strong stigma about same-sex sex or same-sex activity or transgenderism, but in spite of that stigma there isn’t in most cases a violent response from society. But what happens is if you’re gay and you come out and you’re open about being a gay man then you can’t be a bank manager, university worker, business manager, or government worker.” HIV-positive people are often discriminated against by their employers, and as a result can only hold low-income jobs or work as sex workers. Through our interviews with CBO leaders and CMs we learned that even though there is supposed to be free ART available to all Thai citizens, without money it can be very difficult to obtain. Hospitals are frequently unwilling to give out free treatment even when a patient is in a critical situation. Many members of the MAPs are in at this state due to social discrimination, which prevents them from getting decent jobs. Discrimination from society as a whole is often encountered, but perhaps through the use of a mobile application the MAPs can better understand their rights and how to receive treatment.

Living with HIV and preventing it is especially difficult for those who have come from a more rural background before moving to the city. These individuals have not been well educated about HIV/AIDS, and those that seek more information are often told that it is a death sentence. The results from our interviews indicate that education about HIV/AIDS is not adequate and treatment is difficult to obtain due to the social stigma against those with HIV/AIDS as well as

the discrimination against those who cannot pay. By knowing the negative influences that inhibit members of the MAPs from using proper prevention, monitoring, and treatment strategies, an application can be designed to combat these negative influences and encourage proper HIV/AIDS management.

## **4.2 Necessary and desirable features of mobile applications**

The information that we gathered from our QFD showed us the most important features for an HIV/AIDS application from the perspectives of PSI, the most at-risk populations, and case managers. The features that were found to be the most necessary were sections dedicated to information, a community element, and communication with a doctor.

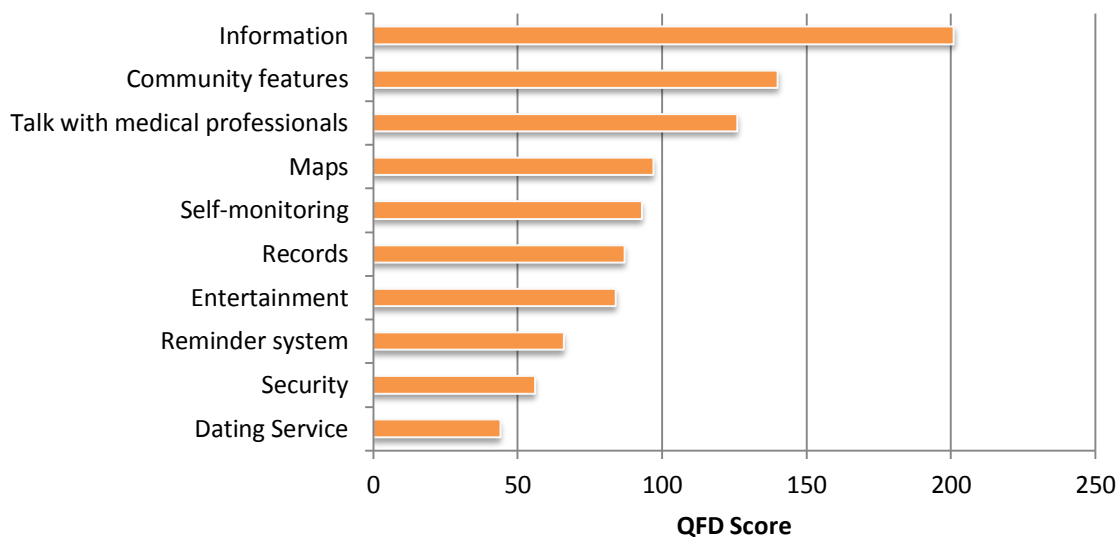
### **4.2.1 Determining important features**

Quality Function Deployment, described in section 3.3.1, determines the importance of features by how well they realize certain desired values. In our QFD, these values focused on improving testing, monitoring, and treatment of HIV/AIDS among the most at-risk populations. Our set of values, which can be found in Appendix H, were determined and given their weighted importance based predominately off of the results of our interviews with case managers and CBO leaders. PSI's views on what an application should include were acquired and added to our QFD table. For the most part PSI's views matched those of the case managers and CBO leaders. The values covered elements of HIV/AIDS management that the interviewees perceived the MAPs to want, as well as elements that they individually viewed as important. The features that scored the highest among the values are seen as best representing the views of our stakeholders, particularly the case managers and CBO leaders.

A necessary feature is one that is viewed as crucial to making an application effective in improving testing, monitoring, and treatment of HIV/AIDS among the at-risk populations. The

results of the QFD yielded a number for each application feature that showed how important it was to the stakeholders. In terms of what to include in an effective HIV/AIDS application, the features that received the highest scores were necessary, the moderately scored features were desirable but not crucial, and the lowest ranked features were seen as not very important to include. Figure 14 shows the list of features in descending order of importance.

### HIV/AIDS Application Features QFD Scores



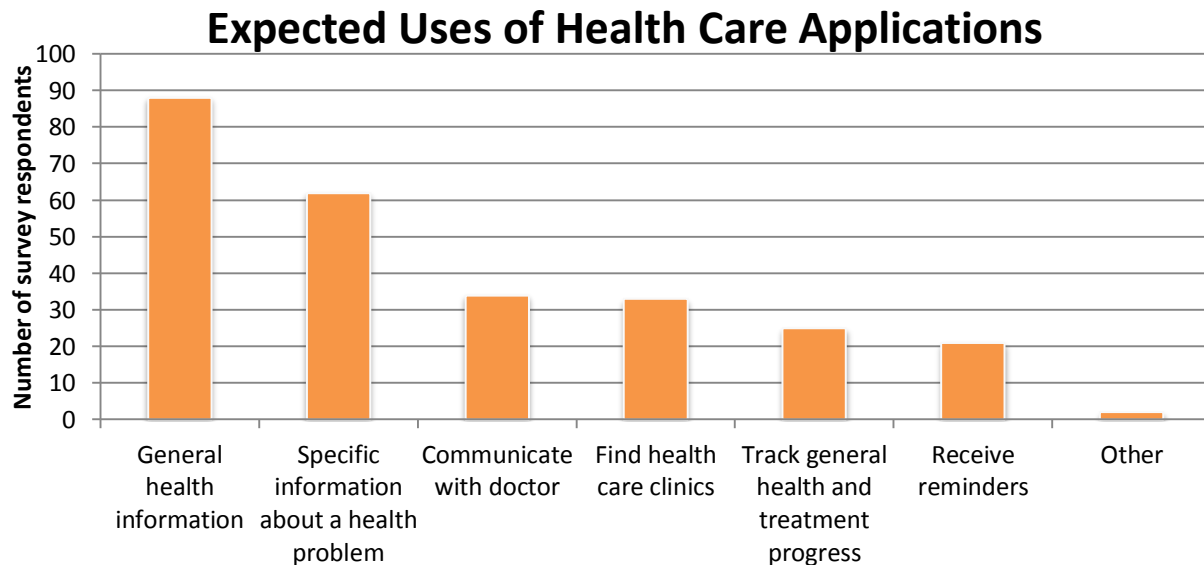
**Figure 14: Ten HIV/AIDS application features ranked from highest to lowest by QFD scores**

The highest-rated feature according to the QFD was information, which received a score of 201. Other necessary features include a community element, with a score of 140, and contact with medical professionals, with a score of 126. Other optional features include those that received between 50 and 100 points, which include maps to clinics or CBOs, a self-monitoring feature, a record feature, and entertainment feature, a reminder system, and a security feature. Security received a lower score because, according to interviews, people are more concerned about maintaining their anonymity than concealing their medical records. The stakeholders assumed that the application would be secure as well. A dating service was found to be an

unnecessary feature due to it only receiving 44 points.

#### 4.2.2 Information

A section devoted to general and in-depth information about HIV/AIDS was found to be a necessary feature in an HIV/AIDS mobile application. An information section can be presented in the forms of structured menus as well as frequently asked questions (FAQ), and can cover general, medication, HIV/AIDS specific, payment, and health-related information. Many of the case managers and CBO leaders we talked to felt a key part of what makes technology-based health care useful is that the user has easier access to more accurate information. Their statements were backed by results from our survey. Figure 15 shows that most people stated they intended to use a health care application to find both general and specific health information. The major factor reducing persistent use of a health care application was that the application did not have a sufficient amount of information. The most important information topic was found to be HIV/AIDS specific information, followed by treatment, medication, and general information.



**Figure 15: Expected uses of health care mobile applications according to MAPs**

During the interviews we found that most members of the MAPs receive health

information from online searches or visits to medical clinics. Information found online can often be inaccurate, misleading, or even dangerous. Because of this, personal visits to medical professionals or to community-based programs have been the primary avenue for people to receive accurate knowledge about HIV/AIDS. However, those who need information often do not go in person due to their fear of being branded as a member of the MAPs or as HIV-positive if seen at a clinic or CBO. Information on an application can be viewed privately, allowing for the user to remain anonymous. The source of the stored knowledge can be controlled so that only credible professionals can contribute, meaning that the information that the user accesses is safe and accurate.

Information specifically about the nature of HIV/AIDS and testing can help improve general awareness, potentially helping those at-risk before it is too late. Section 4.1.1 showed that many people outside of major cities do not have access to up-to-date or accurate information about HIV/AIDS. Our interviews showed us that members of the MAPs tend to move to cities where there is more support for their lifestyles, and once relocated they are met with more chances to be made aware about HIV/AIDS in the form of outreach programs, word-of-mouth, and more knowledgeable clinics. However, the technical director of The HIV Foundation stated during one of our interviews that “...if there’s no information in the country, by the time they [the member of the at-risk population] knows anything about HIV they usually already have it [HIV].” It is often too late for members of the MAPS to live the remainder of their lives in relatively normal fashion as they have already been exposed to HIV for too long.

Several case managers and CBO leaders have also stated that the MAPs’ lack of information about HIV/AIDS causes them to avoid testing. They are afraid of the test results because they think that a positive result means that their lives are over. If these people knew



about the actions they could take to protect their health, they might have been more apt to get tested and as a result have a longer, healthier life. Situations like these are why information is valued so highly in an application; if the person at-risk had access to the right knowledge earlier in life, they might have taken action to help themselves sooner. Due to the high prevalence of smartphone usage among the MAPs, a mobile application could serve as a vessel to provide information to those that need it.

The types of information that were found to be most desired in an application with HIV/AIDS features were about treatment, medication, and general health. Section 4.1.3 indicated that many people in the most at-risk populations do not have a clear understanding of what rights they have to treatment by being a Thai national. For example, ART treatment is free for citizens of Thailand, but this fact that is not extensively known. Also, our interviews revealed that many members of the MAPs are believed to not have enough information regarding medications. This includes how to buy medication, where to buy medication, how to take your medication, or how your medication may interact with other drugs. General health information, such as how to address and diagnose oneself from certain symptoms, has shown from our survey to be desired in an application by the MAPs as well.

#### **4.2.3 Community features**

Community features that provide some similar services to CBOs are seen as important in making an HIV/AIDS application effective. CBOs that actively work to help those at-risk for or living with HIV/AIDS have been shown to greatly improve the lives of those that participate in them. The services people receive from CBOs include information about how to maintain a healthy lifestyle with or without HIV/AIDS, support from understanding and friendly professionals, and a safe location away from the negative social stigma associated with being in the MAPs. During interviews with CBO leaders we found that the members of the MAPs often

face a large amount of discrimination, and the help provided by community programs is some of the only support they receive. Those who are reached by CBOs have a much higher chance of getting tested, revealing their status, and ultimately seeking help. However, through archival research we found that about 50% of people in the MAPs are not reached by CBO efforts. A mobile application could provide more wide-spread support. Including features that mirror the support and guidance of the CBOs is desired in an HIV/AIDS application.

Our findings show that the support provided by community-based programs has proven to increase the willingness for people to get tested and eventually take the necessary actions to stay healthy. CBOs work to encourage testing by proving to their members that they will not be abandoned if they are found to be HIV-positive. The technical director of the HIV Foundation mentioned in his interview that “...almost everyone tells us their [test] result. Because part of the reason they go for testing is because they’re not alone and they know they’re not going to be alone.” An application that has community features, such as supporting an online chat room, is believed to have the ability to promote positive and encouraging attitudes similar to that of CBOs. By talking to others and relating to their problems, the user has the chance to see that they are not alone, potentially influencing them to take the appropriate steps to monitor their behavior. However, a community feature has the potential to spread false information and negativity, so in order to avoid this professional moderators are required to cultivate a healthy online community. Emotional support is typically what makes the services provided by CBOs, and hopefully provided by community features in a mobile application, very valuable.

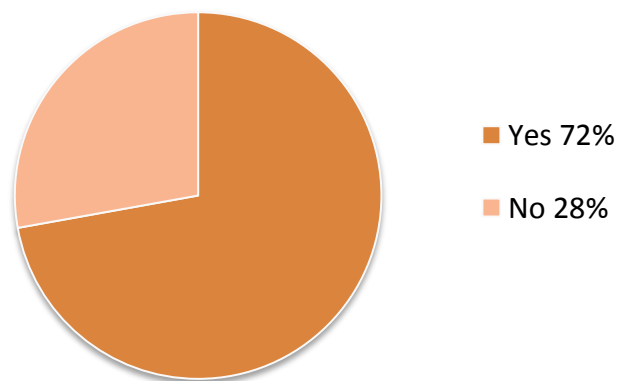
Having a community element feature in an HIV/AIDS application would make the application as a whole more attractive to users. The option to chat with other people would interest more people and potentially have the application see more persistent usage. Through

interviews we found that members of the MAPs widely use messaging applications, such as *LINE* and *WhatsApp*, to connect with other people. Section 4.1.2 shows that social networking applications are some of the most highly downloaded among members of the MAPs. Having a messaging system in an HIV/AIDS application is beneficial because it could lead to more downloads. More people having the application means that there is a higher chance of increased exposure to other important but less entertaining features in the application.

#### 4.2.4 Communication with doctor

Communication with medical professional is a highly desired feature in an HIV/AIDS application. The target populations were found to be willing to contact a doctor through a technological medium. Our survey results, shown in Figure 16, support this claim.

### Willing to Talk With Doctor Securely About HIV/AIDS Through Texting or Calling



**Figure 16: Willingness of MAPs to talk to a doctor through an application**

Doctors are important because they provide much of the important information and treatments that members of the most at-risk population need to live healthy lives. However, as mentioned in section 4.1.4, members of the MAPs often avoid visiting clinics in person out of fear of social stigma, both from the doctors and their community. Also, some clinics are not

properly equipped with the resources to help those with HIV/AIDS. Contacting an appropriate doctor through an application has many benefits for the user.

Negative social stigma and difficulty accessing testing and treatment facilities are what cause many members of the at-risk population to avoid visiting health institutions. Doctors are often not understanding of the lifestyles that the MAPs live and often ask insensitive questions that do not encourage return visits. Others are afraid of simply being seen visiting a clinic, especially in their local communities, because they do not want to be assumed to be HIV-positive or a member of the MAPs. In order to avoid these problems, members of the MAPs often get referred to friendly and discreet institutions by community-based organizations. However, through using an application the user could contact a doctor without needing to travel or expose their identity. Our interviewees proposed that text-based contact is a potential communication method because it is less personal, meaning that more people might be willing to discuss sensitive subjects such as HIV/AIDS. Since there are more medical clinics located within cities, members of the MAPs who live outside of cities are not able to easily access a medical professional. Through the use of a mobile application, people living in rural areas can conveniently communicate with doctors.

Our interviews revealed that not all medical clinics are equal in terms of the information and treatment options they have in regards to HIV/AIDS. It is not uncommon in Thailand for establishments to not be appropriately equipped to handle all HIV-positive patients' situations. A case manager from The HIV Foundation explained that some individuals they worked with had to travel multiple hours to reach a clinic with the appropriate information and resources. An application could facilitate contact with the appropriate doctors through its convenience. The users could get reliable and specific knowledge not found in typical information banks without

actually having to leave their homes. Also, many HIV-positive patients have multiple doctors. An application could store and organize their contacts, further easing the burden on the patients.

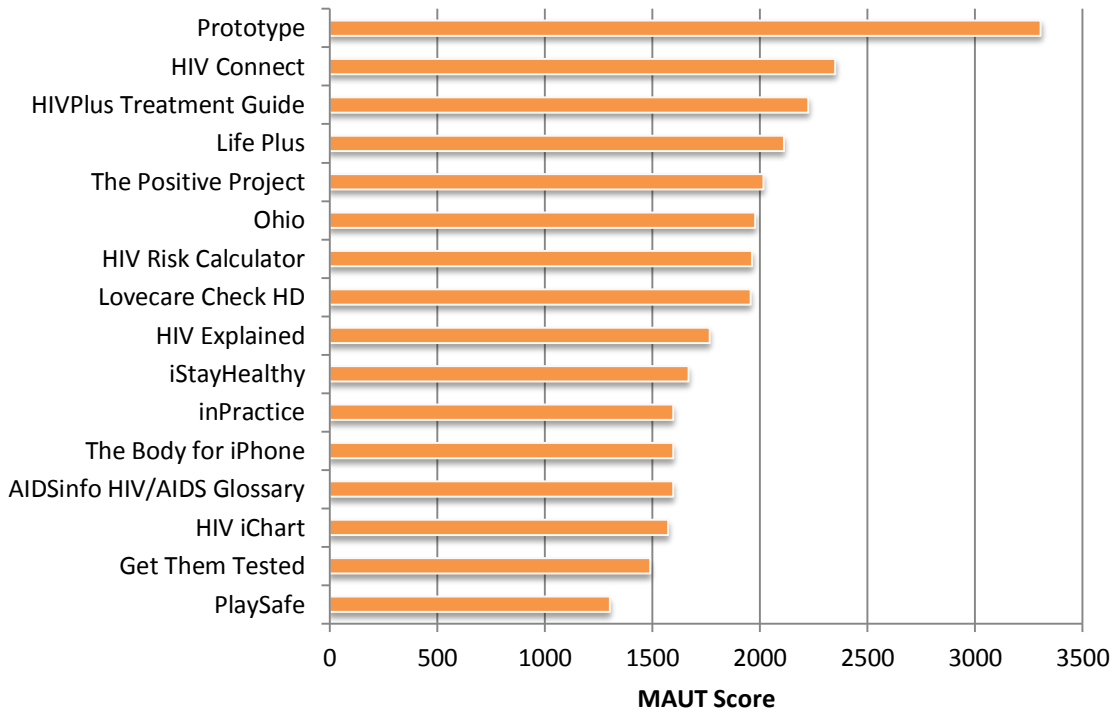
### **4.3 Assessment of mobile applications and their features**

The current available HIV/AIDS applications were compared by their features using MAUT analysis. A list was compiled ranking the applications on their overall effectiveness in reaching the goal of promoting HIV/AIDS testing and management among the MAPs. Of the applications evaluated, *HIV Connect* was determined to come closest to achieving the goal. However, no single application proved to have all of the most necessary and desired features. A prototype of an application was developed by our team to be considered in conjunction with the most effective existing applications as a starting point for the potential development for any future HIV/AIDS applications.

#### **4.3.1 The current applications**

The results of the MAUT show the rankings of the fifteen existing applications we reviewed. The application with the highest total is the highest ranking existing application, and the one with the lowest total is the lowest ranked. The resulting ranking is show in Figure 17.

## Existing Mobile Applications MAUT Scores



**Figure 17: Fifteen existing mobile applications and prototype ranked from highest to lowest by MAUT scores**

*HIV Connect* achieved the highest ranking on this list due to its community features. These features allow HIV patients to communicate with one another about their medication, treatment, and lives. However, what makes *HIV Connect* so successful in our analysis is the medical professional moderator present on the application. The doctor posts information based on threads users start, helps forum members get in touch with other local professionals, and helps find testing resources.

*HIVPlus Treatment Guide* gives patients the tools to self-monitor, make records of their disease, set reminders for medication, and locate pharmacies in their area. The application also has a database of information about HIV medications. Most importantly, *HIVPlus Treatment Guide* features articles about medical research towards a cure as well as essays from HIV-

positive writers about living with the virus. These articles address and debunk the belief that life ends at diagnosis - something that case managers stressed as a message that HIV patients in Thailand need to hear. *Life Plus* provides similar monitoring and record keeping tools, and was scored similarly to *HIVPlus Treatment Guide*, however it scored lower because it failed to address the stigma of living with HIV/AIDS.

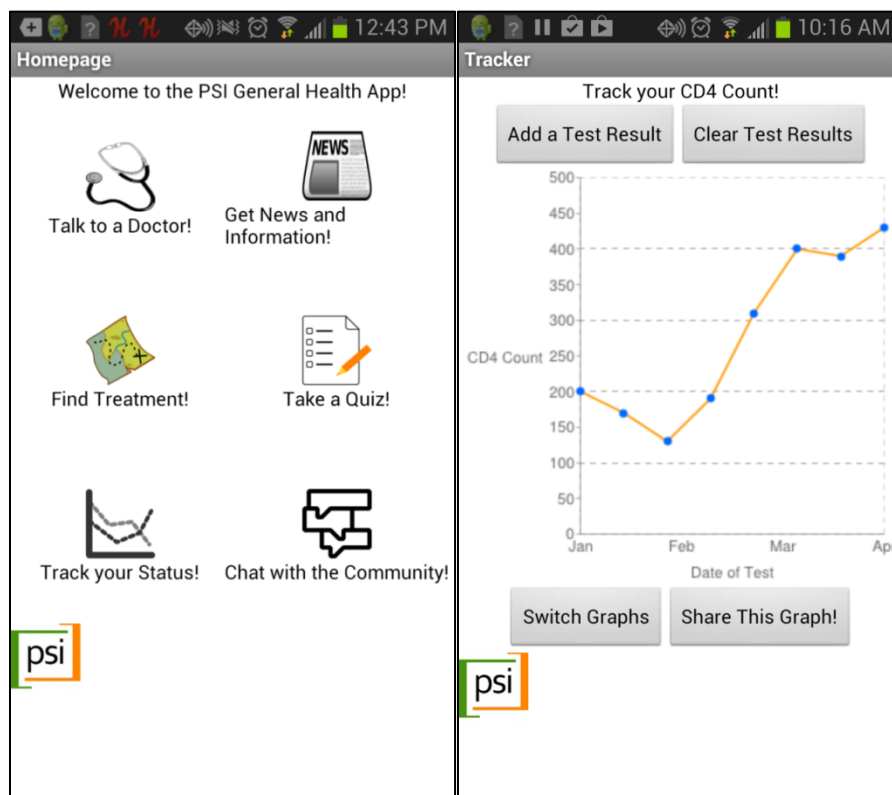
#### **4.3.2 Prototype application**

The highest scoring applications deliver some of the necessary features, although there is still room for improvement. An application that provides an experience where patients can learn about living with HIV, use that knowledge to monitor and manage their disease, and inform their doctor of their progress, all with the encouragement from other patients and friends, has yet to be developed.

In order to demonstrate an application that could do everything deemed necessary, we have developed a prototype of an ideal application that contains the highest ranking features as determined by the QFD. This prototype can serve as a guideline for future application developers in the production of a functional application. The results of our MAUT analysis show that our prototype, if it were made into a real application, ranks significantly higher than any of the existing applications. It does this by providing features that scored highly in our QFD analysis, such as containing information about treatment options, allowing patients to share health information with each other as well as give support and encouragement, and providing tools for patients to monitor their disease and share their data with a doctor. The prototype's high MAUT score shows the large difference in score between an ideal application and the best existing applications, meaning that there is much room for improvement.

This prototype application was created for Android Smartphones using *MIT App Inventor 2*, which allows for the rapid prototyping of mobile applications. *MIT App Inventor 2* is not a

robust platform to properly support many features that are essential in making a mobile health application: there is no support for sending encrypted data over the Internet which is important for doctor-patient confidentiality. However, the prototype application is still able to illustrate how the features that were rated highly in our QFD analysis could be included in a mobile application. Example screenshots of the prototype application are seen in Figure 18 below.



**Figure 18: Prototype screenshots showing homescreen (left) and CD4 tracker (right)**

The screenshot on the left of the figure show the three necessary features – relevant information, a community feature, and talking to a doctor – as well as several optional features. The screenshot on the right shows one of the optional features, a CD4 tracker, how it might appear in the mobile application. The prototype application serves as a reference for PSI if they choose to develop a new application.



#### 4.4 Research limitations

The results of our survey were suspected to have incorrect or conflicting data. This was potentially caused either by confusion over how to answer the questions or intentionally providing incorrect answers. For example, some of the survey participants may have felt uncomfortable sharing certain information with us, or they may have misunderstood the question they were asked. We expected this due to the nature of the HIV/AIDS stigma in Thai culture. We were also unable to identify male sex workers while being sensitive to other participants in the survey. In regards to health care applications, many of the participants did not answer the tedious sections of the questionnaire asking them to rate their preferences on aspects of an application. Many respondents rated all application features the same and did not differentiate between more important or less important features. Finally, we did not survey an equal number of transgender women and men who have sex with men. This research limitation was due to time constraints as well as the opportunistic nature of how we obtained the questionnaire respondents.

#### 4.5 Summary

The results of our project revealed the characteristics of our target populations, the necessary and desirable features of mobile applications, and a framework for assessing mobile applications. We found that the target populations have access to the Internet and smartphones, are willing to use mobile applications, and prefer applications that are interesting, easy to install, useful, and free. We also found that the target populations need more information on prevention methods, need to be encouraged to use condoms and get tested, and need to be made aware that they are at-risk. The necessary features for an effective HIV/AIDS application were determined to be an information section, a community element, and the ability to communicate with a doctor. A framework was created from our QFD and MAUT tables that showed us the most

effective HIV/AIDS applications currently available, *HIV Connect*. However, *HIV Connect* is not completely optimal, so our team developed a prototype application that begins to encompass all the necessary features. The next section discusses our major conclusions and recommendations to PSI and other parties that may perform related research in the future.

## 5. Conclusions and Recommendations

In this chapter we discuss the conclusions we have made from our findings and present the recommendations we have developed for PSI, organizations or companies working in conjunction with our sponsor, and any other parties who are involved in the subject matter. Researchers interested in HIV/AIDS among the target populations or in mobile application assessment could benefit from our research conclusions and future recommendations.

### 5.1 Conclusions

Our first objective was to identify characteristics of the target populations, who were the general gay population, male sex workers, and transgender women in Thailand. We found that these most at-risk populations have the ability to use a mobile application through their survey responses. Data showed that they had sufficient access to the Internet and smartphones, both in rural areas and in cities, and especially among the younger members. When asked if they would download an application with “HIV/AIDS” in the title, most people said they would, and even more said they would download an HIV application without “HIV/AIDS” in the title.

There are some negative factors that affect the MAP’s access to the testing and treatment they need. Most of these negative factors come from the stigma against HIV/AIDS such as the fear of knowing one’s status and the unwillingness to share one’s HIV status. Other negative influences have to do with a lack of information such as reluctance to get treatment. These negative factors should be addressed by the application by providing accurate information and raising awareness about HIV/AIDS.

The second objective was to determine the necessary and desirable features of a mobile application. The best features that should be included in an HIV/AIDS application in order for it to be effective are information, a community element, and contact with a doctor. Our third

objective was to create and use a framework for evaluating mobile applications and their features. In order to best consider the ideas of all stakeholders we determined that the best framework for assessing mobile applications and their features involves using Quality Function Deployment and Multi-Attribute Utility Theory. For our project these analyses revealed that *HIV Connect* is the best application on the market currently. We created a prototype which scored higher than any of the existing applications, so creating a new application based on the prototype would provide the best HIV/AIDS application for the MAPs to use to manage the virus or disease.

## **5.2 Recommendations**

This section details the recommendations for PSI, organizations or companies working in conjunction with our sponsor, or other parties who are interested in conducting a similar assessment. Included are the steps we feel need to be taken in order for PSI to get the best results from this research, further steps that could be taken, as well as guidelines for conducting a similar assessment.

### **5.2.1 Recommendations for PSI about choosing an application**

If PSI wants to use an existing application we recommend working with *HIV Connect*. This application has received the highest score based on our analysis and so, of all the existing HIV/AIDS applications, it is the one best suited to the MAPs. In order for the MAPs to use this application, a Thai version would have to be developed. Aside from the language, there are a couple of features *HIV Connect* is currently lacking that would improve its reception by the MAPs. If there is a problem with using *HIV Connect*, such as its community features being discontinued, PSI should consult our list of ranked existing HIV/AIDS mobile applications for other options. However, we do not recommend using any of the applications ranked as fourth or

below because our research has shown that these applications are not adequate.

Because the existing applications all have shortcomings, we strongly recommend that PSI develop a new application. This application should include all of the features that our list of features ranks as necessary as well as including as many of the optional features as reasonable. The necessary features that we recommend including in the application are information, a community element, and contact with a doctor. An optional feature that we recommend including is a security feature that will conceal the identity of the user. Our analysis has shown that these are the features that will make this application successful in improving HIV/AIDS management among members of the MAPs. Our research has also shown us that, although it received a score in the optional range, including some kind of self-monitoring feature, like a CD4 tracker, is very important. While the other features would help the MAPs learn about HIV and live more comfortably with the virus, once they are HIV-positive, they will learn that having a way to keep track of their progress will be very valuable.

We recommend that PSI try to incorporate details that appeal to the MAPs preferences. These may include having cute stickers in the community based element and chat features, using colors that appeal to the MAPs, or including any other elements that will help make the application visually appealing to the MAPs. Our background research revealed that Windows OS and Blackberry are two operating systems that will see greater usage in the future in Thailand. For that reason, PSI should keep these two operating systems in mind when developing a new application. We believe that PSI can find out the MAPs' preferences in terms of the application interface by performing a survey and holding focus groups with members of the MAPs. If these preferences are incorporated into the application, then it would be more likely that members of the MAPs will download and use the application.

### 5.2.2 Recommendations for PSI about refining the application

Once PSI has an application that they are prepared to have the MAPs use, we recommend that they conduct a usability study. Conducting a usability study involves having some of the target users test out the application and give feedback. This is an important process because it will tell PSI whether or not the user can actually get value from the way the features are implemented to achieve the intended purpose of the application. This process will also reveal any problems that the application might have that have not yet been discovered.

To market the application well, we recommend that PSI choose a name and logo for the application that does not blatantly advertise that the application is for HIV. Our research has shown that more people in the MAPs are willing to download an application without HIV in the title than with HIV in the title. We recommend using a title such as *Health Plus*, *Life Check*, or *Healthy Connection* that does not specifically mention HIV. We also suggest that the logo for the application not include a red AIDS ribbon, but instead have a plus symbol that might indicate health. Including the necessary and desirable features within an existing or new general health application is a possibility that could suppress discrimination from non-users.

We have noticed that there is an older generation among the MAPs that is not as willing or able to use a mobile application due to their insufficient knowledge about how to use some types of technology. Though an application will reach the bulk of the MAPs, we recommend that PSI investigate ways to either encourage use of an application among this older generation or to reach them without using an application.

### 5.2.3 Recommendations for conducting a similar study

For anyone who is interested in following a similar process to the one we followed in this study, we have created a framework for assessing applications or a similar type of technology in the future. This framework can be found in Appendix J. Our process does not only have to be

used for applications or even technology. By following this framework it is possible to give a ranking to any useful tool or process, and it is helpful to use while developing a product. The framework explains how to take into account information from all stakeholders in the decision and how to complete both of the analysis tools in order to reach a final, quantitatively-supported decision.

## References

- AIDS.gov. (2012). *A timeline of AIDS*. Retrieved November 13, 2013, from <http://aids.gov/hiv-aids-basics/hiv-aids-101/aids-timeline/>
- Akao, Y. (1990). *Quality Function Deployment: Integrating customer requirements into product design*. Cambridge, MA: Productivity.
- Autonomous Nonprofit Organization “TV-Novosti.” (2012). On-the-spot AIDS test: S. Africans to get revolutionary smartphone gadget. Retrieved February 5, 2014, from <http://rt.com/news/smartscope-aids-south-app-246/>
- AVERT. (2013). HIV & AIDS in Thailand. Retrieved November 10, 2013, from <http://www.avert.org/hiv-aids-thailand.htm>
- Boulos, M. N. K., Wheeler, S., Tavares, C., & Jones, R. (2011). How smartphones are changing the face of mobile and participatory healthcare: An overview, with example from eCAALYX. *Biomedical engineering online*, 10(1), 24.
- Centers for Disease Control and Prevention. (2011). HIV surveillance – United States, 1981-2008. *Morbidity and Mortality Weekly Report*, 60, 689-693.
- Chang, L. (2011). History of HIV/AIDS Slideshow: A Pictorial Timeline of the AIDS Pandemic. Retrieved November 16, 2013, from <http://www.webmd.com/hiv-aids/ss/slideshow-aids-retrospective>.
- Chiengkul. (2008, June 11). The social impact of AIDS. [translated from Thai]. Retrieved January 14, 2014, from <http://witayakorclub.wordpress.com/2008/06/11/%E0%B8%9B%E0%B8%B1%E0%B8%8D%E0%B8%AB%E0%B8%B2%E0%B8%9C%E0%B8%A5%E0%B8%81%E0%B8%A3%E0%B8%B0%E0%B8%97%E0%B8%9A%E0%B8%95%E0%B9%88%E0%B8%AD%E0%B8%AA%E0%B8%B1%E0%B8%87%E0%B8%84%E0%B8%A1%E0%B8%82%E0%B8%AD/>
- Darkins, A., Ryan, P., Kobb, R., Foster, L., Edmonson, E., Wakefield, B., & Lancaster, A. E. (2008). Care coordination/home telehealth: the systematic implementation of health informatics, home telehealth, and disease management to support the care of veteran patients with chronic conditions. *Telemedicine and e-Health*, 14(10), 1118-1126.
- Datadyne. (2013). Disruptive development: Small but powerful. Retrieved December 1, 2013, from <http://www.datadyne.org/about/>
- Earth, B. (2006). Diversifying gender: Male to female transgender identities and HIV/AIDS programming in Phnom Penh, Cambodia. *Gender & Development*, 14(2), 259-271.



- Focus Medica. (2013). HIV & AIDS Animated Pocket Dictionary. (Version 1.3) [Mobile application software] Retrieved from <https://itunes.apple.com/us/app/hiv-aids-animated-pocket-dictionary/id491128840?mt=8>
- Freifeld, C. C., Chunara, R., Mekar, S. R., Chan, E. H., Kass-Hout, T., Iacucci, A. A., & Brownstein, J. S. (2010). Participatory epidemiology: Use of mobile phones for community-based health reporting. *PLoS medicine*, 7(12), e1000376.
- Hunt, R. (2010). HIV and AIDS. The Board of Trustees of the University of South Carolina. Retrieved December 7, 2013 from <http://pathmicro.med.sc.edu/lecture/hiv2.htm>
- Kim, H.-W., Lee, H. L., & Son, J. E. (2011). Proceedings from the 11th International DSI and the 16th APDSI Joint Meeting: *An exploratory study on the determinants of smartphone app purchase*. Taipei, Taiwan.
- Kollmann, A., Riedl, M., Kastner, P., Schreier, G., & Ludvik, B. (2007). Feasibility of a mobile phone-based data service for functional insulin treatment of type 1 diabetes mellitus patients. *Journal of Medical Internet Research*, 9(5), e36.
- Komchadluek. [translated from Thai] (2013, December 15 [converted from Thai Buddhist Year 2557]). Geography Thailand mobile phone market in 2556. *Komchadluek*. Retrieved January 24, 2013 from <http://www.komchadluek.net/mobile/detail/20131215/174835.html>
- Li, L., Lee, S.-J., Thammawijaya, P., Jiraphongsa, C., & Rotheram-Borus, M. (2009). Stigma, social support, and depression among people living with HIV in Thailand. *AIDS Care*, 21(8), 1007-1013.
- Massachusetts Institute of Technology (2014). MIT App Inventor 2. (Version nb123a) [Mobile application software]. Retrieved February 24, 2014, from <http://ai2.appinventor.mit.edu/>
- Mirza, F., Norris, T. & Stockdale, R. (2008). Mobile technologies and the holistic management of chronic diseases. *Health Informatics Journal*, 14(4), 309-321.
- Muessig, K. E., Pike, E. C., LeGrand, S., & Hightow-Weidman, L. B. (2013). Mobile phone applications for the care and prevention of HIV and other sexually transmitted diseases: A review. *Journal of Medical Internet Research*, 15(1), e1.
- National Library of Medicine (2010). AIDSinfo HIV/AIDS Glossary. (Version 2.1.2) [Mobile application software]. Retrieved from <https://itunes.apple.com/us/app/aidsinfo-hiv-aids-glossary/id397417517?mt=8>
- Pawa, D., Jittakoat, Y., & Mundy, G. (2011). *FoQus: Factors associated with sexual risk behaviors among transgenders*. Unpublished PDF. Retrieved January 22, 2014 from PSI.

- Pawa, D., Ratchasi, S., Jittakoat, Y., & Mundy, G. (2012). *Thailand (2012): Baseline HIV/AIDS TRaC study among male sex workers in Bangkok and Pattaya*. Unpublished PDF retrieved January 22, 2014 from PSI.
- Population Services International. (2010a). *PSI at a glance*. Retrieved November 13, 2013, from <http://www.psi.org/about-psi/psi-at-a-glance>
- Population Services International. (2010b). *Thailand*. Retrieved November 16, 2013, from <http://www.psi.org/thailand>
- Tzeng, G.-H., & Huang, J.-J. (2011). *Multiple Attribute Decision Making: Methods and Applications*. Boca Raton, FL: CRC.
- UNAIDS. (2012a). *Country snapshots Thailand: HIV and men who have sex with men*. Retrieved December 1, 2013, from <http://www.aidsdatahub.org/sites/default/files/documents/MSMSnapshots-Thailand.pdf>
- UNAIDS. (2012b). *Thailand AIDS response progress report 2012*. Retrieved November 13, 2013, from [http://www.unaids.org/en/dataanalysis/knowyourresponse/countryprogressreports/2012countries/ce\\_TH\\_Narrative\\_Report\[1\].pdf](http://www.unaids.org/en/dataanalysis/knowyourresponse/countryprogressreports/2012countries/ce_TH_Narrative_Report[1].pdf)
- UNAIDS. (2012c). *World AIDS day report*. Retrieved November 13, 2013, from [http://www.unaids.org/en/media/unaids/contentassets/documents/epidemiology/2012/gr2012/jc2434\\_worldaidsday\\_results\\_en.pdf](http://www.unaids.org/en/media/unaids/contentassets/documents/epidemiology/2012/gr2012/jc2434_worldaidsday_results_en.pdf)
- UNAIDS. (2013a). *Global report 2012: UNAIDS report on the global AIDS epidemic*. Retrieved November 13, 2013, from [http://www.unaids.org/en/media/unaids/contentassets/documents/epidemiology/2012/gr2012/20121120\\_UNAIDS\\_Global\\_Report\\_2012\\_en.pdf](http://www.unaids.org/en/media/unaids/contentassets/documents/epidemiology/2012/gr2012/20121120_UNAIDS_Global_Report_2012_en.pdf)
- UNAIDS. (2013b). *Global report 2013: UNAIDS report on the global AIDS epidemic*. Retrieved January 23, 2014, from [http://www.unaids.org/en/media/unaids/contentassets/documents/epidemiology/2013/gr2013/UNAIDS\\_Global\\_Report\\_2013\\_en.pdf](http://www.unaids.org/en/media/unaids/contentassets/documents/epidemiology/2013/gr2013/UNAIDS_Global_Report_2013_en.pdf)
- Verkasalo, H., López-Nicolás, C., Molina-Castillo, F. J., & Bouwman, H. (2010). Analysis of users and non-users of smartphone applications. *Telematics and Informatics*, 27(3), 242-255.
- West, J. H., Hall, P. C., Hanson, C. L., Barnes, M. D., Giraud-Carrier, C., & Barrett, J. (2012). There's an app for that: Content analysis of paid health and fitness apps. *Journal of Medical Internet Research*, 14(3), e72.

- Winter, S. (2003). Research and discussion paper: *Language and identity in transgender: gender wars and the case of the Thai kathoey*. Paper presented at the Hawaii conference on Social Sciences, Waikiki, June 2003.
- Wolters Kluwer Health. (2013). AIDS Journal. (Version 1.3) [Mobile application software]. Retrieved from <https://itunes.apple.com/us/app/aids-journal/id494198191?mt=8v>
- Xu, Q., Erman, J., Gerber, A., Mao, Z., Pang, J., & Venkataraman, S. (2011). Proceedings from the 2011 ACM SIGCOMM conference on Internet measurement. *Identifying diverse usage behaviors of smartphone apps*. Berlin, Germany: ACM.
- Zichermann, G., & Cunningham, C. (2011). *Gamification by Design: Implementing Game Mechanics in Web and Mobile Apps*. Sebastopol, CA: O'Reilly Media. Retrieved February 10, 2014, from [ftp://ivacuum.ru/i/WooLF/\[2011\]%20Gamification%20by%20Design.pdf](ftp://ivacuum.ru/i/WooLF/[2011]%20Gamification%20by%20Design.pdf)

## Appendices

### Appendix A: Sponsor description

Population Services International (PSI) (2010a) is a registered non-profit organization that focuses on measurably improving the health of low-income, at-risk people in developing nations. PSI accomplishes their goal by marketing family planning through the private sector, providing health products and services, and raising awareness of health issues. Founded in 1970, PSI had an original mission of improving reproductive health using commercial marketing strategies. This mission was the primary focus for PSI's first 15 years of existence. Over time, PSI added projects about child survival, HIV, malaria, and tuberculosis to its repertoire. Today, this global health organization is comprised of a board of directors, senior staff, country managers, celebrity ambassadors, and 8,900 other staff. PSI receives funding from several donors: international governments, United Nations agencies, private sources, and the Global Fund to Fight AIDS, Tuberculosis, and Malaria; in 2012 PSI's annual revenue was \$546.4 million. The world headquarters for Population Services International is located in Washington, D.C., USA, and PSI programs have been established in 69 countries globally.

In 2003, PSI (2010b) extended its efforts into Thailand with an emphasis on HIV prevention upon the opening of the O-Zone Drop-In Center in Chiang Mai, a program that promotes healthier behaviors for injection drug users. Soon afterwards, PSI developed the Sisters Project, a program that provides HIV outreach activities and services to transgender individuals in Pattaya. Our project aligns with PSI/Thailand's efforts at decreasing HIV transmission rates among vulnerable populations, particularly men who have sex with men (MSM) and transgender women, as PSI currently provides HIV prevention products, services, and communications to Thai people. Together with the Thai Ministry of Public Health, the Health Department of

Bangkok Metropolitan Administration, and the Raks Thai Foundation, PSI continues to work towards improving the prevention and monitoring of HIV/AIDS cases in Thailand.

## Appendix B: Interview of Emmanuel Agu, WPI computer science professor

The following are the interview questions about mobile health care and application development asked by Gabriel Isko, Victoria Melchert, and Robert Mullins. The responses are provided by Emmanuel Agu, WPI computer science professor and developer of *Sugar*, recorded on December 6, 2013.

### 1. Please explain your credentials and any research you have performed related to using a smartphone as a platform for health care.

I have been involved with mobile computing, which is using mobile devices - laptops, tablets, phones - for about over 16 years. I have done everything from developing tour guides to general applications of all kinds. Three or four years ago I started to focus on health. The first thing I did was an MQP 8 years ago working with EMS services for Internet reporting. At the time, if someone breaks a leg, they can have to fill out a form and then it is put in a stack. Once a month someone had to put these forms in a computer. In 2004 or so we helped develop a mobile app to take into the incident site where a form could be filled out on a phone and uploaded to the database in real time. Now I work with a grant with a goal to help patients with diabetes. Diabetes patients are supposed to track carbs, glucose, weight, and other maintenance stuff. The app helps patients to track those things. Additionally, people with diabetes have wounds that will not heal over several years. People with those wounds have to go to a hospital to get checked out and cleaned. Some people without cars need to take an ambulance every week to do this. This is very expensive. The app allows you to take a picture of the wound and compare it to the last week's image to see if anything has changed. The app automatically compares the size and color of the wound and its cells to see what has changed. The patients can use the app to get feedback in their own homes. This empowers the patient and they believe that they have some control of the process. Patient engagement is key.

### 2. What are the details of your app?

The app is still currently being developed. We plan to back up our info in the cloud. HealthVault is a medical specific service to keep your data. Multiple providers can see this information by utilizing this cloud. Our audience is 55 and above, so we have large colorful buttons. We had focus groups to find what they wanted and what would help them. In general, the things you think will work will not work. We initially thought to propose social networking to help each other, but it turns out that the people who have diabetes that are far along just give up. When they give up, they don't care anymore, and they disappear. They put their heads in the sand. They stop doing what they are supposed to do. Like having to watch your carbs: people get a gallon of soda and doughnuts because they've given up. That is about as much carbs they should have in a week. They don't want to be identified so that people don't see that they are doing not-so-good things for their health. You have to expect non-compliance.

One of the things we have to make data entry easy is bluetooth readings. Step on a scale or take a glucose reading, and it is sent to the app. It has been suggested that we don't allow patients to be able to edit their data. Doctors say that these people would enter incorrect readings so that they can cheat or lie [to get away with bad behavior]. Even if they are doing bad things, you have to be positive with them. "You didn't weigh yourself to say? Well we will try again next week!" Try to stay positive. They are already down about their ailment. Think of something positive to say. "Good, you weighed yourself this week!"

3. What are your thoughts on app inventor, which was suggested by one of our advisors?

App inventor started as a google project. MIT took it over. Think of it like Lego blocks; you move around the visuals and hit a button and it spits out an application. The claim is that non-CS (computer science) majors should be able to do it. During an App inventor demonstration the man giving the talk had a bunch of technology problems and still managed to make an entire working game during the hour-long talk minus 10-30 minutes due to problems. He still finished.

4. How would we assess the effectiveness of an app in your opinion?

The first thing to do is pick the most popular ones, because people are using it. You go in and pick those ones, and look at the comments that they have said.

Otherwise, what makes a good app? I think number one would be ease of use. How is it laid out? How easy is it to figure out what you're looking for? Do the screens and buttons make sense? Basically, is it comprehensive?

Engagement is a big one. Is it pleasing; are their elements that engage you? Engaging things would be things like factoids. Facts that help you learn about the things about the disease that are context sensitive. Someone reading a book about HIV would zone out after 10 minutes. But if people are linked to a context aware message from that book [at an appropriate time], that is more useful. In recording their progress, say something like "80% of people that record their information live longer" etc. Visual appeal is important too; get an artist so that it looks nice. Have nice avatars. Make sure the screens look and feel is good. Interactive reminders are also important.

5. How would you suggest getting non-compliant patients to use the app?

Behavior change is a science; a branch of psychology. The first thing is to see what you can do to get someone to change from doing the wrong thing to right thing. You give rewards of some kinds. Set goals, goals are a big one. Set reminders, track where they are. The human mind plays lots of tricks. "Oh I'm doing a good job", but if you write it down it becomes much more clear. "Oh, wow I didn't do this thing for a whole week..."

6. Did you do a cost benefit analysis?

For me, cost-benefit is look at the certain way someone is doing something right now. For example, sequence of events (or work flow) that happens when they use paper, and then the work flow when they use the app. Workflow A versus workflow B. What is better about B compared to A.

Another random thing about apps; people talk about free apps. Most free apps have much more ads than paid ones. That's a factor of cost benefit analysis. Free apps have ads that take data, so when it says free it's really taking your data. Some people can't afford that.

7. Do you have any specific examples regarding our IQP to improve compliance?

Some things are going to be culture dependent. If the culture is family dependent, get their family involved. Peer dependent, get their friends involved. Capitalists dependent, get money involved.

The population that is not HIV-positive is important. For those people, give incentives for testing, incentives for lowering risky behaviors. Give incentives that are measurable in the form of rewards. Health care right now is reactive, you pay your insurance and if you get ill, you go to your doctor and get treated. But it is turning to preventative. An example would be the paying of healthy people to keep up with their good habits. People who have healthy lifestyles will not be ill as much, and cost less money to treat. You can pose preventive things around that, around HIV. The good thing about HIV is that you can go to a clinic and get pamphlets that give information on what to track. You know about American culture, so when you get to Thailand you have to tweak how you'd track that information.

8. What other technologies do you know of that can be useful for health tracking?

There are sensors, bands, and things can be done on the phone. You can take someone's heart rate, find an irregular heartbeat, and determine a person's mood or sleeping pattern from the phone. A phone has a lot of sensors, such as how much it is shaking, how light it is, how loud it is, etc. It can use these senses with machine learning to establish models such as "90% chance this person is sleeping" because of the current conditions.

9. What is your opinion on mobile health care and its benefits?

The main thing is that it helps with mobile tracking and preventive things. In the beginning it won't replace anything, but it has parallel information that it could get. It will slowly get into that information. The medical service is conservative. It will take a while. I have a run-tracker app for when I run, but my doctor doesn't know that. Eventually my doctor will say to me "You need to run more, get this app". Also, mobile health allows more access by more people. Countries like Thailand can get help that they wouldn't have 20 years ago because they can cheaply access it on the phone. It's more far reaching, everywhere, more disruptive.



## Appendix C: Interview protocol with case managers

The following interview protocol was utilized during interviews with five case managers from Mplus, SWING, Caremat, The HIV Foundation, and The Poz. English and Thai versions are provided.

### English Version

Hello,

We are students from Chulalongkorn University in Bangkok and Worcester Polytechnic Institute in the U.S. doing research on a project about assessing different types of technology-based approaches to health care, specifically HIV/AIDS prevention, monitoring, and treatment. Through this project we hope to target the general gay population, male sex workers, and transgender women in Thailand and reduce the impact of HIV/AIDS among these people. We appreciate you taking the time to speak with us. We hope to learn your opinions on and knowledge you have about technology-based health care, especially existing or possible future HIV/AIDS mobile applications. Your answers can be kept anonymous and confidential, if you so choose. You do not have to answer any questions that you are not comfortable answering. Thank you again for your time.

- 1. What do you believe are the benefits to technology-based health care?*
- 2. What are some technology-based media through which health care is currently delivered in Thailand or elsewhere?*
- 3. Do you believe mobile applications would be an effective strategy for technology-based health care? How and why or why not? For what aspects of health care?*
- 4. Have you performed any research on existing health care mobile applications? If so, which ones and what do you believe were some benefits and drawbacks of the existing mobile applications?*
- 5. What features do you believe are beneficial to include in a mobile application for the spreading and gathering of health care information? Please explain why.*
- 6. Have you performed any research on existing HIV/AIDS mobile applications? If so, which ones and what were some benefits and drawbacks of the existing HIV/AIDS mobile applications?*
- 7. What features do you as a case manager believe would be beneficial in an HIV/AIDS mobile application?*
- 8. What types of data would case managers hope to gather from using HIV/AIDS mobile applications? What benefit would this have on reducing the impact of HIV/AIDS?*

*9. How easily do you believe a person in the target populations - MSM and transgender women – could access an HIV/AIDS mobile application or other type of technology-based medium? Why or why not?*

*10. How willing do you think a person in the target populations would be to use an HIV/AIDS mobile application or other type of technology-based medium? Why or why not?*

*11. What features of an HIV/AIDS mobile application do you think the target populations would think to be desirable? Why?*

*12. What features of an HIV/AIDS mobile application do you think are most important to reduce the impact of the disease among members of the target populations?*

*13. How much money do you think it would cost to develop and maintain an HIV/AIDS mobile application? Who would bear these costs?*

*14. Do you think people in the target populations would be willing to purchase a phone with application capabilities and/or pay to use an HIV/AIDS mobile application? Why or why not?*

*15. Do you have any additional concerns or comments about promoting an existing or developing a new HIV/AIDS mobile application to target MSM and TG women in Thailand?*

This concludes our interview. Thank you again for taking the time to speak with us today. If we have any further questions, would you be willing to speak with us again?

## Thai Version

สวัสดี,

พวกเราเป็นนิตินิตจาก จุฬาลงกรณ์มหาวิทยาลัย และ วอร์เซสเตอร์ โพลีเทคนิค ซึ่งในขณะนี้ พวกเรากำลังทำโปรเจกต์ที่จะค้นหาและประเมินการใช้เทคโนโลยีต่างๆในส่วนของบริการด้านสุขภาพ โดยเน้นไปที่ การป้องกันโรค HIV/AIDS, การเฝ้าระวัง, และ การรักษา เราขอขอบคุณท่านที่เสียสละเพื่อตอบคำถามพวกเรา ทางนิตินิตเองคาดหวังเป็นอย่างยิ่งว่าจะได้ ทราบถึงความคิดเห็น และความรู้ของท่านในเรื่องเทคโนโลยีกับสุขภาพ โดยเฉพาะแอปพลิเคชันที่เกี่ยวข้องกับ HIV/AIDS ที่มีอยู่ ปัจจุบัน หรือที่จะถูกสร้างขึ้นในภายภาคหน้า คำตอบของท่านจะถูกเก็บเป็นความลับ และท่านไม่มีความจำเป็นต้องตอบคำถามที่ท่านไม่สะดวกในการตอบ ขอขอบคุณอีกครั้งที่ท่านสละเวลาในการตอบ

1. ท่านคิดว่าข้อดีของการผสมผสานของเทคโนโลยีและการดูแลและสุขภาพมีอะไรบ้าง?
2. ในขณะนี้ ประเทศไทยมีสื่อเทคโนโลยีใดบ้างที่เกี่ยวข้องกับการดูแลสุขภาพ?
3. ท่านเชื่อหรือไม่ ว่าแอปพลิเคชันในมือถือจะเป็นสื่อที่ดีที่สุดสำหรับการดูแลสุขภาพ? เพราะเหตุใด? เป็นสื่อที่ดีที่สุดสำหรับการดูแลสุขภาพในด้านใด?
4. ท่านเคยค้นคว้าเกี่ยวกับแอปพลิเคชันดูแลสุขภาพที่มีอยู่หรือไม่? หากเคย เป็นแอปพลิเคชันใดบ้างและ ท่านคิดว่าอะไรเป็นข้อดี และข้อเสีย ของแอปพลิเคชันเหล่านั้นบ้าง?
5. ท่านคิดว่าส่วนประกอบใดที่จะเป็นประโยชน์สำหรับแอปพลิเคชันในการรวบรวมและเผยแพร่ข้อมูล สำหรับการดูแลสุขภาพ? โปรดอธิบาย
6. ท่านเคยค้นคว้าเกี่ยวกับแอปพลิเคชันเกี่ยวกับโรคเอดส์ที่มีอยู่หรือไม่? หากเคย เป็นแอปพลิเคชันใดบ้างและ ท่านคิดว่าอะไรเป็นข้อดี และข้อเสีย ของแอปพลิเคชันเหล่านั้นบ้าง?
7. ท่านคิดว่าส่วนประกอบใดที่จะเป็นประโยชน์สำหรับแอปพลิเคชันในสายตาผู้ดูแลผู้ร่วมอยู่กับเชื้อ

สำหรับการรวบรวมและเผยแพร่ข้อมูลสำหรับการดูแลสุขภาพ? โปรดอธิบาย

8. ท่านคิดว่าข้อมูลส่วนตัวใดบ้างที่ผู้ดูแลผู้เข้าร่วมกับเชื้อคาดหวังจะได้รับจากการใช้แอปพลิเคชันสำหรับโรคเอดส์ และจะมีผลประโยชน์ใดบ้างที่จะช่วยในการลดการแพร่กระจายของเอดส์?
9. ท่านคิดว่าบุคคลที่มีความเสี่ยงเช่น กลุ่มชายรักชาย กลุ่มสาวประเภทสอง สามารถเข้าถึงข้อมูลเกี่ยวกับแอปพลิเคชันบนมือถือสำหรับ HIV/AIDS หรือสื่ออื่นๆที่เกี่ยวข้องกับข้อมูลดังกล่าวหรือไม่? และทำไม?
10. ท่านคิดว่าความเป็นไปได้ที่บุคคลเหล่านี้ที่จะใช้ แอปพลิเคชันบนมือถือสำหรับ HIV/AIDS หรือสื่ออื่นๆ เป็นไปได้แค่ไหน? และทำไม?
11. ท่านคิดว่าองค์ประกอบใด ในแอปพลิเคชัน HIV/AIDS เป็นสิ่งจำเป็นสำหรับกลุ่มเป้าหมาย? และทำไม?
12. ท่านคิดว่าองค์ประกอบใดในแอปพลิเคชัน HIV/AIDS เป็นสิ่งสำคัญที่จะลดผลข้างเคียงจาก HIV ในกลุ่มผู้เข้าร่วมกับเชื้อ?
13. ท่านคิดว่า การสร้าง การพัฒนา การคงอยู่ และการบำรุงรักษา สำหรับ แอปพลิเคชันนี้ มีค่าใช้จ่ายประมาณเท่าไร?
14. ท่านคิดว่ากลุ่มผู้มีความเสี่ยงสูง จะยินยอมในการชำระเงินเพื่อซื้อมือถือที่สามารถใช้แอปพลิเคชัน หรือจ่ายเงินเพื่อซื้อแอปพลิเคชัน HIV/AIDS หรือไม่? และทำไม?
15. ท่านมีข้อเสนอแนะ หรือ ความกังวลเกี่ยวกับการ โฆษณาแอปพลิเคชันทางการแพทย์ หรือ การพัฒนาแอปพลิเคชันทางการแพทย์ขึ้นมาใหม่เพื่อกลุ่มชายรักชายและกลุ่มสาวประเภทสองหรือไม่?

## Appendix D: Interview protocol with community-based program leaders

The following interview protocol was utilized during interviews with seven community-based organization leaders from Sisters, Mplus, SWING, Caremat, The HIV Foundation, and The Poz. English and Thai versions are provided.

### English Version

Hello,

We are students from Chulalongkorn University in Bangkok and Worcester Polytechnic Institute in the U.S. doing research on a project about assessing different types of technology-based approaches to health care, specifically HIV/AIDS prevention, monitoring, and treatment. Through this project we hope to target the general gay population, male sex workers, and transgender women in Thailand and reduce the impact of HIV/AIDS among these people. We appreciate you taking the time to speak with us. We hope to learn about your community-based organization and also about characteristics of MSM and TG women. By talking to you we hope to gain insight into the attitudes of MSM and transgender women towards HIV/AIDS and technology-based health care and also the population's awareness of the existing HIV/AIDS programs. Your answers can be kept anonymous and confidential, if you so choose. You do not have to answer any questions that you are not comfortable answering. Thank you again for your time.

- 1. What are the demographics of the people who utilize this facility? How many people visit daily? How many utilize this facility regularly?*
- 2. What types of services and care do these people receive?*
- 3. Have any people who visit this facility disclosed their HIV status to you? Why or why not?*
- 4. Do you believe there is a stigma about HIV/AIDS in Thailand? Why?*
- 5. What do you believe are the attitudes of MSM and transgender women towards HIV/AIDS? Why?*
- 6. Do you think MSM or transgender women receive adequate information about HIV/AIDS prevention? Why? What prevention tools do you provide them with, if any?*
- 7. Do you think MSM or transgender women at-risk for HIV/AIDS get tested often enough for the disease? Why or why not? What do you think causes these people not to go for initial or repeated HIV testing?*
- 8. Do you think MSM or transgender women with HIV/AIDS are receiving adequate health care? Why or why not?*

9. *Do you think MSM or transgender women with HIV/AIDS always report their disease status to health care professionals? If not, why?*

10. *Do you think MSM or transgender women with HIV/AIDS are receiving access to disease treatment? Why or why not? How do you think this can be improved?*

11. *Do you think MSM or transgender women would be able to use a mobile application or other technology-based medium for HIV/AIDS to improve prevention, monitoring, reporting, and treatment? Do you think they have adequate access to the Internet or smartphones?*

12. *Do you think these populations would be willing to use mobile applications or some other type of technology to receive and send information to a case manager? Why or why not?*

13. *Do you think integrating technology-based health care with community-based programs would be possible in order to improve the HIV/AIDS situation? How?*

14. *Do you think it would be beneficial to MSM and transgender people to integrate technology-based health care with community-based programs? Why and how?*

15. *What else do you think can be done to lessen the impact of HIV/AIDS among MSM and transgender people?*

This concludes our interview. Thank you for taking the time to speak with us today. If we have any further questions, would you be willing to speak with us again?

## Thai Version

สวัสดี,

พวกเราเป็นนิตินิตจาก จุฬาลงกรณ์มหาวิทยาลัย และ วอร์เซสเตอร์ โพลีเทคนิค ซึ่งในขณะนี้ พวกเรากำลังทำโปรเจกที่จะค้นคว้าและประเมินการใช้เทคโนโลยีต่างๆในส่วนของบริการด้านสุขภาพ โดยเน้นไปที่ การป้องกันโรค HIV/AIDS, การเฝ้าระวัง, และ การรักษา เราขอขอบคุณทุกท่านที่เสียสละเวลาเพื่อตอบคำถามพวกเรา ทางนิตินิตเองคาดหวังเป็นอย่างยิ่งว่าจะได้รับข้อมูลจากองค์กรของท่านเกี่ยวกับ สาวประเภทสอง กลุ่มเกย์ทั่วไป และกลุ่มชายขายบริการ

พวกเราหวังว่าคำตอบที่ได้รับจากท่านจะช่วยให้พวกเรา เข้าใจกลุ่มเสี่ยง เช่นสาวประเภทสอง และกลุ่มชายรักชายมากขึ้นเพื่อที่จะ สามารถหาแอปพลิเคชันที่เหมาะสมและตรงกับความต้องการของท่านได้ คำตอบของท่านจะถูกเก็บเป็นความลับและจะถูกอ้างอิงในการค้นคว้าของเราเท่านั้น ถ้าคำถามใดที่คุณรู้สึกไม่สะดวกใจที่จะตอบ คุณสามารถเว้นไว้ได้ พวกเราขอขอบคุณที่ท่านสละเวลาในการช่วยเหลือพวกเราในการกรอกแบบสอบถามนี้ พวกเราหวังว่าข้อมูลที่ท่านกรอกมาจะสามารถช่วยพวกบรรลุเป้าหมายของโปรเจกนี้

1. มีกลุ่มเฉพาะใดมารับบริการจากที่แห่งนี้บ้าง?  
ท่านสามารถประมาณจำนวนผู้ใช้บริการสถานที่แห่งนี้ได้หรือไม่?
2. พวกเขาได้รับการแบบไหนบ้าง?
3. เคยมีท่านใดที่มาที่นี่และเปิดเผยสถานะ โรคเอดส์ของตนต่อท่านหรือไม่?
4. ท่านเชื่อว่าในประเทศไทย ผู้ที่อยู่ร่วมกับเชื้อเอชไอวีถูกสังคมนรังเกียจหรือไม่ เพราะอะไร?
5. ท่านคิดว่ามุมมองและความคิดเห็นของกลุ่มชายรักชายและสาวประเภทสองที่มีต่อโรคเอดส์นั้นเป็นอย่างไร? และทำไม?
6. ท่านคิดว่ากลุ่มชายรักชายและสาวประเภทสองนั้น ได้รับข้อมูลที่เพียงพอหรือไม่ ในการป้องกันโรคเอดส์? และทำไม? ท่านมอบอุปกรณ์ป้องกันโรคเอดส์ให้พวกเขาหรือไม่?

ถ้าท่านมอบอุปกรณ์พวกนั้นให้กลุ่มเสี่ยง ท่านได้มอบอุปกรณ์ป้องกันแบบไหนให้พวกเขา?

7. ท่านคิดว่ากลุ่มชายรักชายและสาวประเภทสองนั้น ได้รับการตรวจรักษาโรคอย่างเพียงพอหรือไม่? และทำไม? ท่านคิดว่าทำไมกลุ่มเสี่ยงถึงไม่ต้องการไปตรวจหาโรคเอดส์ หรือกลับไปตรวจอีก?

8. ท่านคิดว่ากลุ่มชายรักชายและสาวประเภทสองนั้น ที่อยู่ร่วมกับเชื้อนั้น ได้เข้ารับการรักษาอย่างถูกต้องหรือไม่เพราะอะไร?

9. ท่านคิดว่าทำไมกลุ่มชายรักชายและสาวประเภทสองนั้น ไม่แจ้งข้อมูลทางการแพทย์ของพวกเขาต่อแพทย์และ บุคลากรทางการแพทย์?

10. ท่านคิดว่ากลุ่มชายรักชายและสาวประเภทสองที่เป็นคนไทย และไม่ใช่คนไทย นั้น จะสามารถเข้าถึง หรือรู้จัก โรงพยาบาลหรือสถานที่รักษาเอดส์ได้หรือไม่ เพราะอะไร? และถ้าไม่ ท่านคิดว่า จะแจ้งให้กลุ่มเสี่ยงทราบได้อย่างไร?

11. ท่านคิดว่ากลุ่มชายรักชายและสาวประเภทสองนั้น จะสามารถใช้แอปพลิเคชันในมือถือ หรือสื่อเทคโนโลยีอื่น ๆ ที่เกี่ยวกับการดูแลโรคเอดส์เพื่อที่จะพัฒนาการรักษา การป้องกัน และการรายงานผลการตรวจสุขภาพ ได้หรือไม่? ท่านคิดว่าพวกเขาสามารถเข้าถึงอินเทอร์เน็ตในสมาร์ตโฟนได้หรือไม่?

12. ท่านคิดว่ากลุ่มชายรักชายและสาวประเภทสองนั้น จะยอมใช้แอปพลิเคชันบนมือถือหรือสื่อเทคโนโลยีอื่น ๆ เพื่อที่จะรับหรือส่งข้อมูลหรือไม่? เพราะเหตุใด?

13. ท่านคิดว่าการผสมผสานเทคโนโลยีและการรณรงค์จากองค์กรของท่านนั้น เป็นไปได้หรือไม่? เพราะเหตุใด? และอย่างไร?

14. ท่านคิดว่า การผสมผสานเทคโนโลยีและการรณรงค์จากองค์กรของท่านนั้น จะเป็นประโยชน์ต่อกลุ่มชายรักชายและสาวประเภทสองหรือไม่? เพราะเหตุใด และอย่างไร?



15. ท่านคิดว่ามีสิ่งอื่นใดบ้างที่จะสามารถลดผลกระทบจาก โรคเอดส์ในกลุ่มชายรักชายและสาวประเภทสองได้?

พวกเราทั้งหมดขอขอบคุณท่านที่เสียสละเวลามาช่วยตอบคำถามของเรา  
และขอขอบคุณที่ท่านช่วยกระจายแบบสอบถามออนไลน์ให้กลุ่มเป้าหมายกรอก

## Appendix E: Questionnaire for target populations

The following is the final printed survey questionnaire that was distributed to and filled out by 49 members of the target populations. It asks about general demographic information, HIV/AIDS-related knowledge and practices, along with their ability and willingness to use mobile health care applications. English and Thai versions are provided.

### English Version

Hello,

This questionnaire is being distributed by students from Chulalongkorn University in Bangkok and Worcester Polytechnic Institute in the USA who are doing research to assess different types of technology-based approaches to health care, specifically HIV/AIDS prevention, monitoring, and treatment.

We appreciate you taking the time to fill out this questionnaire. We hope to learn basic demographical information, your involvement in community-based programs, and the measures you currently take to prevent or manage HIV. We also hope to learn your opinion on and familiarity with technology-based approaches to health care, such as the use of a mobile application. We hope to find ways to help people living with HIV/AIDS better manage their disease.

This questionnaire will take about 15 minutes to complete and has 68 questions.

Please fill out the following questionnaire as fully and honestly as possible. You do not need to answer questions that you are uncomfortable answering. Please keep in mind that your responses will be kept completely anonymous and confidential. We will not ask for any identifying information. Thank you for your time.

## General information

1. What is your gender?
  - Male
  - Female
  - Transgender
  - Other (please explain): \_\_\_\_\_
2. What is your sexual orientation?
  - Male
  - Female
  - Transgender
  - Other (please explain): \_\_\_\_\_
3. Age: \_\_\_\_\_

## Community-based organizations

4. Which community-based organizations have you heard of? (You may choose more than one.)
  - Sisters
  - SWING
  - Mplus
  - Rainbow Sky Association (RSAT)
  - The Poz
  - Caremat
  - Glory Hut
  - HIV Foundation
  - None
  - Other (please explain): \_\_\_\_\_
5. Which community-based organizations do you receive services from? (You may choose more than one.)
  - Sisters
  - SWING
  - Mplus
  - Rainbow Sky Association (RSAT)
  - The Poz
  - Caremat
  - Glory Hut
  - HIV Foundation
  - None
  - Other (please explain): \_\_\_\_\_
6. How often do you visit a community-based organization? (Please choose one.)
  - More than once per month
  - Once per month
  - A few times per year
  - Once per year
  - Less than once per year
  - Never
7. What services do you receive? (You may choose more than one.)
  - Mental support
  - Talk with staff or other visitors from CBO
  - Medical counseling
  - HIV services
  - None
  - Other (please explain): \_\_\_\_\_

**HIV prevention information**

8. Please rate the amount that you use each HIV transmission prevention method. (Please only choose one for each method.)

	I never use this prevention method	I sometimes use this prevention method	I always use this prevention method	I have never heard of this prevention method	I don't want to answer
Condom					
Water-based lubricant					
Microbicides					
Pre-exposure Prophylaxis (PrEP)					
Post-exposure Prophylaxis (PEP)					
Not sharing needles					

9. How many times per year do you get tested for HIV? (Please choose one.)

- I have never had an HIV test.
- I have been tested once over many years.
- Once
- Twice
- More than twice
- I do not feel comfortable answering this question.

10. How many months ago was your last HIV test? (Please choose one.)

- I have never had an HIV test.
- Within 3 months
- Within 6 months
- Within 1 year
- Within 2 years
- More than 2 years ago
- I do not feel comfortable answering this question.

11. Check any reasons that apply for why you have not had an HIV test. (You may choose more than one.)

- I have never been asked to get tested by a health care professional.
- I trust that my partner will not be HIV+.
- I am afraid to know my status.
- I do not think I am at-risk for HIV.
- I do not know where to get tested.
- I do not have access to HIV testing.
- I am afraid to encounter discrimination.
- Other (please explain): \_\_\_\_\_

12. What is your current HIV status?

- Positive
- I do not know my current HIV status.

- Negative
- I am not comfortable sharing my HIV status.

13. If you were HIV-positive, who would you be comfortable sharing your status with?

- Personal doctor
- Family
- Friends
- Strangers
- Sexual partners
- No one
- Other (please explain):\_\_\_\_\_

14. Have you joined any of the following Facebook groups? (If your Facebook group is not listed, please name it in the “other” category.)

- “Foundation for AIDS Rights” (FAR) Facebook page
- “We are humans too even though we have HIV” Facebook page
- “HIV-positive network/AIDS Thailand” Facebook page
- “1663 AIDS consulting hotline” Facebook
- I do not have a Facebook account.
- I did not know that these groups existed.
- I have heard of one or more of these groups but do not belong to one.
- Other (please explain):\_\_\_\_\_

15. If HIV-positive, do you regularly monitor your disease through CD4 and viral load testing?

- Yes
- No
- I have not heard of these methods.

16. Check any reasons that apply for why you might not receive HIV/AIDS treatment if positive. (You may choose more than one.)

- I am not aware of treatment options.
- I cannot afford treatment options.
- I cannot access treatment options.
- I do not believe treatment is effective.
- I am fearful of receiving treatment.
- I am fearful of discrimination.
- I do not want to receive treatment.
- Other (please explain):\_\_\_\_\_

17. Have you ever shared your HIV status with a doctor to start treatment?

- Yes
- No

18. Are you comfortable sharing your status with a doctor through the Internet?

- Yes
- No

19. Do you think someone’s HIV status affects the way people treat them?

- Yes
- No

20. Did you know that antiretroviral treatment (ART), the primary method for treating HIV, is free for Thai nationals?

- Yes
- No

**Information about technology**

This next section of the survey will be used to gather information about your Internet, phone, and mobile application usage.

**Internet and mobile phones**

21. Do you have access to the Internet?

- Yes
- No

22. Please check any methods that you use to access the Internet. (You may choose more than one.)

- Personal computer
- Tablet
- Mobile phone
- Public computer or Internet cafe
- Friend's computer
- I do not access the Internet.
- Other (please explain): \_\_\_\_\_

23. Do you use Internet services to meet new people?

- Yes
- No

24. Please check any service that you have used to meet new people. (You may choose more than one.)

- Facebook
- Twitter
- Zweii
- Grindr
- JackD
- Hornet
- Gayromeo
- Other (please explain): \_\_\_\_\_

25. What kind of mobile phone do you have? (You may choose more than one.)

- Smartphone
- Feature phone
- I don't have a mobile phone
- Other (please explain): \_\_\_\_\_

26. If you have a smartphone, what kind of smartphone do you have? (You may choose more than one.)

- Google Android
- Apple iOS
- Microsoft Windows Phone
- Blackberry
- Other (please explain): \_\_\_\_\_

27. If you own a tablet, what operating system does it run on? (You may choose more than one.)

- Google Android
- Apple iOS
- Microsoft Windows
- I do not have a tablet.
- I have multiple tablets with multiple operating systems
- Other (please explain): \_\_\_\_\_

## Applications

28. Do you use mobile applications?

Mobile applications count on any handheld device, including those that are borrowed or a friend's.

- Yes       No

29. What types of applications do you typically use?

- Social networking       Information  
 Games       Health care  
 Entertainment       Other (please explain): \_\_\_\_\_

30. How much do you typically pay for an application?

- I prefer to download free applications.       1.99 - 3.99 (~60 baht – 120 baht)  
 0.99 USD (~30 baht)       4.99 or over (~150 baht or over)

31. If you use a health care application, what do you use it for?

- General health care information       Contact with a doctor or pharmacist  
 Specific health care information       Find closest clinic or hospital  
(diabetes, hypertension, heart health,       Personal health care recording (weight,  
AIDS)      BMI, blood pressure, blood tests)  
 Reminders (to take medication, doctors  
appointments)

## Evaluation of application attributes

Please rate the following attributes of mobile applications based on how important they are to you, with 1 being not important and 4 being very important.

	1 Not important	2 Somewhat important	3 Important	4 Very Important
32. <b>Easy installation</b> – (The application has a quick installation and set-up.)				
33. <b>Frequent updates</b> – (The application has many updates.)				
34. <b>Entertaining</b> – (The application has some sort of interactive features, like a game, puzzle, trivia, etc.)				
35. <b>Interesting</b> – (The application provides new information and/or has a unique set-up.)				
36. <b>Useful</b> – (The application helps you in your daily life.)				
37. <b>Easy to use</b> – (The application requires little-to-no learning to be able to use.)				
38. <b>Stable</b> – (The application does not crash or lose data.)				

39. Which of the application attributes is the most important to you? (Please choose one.)

- |  |                                    |   |
|--|------------------------------------|---|
| <input type="radio"/> Easy to install      | <input type="radio"/> Entertaining | <input type="radio"/> Easy to use                   |
| <input type="radio"/> Updated infrequently | <input type="radio"/> Interesting  | <input type="radio"/> Stable                        |
| <input type="radio"/> Updated frequently   | <input type="radio"/> Useful       | <input type="radio"/> Other (please explain): _____ |

40. What might cause you to stop using and/or uninstall an application? (You may choose more than one.)

- |  |  |
|--|--|
| <input type="radio"/> It was boring.             | <input type="radio"/> It took up too much memory on my device. |
| <input type="radio"/> It did not update enough.  | <input type="radio"/> It had many errors.                      |
| <input type="radio"/> It updated too frequently. | <input type="radio"/> It ran slowly.                           |
| <input type="radio"/> It stopped being useful.   | <input type="radio"/> Other (please explain): _____            |

41. What would you be willing to pay for an app?

- |   |  |
|---|--|
| <input type="radio"/> Free                | <input type="radio"/> 1.99 – 3.99 (~60 – 120 baht)     |
| <input type="radio"/> 0.99 USD (~30 baht) | <input type="radio"/> 4.99 or over (~150 baht or over) |

**Factors that influence the download/purchase of an application**

Please rate the following factors based on how influential they are when it comes to downloading/purchasing an application.

	1 Not important	2 Somewhat important	3 Important	4 Very important
42. <b>Positive trial performance</b> – (The application supported a trial version which performed well.)				
43. <b>Community element</b> – (Using the application allows you to be part of a group, either connecting with your personal friends or contributing to an online community.)				
44. <b>High ranking</b> – (The application had a high ranking (many downloads) in the app store.)				
45. <b>Personal recommendation</b> – (Friends or family have personally said that the application is good.)				
46. <b>Positive online reviews</b> – (The applications received positive reviews on the Internet from past users.)				
47. <b>Free</b> – (The application was free.)				
48. <b>Inexpensive</b> – (The application has a price that was low.)				
49. <b>Positive word of mouth</b> – (You have				



heard that the application is good from various sources.)				
---	--	--	--	--

50. Which of the following factors most influences you to download/purchase an application? (Please choose one.)

- Positive trial performance
- Supported community element
- High marketplace ranking
- Personal recommendation
- Positive word of mouth
- Positive online reviews
- Price is “free”
- Price is inexpensive
- Other (please explain): \_\_\_\_\_

**Health care application information**

51. What is your experience with mobile health care applications? (You may choose more than one.)

- I have used a mobile application to monitor my health.
- I would be willing to use a mobile application to monitor my health.
- I would feel uncomfortable using a mobile application to monitor my health.
- I am not interested in a health care application.

52. What is the maximum price you are willing to pay for a medical application?

- 0.99 USD (~30 baht)
- 1.99 – 3.99 USD (~60 – 120 baht)
- 4.99 or over (~150 baht or over)
- I would not pay for one.
- I would not download a medical application.

53. What reasons might cause you to not persistently use a health care application? (You may choose more than one.)

- It did not have enough information.
- It did not connect me to a doctor.
- It did not help me with my medical condition.
- I did not wish others to see the application on my device.
- I recovered from my medical problem and no longer needed the application.
- I was not motivated to use the application.
- Other (please explain): \_\_\_\_\_

54. Would you be willing to communicate with a medical professional securely over your phone through texting or calling about HIV/AIDS?

- Yes
- No

**Health care application attributes**

Please rate the following attributes of health care applications based on how important they are to you, with 1 being not important and 4 being very important.

	1 Not important	2 Somewhat important	3 Important	4 Very important
--	-----------------------	----------------------------	----------------	------------------------

55. <b>Self-diagnosis</b> – (The application helps you to diagnose any medical problems you may have.)				
56. <b>Referrals and advice</b> – (The application refers you to medical professionals and gives advice on how to address your medical problem.)				
57. <b>Maps to clinics</b> – (The application provides help in locating and getting to medical clinics.)				
58. <b>Interactivity</b> – (The application has a game, quiz, or other interactive feature.)				
59. <b>Progress tracking</b> – (The application can track your progress with medication or other medical treatments.)				
60. <b>Information</b> – (The application provides useful information as well as trivia about interesting medical topics.)				
61. <b>Contact with doctor</b> – (The application can connect you to an actual doctor to receive information or schedule appointments.)				
62. <b>Reminders and calendars</b> – (The application has an available system to remind the user to take medication and visit medical clinics.)				

63. Which of these health care application features is the most important to you? (Please choose one.)

- |  |   |
|--|---|
| <input type="radio"/> Self-diagnosis       | <input type="radio"/> Information             |
| <input type="radio"/> Referrals and advice | <input type="radio"/> Contact with doctor     |
| <input type="radio"/> Maps to clinics      | <input type="radio"/> Reminders and calendars |
| <input type="radio"/> Interactivity        | <input type="radio"/> Other (please explain): |
| <input type="radio"/> Progress tracking    | _____   |

64. What would you expect to use a health care application for? (You may choose more than one.)

- To receive general health information.
- To receive specific information about a health problem.
- To communicate with a medical professional.
- To find health care clinics.
- To track my general health and treatment progress.
- To receive reminders to take treatment.
- Other (please explain): \_\_\_\_\_

65. Are you willing to download an application with “HIV/AIDS” in the title?

- Yes

- No

66. Are you willing to download a general health care application without “HIV/AIDS” in the title but with information about HIV still included in the application?

- Yes
- No

### **Computer**

67. Do you have a computer at home?

- Yes
- No

68. Do you prefer to use programs on a personal computer over applications?

- Yes
- No

This concludes the questionnaire. Thank you for taking the time to answer our questions. Your answers will be kept anonymous and individually confidential. All questionnaires will be destroyed after data collection and analysis have been completed. The information we gather will be used to help develop an effective mobile health care application for those most at-risk for HIV/AIDS.

## Thai Version

สวัสดี,

พวกเราคือนิสิตจาก จุฬาลงกรณ์มหาวิทยาลัย และ วอร์ซสเตอร์ โพลีเทคนิค  
ซึ่งในขณะนี้พวกเรากำลังทำโปรเจกต์เกี่ยวกับการประเมินการใช้เทคโนโลยีต่างๆ  
ในส่วนของบริการด้านสุขภาพ โดยเน้นไปที่การพัฒนาแอปพลิเคชัน เกี่ยวกับ การเฝ้าระวัง  
และการรักษาสุขภาพ เราขอขอบคุณท่านที่เสียสละเวลาเพื่อตอบคำถามของเรา

ทางนิติตเองคาดหวังเป็นอย่างยิ่งว่าจะได้ทราบถึงความคิดเห็น  
และความรู้ของท่านในเรื่องเทคโนโลยีกับสุขภาพ โดยเฉพาะแอปพลิเคชันที่เกี่ยวข้องกับ HIV/AIDS ที่มีอยู่ ณ  
ปัจจุบัน หรือที่จะถูกพัฒนาขึ้นในอนาคต

แบบสอบถามนี้มีทั้งหมด 68 ข้อ และจะใช้เวลาประมาณ 15 นาที ในการกรอกคำตอบ

โปรดตอบแบบสอบถามนี้ให้ใกล้เคียงความจริงมากที่สุดเท่าที่ท่านจะทำได้  
คำตอบของท่านจะถูกเก็บเป็นความลับ และท่านไม่มีความจำเป็นที่จะต้องตอบคำถามที่ท่านไม่ต้องการที่จะตอบ

ขอขอบคุณอีกครั้งที่ท่านสละเวลาในการตอบแบบสอบถามนี้

## ข้อมูลทั่วไป

1. เพศของคุณ?

- ชาย
- หญิง
- สาวประเภทสอง
- อื่นๆ (โปรดระบุ) : \_\_\_\_\_

2. คุณชอบเพศไหน?

- ชาย
- หญิง
- สาวประเภทสอง
- อื่นๆ (โปรดระบุ) : \_\_\_\_\_

3. อายุ: \_\_\_\_\_

## องค์กรเพื่อชุมชน

4. ท่านเคยได้ยินชื่อขององค์กรชุมชนใดบ้าง (เลือกได้มากกว่าหนึ่งข้อ)

- Sisters
- Swing
- Mplus
- ฟาสีรุ่ง (RSAT)
- The Poz
- Caremat
- Glory Hut
- HIV Foundation (มูลนิธิ HIV ประเทศไทย)
- ไม่เคยได้ยินเลย
- อื่นๆ (โปรดระบุ) : \_\_\_\_\_

5. ท่านรับบริการจากองค์กรชุมชนใดบ้าง? (เลือกได้มากกว่าหนึ่งข้อ)

- Sisters
- Swing
- Mplus
- ฟาสีรุ่ง (RSAT)
- Caremat
- Glory Hut
- HIV Foundation (มูลนิธิ HIV ประเทศไทย)
- ไม่เคยได้ยินเลย

The Poz

อื่นๆ (โปรดระบุ) : \_\_\_\_\_

6. โดยปรกติแล้ว ท่านรับบริการจาก องค์กรชุมชนต่างๆตามที่ระบุข้างต้น บ่อยแค่ไหน? (เลือกเพียงหนึ่งข้อ)

มากกว่าหนึ่งครั้งต่อเดือน

ปีละครั้ง

เดือนละหนึ่งครั้ง

น้อยกว่าปีละครั้ง

ปีละสองสามครั้ง

ไม่เคยเลย

7. ท่านรับบริการแบบใดบ้าง? (เลือกได้มากกว่าหนึ่งข้อ)

ได้การสนับสนุนทางด้านจิตใจ

บริการเกี่ยวกับ HIV (การตรวจ, การรับการปรึกษา,

ได้พูดคุยกับคนในองค์กร

การรับถุงยางอนามัย)

ได้รับการปรึกษาทางการแพทย์

ไม่มี

อื่นๆ (โปรดระบุ) : \_\_\_\_\_

### คำถามเกี่ยวกับ HIV

8. โปรดเลือกความถี่ที่ท่านใช้ในป้องกันการติดเชื้อเอชไอวีในแต่ละวิธีด้านล่าง (กรุณาตอบทุกวิธี)

	ไม่เคยใช้เลย	ใช้บางครั้ง	ใช้สม่ำเสมอ	ไม่เคยได้ยีน	ไม่ยากตอบ
	ย			น	บ
ถุงยางอนามัย					
สารหล่อลื่น					
เจลฆ่าเชื้อ HIV (Microbicides)					
ยาด้านไวรัสชนิดก่อนการสัมผัสเชื้อ (PrEP)					
ยาด้านไวรัสก่อนหลังการสัมผัสเชื้อ (PEP)					
ไม่ใช้เข็มร่วมกัน					

9. ในหนึ่งปี ท่านเข้ารับบริการตรวจ HIV กี่ครั้ง? (เลือกเพียงหนึ่งข้อ)

ฉันไม่เคยรับบริการตรวจมาก่อน

2 ครั้ง

หนึ่งครั้งในหลายปีที่ผ่านมา

มากกว่า 2 ครั้ง

1 ครั้ง

ฉันรู้สึกไม่สบายใจในการตอบ

10. ท่านตรวจ HIV ครั้งสุดท้ายเมื่อไหร่? (เลือกเพียงหนึ่งข้อ)

ฉันไม่เคยรับบริการตรวจมาก่อน

ภายใน 2 ปีที่ผ่านมา

ภายใน 3 เดือนที่ผ่านมา

มากกว่า 2 ปี

ภายใน 6 เดือนที่ผ่านมา

ฉันรู้สึกไม่สบายใจในการตอบ

ภายใน 1 ปีที่ผ่านมา

11. ทำไมท่านถึงคิดว่าท่านไม่จำเป็นที่จะต้องเข้ารับการตรวจ HIV? (เลือกได้มากกว่าหนึ่งข้อ)

แพทย์ผู้ดูแลของฉันไม่เคยแนะนำให้ฉันตรวจ

ฉันไม่สามารถเข้าถึงการตรวจได้ เช่น

ฉันเชื่อใจว่าคู่อภิเษกของฉันไม่ติดเชื้อ

สถานที่ตรวจอยู่ไกลเกินไป

ฉันกลัวที่จะรู้ผล

หรือไม่สามารถเดินทางไปได้

ฉันไม่คิดว่าฉันอยู่ในกลุ่มผู้ที่เสี่ยงในการติดเชื้อ

ฉันกลัวว่าจะโดนรังเกียจหากฉันติดเชื้อ

HIV

อื่นๆ (โปรดระบุ): \_\_\_\_\_

ฉันไม่ทราบว่าจะตรวจได้ที่ใดบ้าง

12. ตอนนี้สถานะการติดเชื้อ HIV ของท่านเป็นอย่างไร? (เลือกเพียงหนึ่งข้อ)

ติดเชื้อ (ผลเป็นบวก ตรวจพบเชื้อ HIV)

ฉันไม่ทราบ

ไม่ติดเชื้อ (ผลเป็นลบ ตรวจไม่พบเชื้อ

ฉันไม่สบายใจที่จะตอบ

HIV)

13. ถ้าท่านติดเชื้อ HIV ท่านสบายใจที่จะเปิดเผยสถานะการติดเชื้อ HIV ของท่านกับผู้ใด?

(เลือกได้มากกว่าหนึ่งข้อ)

แพทย์ผู้ดูแล

คู่รัก

ครอบครัว

ไม่มี

เพื่อน

อื่นๆ (โปรดระบุ): \_\_\_\_\_

คนแปลกหน้า

14. ท่านได้เข้าร่วมกลุ่มในเฟซบุ๊กสำหรับผู้ตรวจพบ HIV หรือไม่? (เลือกได้มากกว่าหนึ่งข้อ)

- มุถุนิธิศูนยคุมครองสิทธิดานเอคส์ (FAR)
- เป็นเอคส์ ก็ เป็นคน
- TNP+ เครื่อง่ายผู้ติดเชื้อเอชไอวี/เอคส์ ประเทศไทย
- 1663 สายคว่นปรักษาเอคส์
- ฉันไม่มีบัญชีเฟซบุ๊ก
- ฉันไม่ทราบว่ามีกลุ่มเหล่านี้
- ฉันเคยได้ยื่นชื่อกลุ่มเหล่านี้แต่ไม่ได้เข้าร่วม
- อื่นๆ (โปรดระบุ) : \_\_\_\_\_

15. ท่านตรวจเลือด - เช็คค่าภูมิคุ้มกัน CD4 และปริมาณเชื้อไวรัส (HIV - RNA) อย่างสม่ำเสมอหรือไม่?

- ใช่
- ไม่
- ฉันไม่เคยได้ยื่นเกี่ยวกับวิธีนี้

16. กรุณาเลือกเหตุผลที่ทำให้ท่านไม่เข้ารับการรักษา (เลือกได้มากกว่าหนึ่งข้อ)

- ฉันไม่ทราบว่ามีการรักษาแบบใดบ้าง
- ฉันไม่สามารถชำระค่ารักษาพยาบาลได้
- ฉันไม่สามารถเข้าถึงการรักษาได้
- ฉันไม่เชื่อว่าการรักษาจะได้ผล
- ฉันกลัวที่จะรับการรักษา
- ฉันกลัวที่จะถูกเหยียดหยาม
- ฉันไม่ต้องการรับการรักษา
- อื่นๆ (โปรดระบุ) : \_\_\_\_\_

17. ท่านเคยเปิดเผยสถานะการติดเชื้อ HIV ให้แพทย์เฉพาะทางทราบเพื่อที่จะเริ่มต้นการรักษาหรือไม่?

- เคย
- ไม่เคย

18. ท่านสบายใจที่จะให้ข้อมูลกับแพทย์ผู้ดูแลท่านผ่านทางอินเทอร์เน็ตหรือไม่?

- สบายใจ
- ไม่สบายใจ

19. ท่านคิดว่าการติดเชื้อ HIV มีผลต่อผู้อื่นในการปฏิบัติกับผู้อยู่ร่วมกับเชื้อหรือไม่?

- มี
- ไม่มี

20. ท่านทราบหรือไม่ว่า สำหรับบุคคลที่มีสัญชาติไทยนั้น สามารถเข้ารับการรักษาได้โดยไม่คิดค่าใช้จ่าย? การรักษาด้วยยาด้านไวรัส (Antiretroviral Therapy, ART)

- ทราบ
- ไม่ทราบ



## ข้อมูลเกี่ยวกับแอปพลิเคชัน

ในช่วงที่สองของแบบสอบถามนี้จะถามท่านเกี่ยวกับการใช้งานอินเทอร์เน็ต มือถือ และแอปพลิเคชัน

21. ท่านใช้อินเทอร์เน็ตหรือไม่?

- ใช่       ไม่ใช่

22. ท่านใช้อุปกรณ์ใดในการเชื่อมต่ออินเทอร์เน็ต ? (ท่านสามารถเลือกได้มากกว่าหนึ่งข้อ)

- คอมพิวเตอร์ส่วนตัว       คอมพิวเตอร์ของเพื่อน  
 แท็บเล็ต       ฉันไม่มีอุปกรณ์ที่จะเชื่อมต่ออินเทอร์เน็ต  
 มือถือ       อื่นๆ (โปรดระบุ) : \_\_\_\_\_  
 คอมพิวเตอร์สาธารณะ  
หรือร้านอินเทอร์เน็ต

23. ท่านใช้บริการต่างๆ ในอินเทอร์เน็ต เพื่อรู้จักเพื่อนใหม่ บ้างหรือไม่?

- ใช่       ไม่ใช่

24. โปรดระบุช่องทางที่คุณใช้เพื่อรู้จักเพื่อนใหม่ทางอินเทอร์เน็ต? (เลือกได้มากกว่าหนึ่งข้อ)

- Facebook       Grindr       Gayromeo  
 Twitter       JackD       อื่นๆ (โปรดระบุ) : \_\_\_\_\_  
 Zweii       Hornet

25. ท่านใช้มือถือแบบไหน? (เลือกเพียงหนึ่งข้อ)

- สมาร์ทโฟน       มือถือปุ่มกด       ฉันไม่ใช้มือถือ       อื่นๆ  
(ฟีเจอร์โฟน)      (โปรดระบุ) : \_

26. โปรดระบุระบบปฏิบัติการของสมาร์ทโฟนที่คุณใช้? (เลือกเพียงหนึ่งข้อ)

- Google       Microsoft Windows       อื่นๆ (โปรดระบุ) : \_\_\_\_\_  
Android      Phone  
 Apple iOS       Blackberry

27. หากท่านมีแท็บเล็ต แท็บเล็ตของท่านทำงานบนระบบปฏิบัติการใด? (เลือกเพียงหนึ่งข้อ)

- Google Android
- Microsoft Windows
- ฉันมีแท็บเล็ตหลายเครื่องจึงมีหลายระบบปฏิบัติการ
- Apple iOS
- ฉันไม่มีแท็บเล็ต
- อื่นๆ (โปรดระบุ) : \_\_\_\_\_

### แอปพลิเคชัน

28. ท่านใช้แอปพลิเคชันบนมือถือหรือไม่? ไม่ว่าจะเป็นบนมือถือของท่านหรือของผู้อื่นที่ท่านยึดก็ตาม?

- ใช่
- ไม่ใช่

29. โดยปรกติแล้ว ท่านใช้แอปพลิเคชันแบบไหน? (เลือกได้มากกว่าหนึ่งข้อ)

- แอปพลิเคชันเครือข่ายสังคมออนไลน์ (เฟซบุ๊ก ทวิตเตอร์)
- แอปพลิเคชันเกม
- แอปพลิเคชันสื่อบันเทิง (youtube / ดูหนังฟังเพลง และอื่นๆ)
- แอปพลิเคชันข้อมูลข่าวสาร
- แอปพลิเคชันการดูแลสุขภาพ
- อื่นๆ (โปรดระบุ) : \_\_\_\_\_

30. โดยปรกติแล้ว ท่านซื้อแอปพลิเคชันในราคาเท่าไร? (เลือกเพียงหนึ่งข้อ)

- ฉันมักจะดาวน์โหลดแอปพลิเคชันฟรี
- ประมาณ 30 บาท
- ประมาณ 60~120 บาท
- มากกว่า 150 บาท

31. หากท่านใช้แอปพลิเคชันด้านสุขภาพ ท่านจะใช้ทำอะไรบ้าง? (เลือกได้มากกว่าหนึ่งข้อ)

- รับข้อมูลทั่วไปเกี่ยวกับสุขภาพ (โดยไม่เจาะจงโรคใดโรคหนึ่ง)
- รับข้อมูลเกี่ยวกับปัญหาเฉพาะด้านเกี่ยวกับสุขภาพ (เช่น เบาหวาน ความดัน โรคหัวใจ เอคส์ อย่างเจาะจง)
- เดือนเวลาที่จะต้องทานยา หรือ พบแพทย์
- ติดต่อแพทย์หรือเภสัช
- หากคลินิกหรือโรงพยาบาลที่อยู่ใกล้ที่สุด
- ดูข้อมูลโดยรวมเกี่ยวกับสุขภาพของตัวเอง (น้ำหนัก BMI ความดัน ผลเลือด)

**การประเมินองค์ประกอบของแอปพลิเคชันด้านสุขภาพ**

กรุณาให้คะแนนตามความสำคัญขององค์ประกอบนั้นๆ ที่มีต่อท่าน (1 คือ ไม่สำคัญ 4 คือ สำคัญมาก)

กรุณาตอบทุกข้อ

	1 (ไม่สำคัญเลย)	2 (ไม่สำคัญ)	3 (สำคัญ)	4 (สำคัญมาก)
32. การติดตั้ง (การติดตั้งที่ง่าย รวดเร็วและสะดวก)				
33. การอัปเดต (มีการอัปเดตอย่างสม่ำเสมอ)				
34. ความบันเทิง (มีองค์ประกอบที่สร้างความสนุกให้ผู้ใช้ เช่น เกม คำถาม ฯลฯ)				
35. ความน่าสนใจ (มีข้อมูลใหม่ๆ อย่างสม่ำเสมอ)				
36. ประโยชน์การใช้สอย (สามารถนำไปใช้ชีวิตประจำวันได้)				
37. มีความง่ายต่อการใช้งาน (สามารถเข้าใจได้ง่าย)				
38. ความเสถียร (แอปพลิเคชันนี้สามารถทำงานได้อย่างราบรื่น)				

39. ท่านคิดว่าองค์ประกอบส่วนใดของแอปพลิเคชันสำคัญต่อท่านมากที่สุด? (เลือกเพียงหนึ่งข้อ)

- |   |   |  |
|---|---|--|
| <input type="radio"/> การติดตั้งที่ง่าย | <input type="radio"/> มีความบันเทิง     | <input type="radio"/> ความง่ายต่อการใช้งาน |
| <input type="radio"/> การอัปเดตที่น้อย  | <input type="radio"/> ความน่าสนใจ       | <input type="radio"/> ความเสถียร           |
| <input type="radio"/> การอัปเดตที่ดี    | <input type="radio"/> ประโยชน์การใช้สอย | <input type="radio"/> อื่นๆ                |

40. เหตุผลที่จะทำให้ท่านลบแอปพลิเคชันทิ้ง? (เลือกได้หลายข้อ)

- |  |  |
|--|--|
| <input type="radio"/> แอปพลิเคชันไม่มีความน่าสนใจ        | <input type="radio"/> แอปพลิเคชันใช้พื้นที่ความจำมากเกินไป |
| <input type="radio"/> แอปพลิเคชันไม่มีการอัปเดต          | <input type="radio"/> แอปพลิเคชันมีความผิดพลาดที่มากเกินไป |
| <input type="radio"/> แอปพลิเคชันมีการอัปเดตที่มากเกินไป | <input type="radio"/> แอปพลิเคชันทำงานช้ามาก               |

แอปพลิเคชันไม่เป็นประโยชน์

อื่นๆ \_\_\_\_\_

41. ท่านยินดีที่จะซื้อแอปพลิเคชันในราคาเท่าไร? (เลือกเพียงหนึ่งข้อ)

ฉันมักจะดาวน์โหลดแอปพลิเคชันฟรี

ประมาณ 60~120 บาท

ประมาณ 30 บาท

มากกว่า 150 บาท

สิ่งที่มีผลต่อการตัดสินใจในการซื้อแอปพลิเคชัน

กรุณาให้คะแนนตามความสำคัญต่อการตัดสินใจดาวน์โหลดหรือซื้อแอปพลิเคชัน (1 คือ ไม่สำคัญ 4 คือ สำคัญมาก) กรุณาตอบทุกข้อ

	1 (ไม่สำคัญเลย)	2 (ไม่สำคัญ)	3 (สำคัญ)	4 (สำคัญมาก)
42. แอปพลิเคชันทดลองที่ดี (แอปพลิเคชันทดลองสามารถทำงานได้ดี มีประโยชน์)				
43. การเป็นส่วนหนึ่งของสังคม (เช่น ช่วยให้ท่านเป็นส่วนหนึ่งของกลุ่ม ไม่ว่าจะเป็นการติดต่อกับเพื่อน หรือการเข้าร่วมกับสังคมออนไลน์)				
44. ถูกจัดไว้ในอันดับสูงๆ (เช่น มีจำนวนผู้ดาวน์โหลดแอปพลิเคชันนี้สูง)				
45. การแนะนำโดยส่วนตัว (เช่น ถูกแนะนำโดยเพื่อน หรือ ครอบครัวว่า แอปพลิเคชันนี้ดีมาก)				
46. มีผู้แสดงความคิดเห็น(รีวิว)ที่ดีในอินเทอร์เน็ต (แอปพลิเคชันนี้ได้รับการตอบรับที่ดีจากผู้ใช้)				
47. ฟรี (แอปพลิเคชันนี้สามารถดาวน์โหลดได้โดยไม่ต้องซื้อ)				
48. มีราคาที่ถูก (แอปพลิเคชันนี้สามารถซื้อได้ในราคาไม่แพงมาก)				
49. การที่ได้ยินผู้อื่นกล่าวถึงแอปพลิเคชันนี้ในทางที่ดี				

50. ท่านคิดว่าสิ่งใดมีผลต่อคุณมากที่สุดในการดาวน์โหลดหรือซื้อแอปพลิเคชัน? (เลือกหนึ่งข้อ)

- |   |   |
|---|---|
| <input type="radio"/> แอปพลิเคชันทดลองที่ดี                               | <input type="radio"/> มีผู้แสดงความคิดเห็นที่ดีในอินเทอร์เน็ต |
| <input type="radio"/> ร่วมเป็นส่วนหนึ่งของสังคม                           | <input type="radio"/> ฟรี                                     |
| <input type="radio"/> ถูกจัดไว้ในอันดับที่สูง                             | <input type="radio"/> มีราคาที่ถูก                            |
| <input type="radio"/> การแนะนำเป็นการส่วนตัว                              | <input type="radio"/> อื่นๆ _____                             |
| <input type="radio"/> การที่ได้ยินผู้อื่นกล่าวถึงแอปพลิเคชันนี้ในทางที่ดี |   |

### ข้อมูลเกี่ยวกับแอปพลิเคชันด้านสุขภาพ

51. ประสบการณ์ที่ท่านมีในการใช้แอปพลิเคชันด้านสุขภาพ? (เลือกได้มากกว่าหนึ่งข้อ)

- |  |   |
|--|---|
| <input type="radio"/> ฉันเคยใช้แอปพลิเคชันในการดูแลสุขภาพ                | <input type="radio"/> ฉันไม่สบายใจในการใช้แอปพลิเคชันด้านสุขภาพในมือถือ |
| <input type="radio"/> ฉันยินดีที่จะใช้แอปพลิเคชันในมือถือในการดูแลสุขภาพ | <input type="radio"/> ฉันไม่สนใจในการใช้แอปพลิเคชันด้านสุขภาพในมือถือ   |

52. ท่านยินยอมที่จะจ่ายเงินมากที่สุดเท่าไรในการใช้แอปพลิเคชันด้านสุขภาพ? (เลือกเพียงหนึ่งข้อ)

- |                                   |  |  |
|-----------------------------------|--|--|
| <input type="radio"/> ~30 บาท     | <input type="radio"/> ~150 บาท             | <input type="radio"/> ฉันจะไม่ดาวน์โหลดแอปพลิเคชันด้านสุขภาพ |
| <input type="radio"/> ~60-120 บาท | <input type="radio"/> ฉันไม่ยินดีที่จะซื้อ |  |

53. เหตุผลที่ทำให้ท่านใช้แอปพลิเคชันด้านสุขภาพไม่ต่อเนื่อง? (เลือกได้มากกว่าหนึ่งข้อ)

- |   |   |
|---|---|
| <input type="radio"/> มีข้อมูลไม่เพียงพอ                                  | <input type="radio"/> ฉันหายดีแล้วและไม่จำเป็นต้องใช้แอปพลิเคชันนี้แล้ว |
| <input type="radio"/> ไม่สามารถเชื่อมต่อกับแพทย์ผู้ดูแลได้                | <input type="radio"/> ฉันหมดแรงจูงใจในการใช้แอปพลิเคชันนี้แล้ว          |
| <input type="radio"/> ไม่สามารถช่วยเหลือทางการรักษาได้                    | <input type="radio"/> อื่นๆ _____                                       |
| <input type="radio"/> ฉันไม่ยอมให้ผู้อื่นเห็นแอปพลิเคชันนี้บนมือถือของฉัน |   |

54. ท่านสะดวกใจหรือไม่ในการรับ-ส่งข้อความ เกี่ยวกับเรื่องของ HIV/AIDS ทางโทรศัพท์มือถือ?

○ สะดวกใจ

○ ไม่สะดวกใจ

### องค์ประกอบในแอปพลิเคชันสำหรับการดูแลรักษาสุขภาพ

โปรดให้คะแนนตามความสำคัญที่มีต่อท่าน (1 คือ ไม่สำคัญ 4 คือ สำคัญมาก) กรุณาตอบทุกข้อ

	1 (ไม่สำคัญเลย)	2 (ไม่สำคัญ)	3 (สำคัญ)	4 (สำคัญมาก)
<b>55. การตรวจสอบสุขภาพ</b> (แอปพลิเคชันนี้ทำให้คุณสามารถตรวจสอบสุขภาพและเห็นถึงปัญหาทางด้านสุขภาพที่ท่านอาจจะมีได้)				
<b>56. การให้คำแนะนำ</b> (แอปพลิเคชันนี้สามารถแนะนำให้ท่านรู้จักกับแพทย์ผู้เชี่ยวชาญและให้คำแนะนำสำหรับการจัดการกับปัญหาด้านสุขภาพของท่าน)				
<b>57. มีแผนที่ของศูนย์บริการสุขภาพ</b> (แอปพลิเคชันนี้สามารถให้ข้อมูลสถานที่ตั้งของศูนย์บริการทางด้านสุขภาพต่างๆ)				
<b>58. ลูกเล่น</b> (แอปพลิเคชันนี้มีเกม คำถามเล็กๆ น้อยๆ หรือลูกเล่นอื่นๆ)				
<b>59. การติดตามขั้นตอนการรักษา</b> (แอปพลิเคชันนี้สามารถติดตามประวัติการรักษาหรือขั้นตอนการรักษา)				
<b>60. ข้อมูลความรู้</b> (แอปพลิเคชันนี้สามารถให้ความรู้ที่น่าสนใจ)				
<b>61. การติดต่อกับแพทย์</b> (แอปพลิเคชันนี้สามารถเชื่อมต่อกับแพทย์ได้จริงเพื่อที่จะสอบถามข้อมูลหรือนัดวันเข้าพบ)				
<b>62. ปฏิทินและการแจ้งเตือน</b> (แอปพลิเคชันนี้สามารถแจ้งเตือนผู้ใช้ให้ทานยาหรือเตือนเมื่อใกล้ถึงเวลาที่นัดหมายแพทย์ไว้)				

63. ท่านคิดว่าองค์ประกอบใดที่สำคัญที่สุดในแอปพลิเคชันด้านการดูแลสุขภาพ? (เลือกเพียงหนึ่งข้อ)

- การตรวจสอบสุขภาพ
- การให้ข้อมูลและคำปรึกษา
- มีแผนที่ของศูนย์บริการสุขภาพ
- ลูกเล่น
- การติดตามขั้นตอนการรักษา
- ข้อมูล
- ติดต่อแพทย์
- แจ้งเตือน และปฏิทิน
- อื่นๆ \_\_\_\_\_

64. ท่านคาดหวังว่าจะสามารถใช้แอปพลิเคชันด้านการดูแลสุขภาพเพื่อสิ่งใดบ้าง?

(เลือกได้มากกว่าหนึ่งข้อ)

- รับข้อมูลทั่วไปเกี่ยวกับสุขภาพ (โดยไม่เจาะจงโรคใดโรคหนึ่ง)
- รับข้อมูลเกี่ยวกับปัญหาเฉพาะด้านเกี่ยวกับสุขภาพ (เช่น เบาหวาน ความดัน โรคหัวใจ เอคส์อย่างเจาะจง)
- ติดต่อแพทย์หรือเภสัช
- หาคคลินิกหรือโรงพยาบาลที่อยู่ใกล้ที่สุด
- ดูข้อมูลโดยรวมเกี่ยวกับสุขภาพของตัวเอง (น้ำหนัก BMI ความดัน ผลเลือด)
- เตือนเวลาที่จะต้องทานยา หรือ พบแพทย์
- อื่นๆ \_\_\_\_\_

65. ท่านคิดว่าท่านจะดาวน์โหลดแอปพลิเคชันที่มีคำว่า “เอชไอวี / HIV, เอคส์ / AIDS” อยู่ในชื่อของแอปพลิเคชันนั้นๆหรือไม่?(กรุณาตอบด้วย เนื่องจากคำถามนี้สำคัญมากค่ะ)

- ดาวน์โหลด
- ไม่ดาวน์โหลด

66. ท่านคิดว่าท่านจะดาวน์โหลดแอปพลิเคชันที่เกี่ยวกับสุขภาพทั่วไป (ให้ข้อมูลเกี่ยวกับหลายๆโรค) โดยไม่มี “เอชไอวี / HIV, เอคส์ / AIDS” อยู่ในชื่อของแอปพลิเคชัน แต่มีข้อมูลเกี่ยว เอชไอวี อยู่ในแอปพลิเคชันหรือไม่? (กรุณาตอบด้วย เนื่องจากคำถามนี้สำคัญมากค่ะ)

- ดาวน์โหลด
- ไม่ดาวน์โหลด

## คอมพิวเตอร์

67. ท่านมีคอมพิวเตอร์ที่บ้านหรือไม่?

- มี
- ไม่มี

68. ท่านต้องการใช้โปรแกรมบนคอมพิวเตอร์ส่วนตัวมากกว่าแอปพลิเคชันบนมือถือหรือไม่?

- ใช่
- ไม่ใช่

ขอบคุณที่ท่านได้ใช้เวลาในการตอบแบบสอบถามนี้



## Appendix F: Case manager interview responses

### Interview with case manager at Mplus

The following interview questions were asked through a phone interview by Pantitra Sankatumvong on February 7, 2014. The responses are provided by a case manager at Mplus in Chiang Mai.

1. What do you believe are the benefits to technology-based health care?

I think that it enables people to access information more easily. Like when we have a problem or worries, we can use technology to search for information more easily.

2. What are some technology-based media through which health care is currently delivered in Thailand or elsewhere?

Websites and an application from Thaihealth.org that promotes safe sex.

3. Do you believe mobile applications would be an effective strategy for technology-based health care? How, and why or why not? For what aspects of health care?

I agree [that it would be an effective strategy], but only a few people will download and use it if it's an application about health care. More people are interested in chatting. I'm afraid that people will not be interested [in a health care application]. How about making a chatting program with information, probably about HIV, in it?

4. Have you performed any research on existing health care mobile applications? If so, which ones and what do you believe were some benefits and drawbacks of the existing mobile applications?

Yes. I've seen Thaihealth.org's application. However, it's still "a rock-like" application that we [case managers] cannot interact with. We can only be the ones to receive the media and information.

5. What features do you believe are beneficial to include in a mobile application for the spreading and gathering of health care information? Please explain why.

I think it should be interactive. I also think that it should have enough information and can respond us. It should not just show the number you should call, but instead have instant contact or communication. I want to be able to track people who wanted to see health information, or other things, if you want to do a quantitative or qualitative analysis [about the application user].

6. Have you ever performed any research on existing HIV/AIDS mobile applications? If so, which ones and what were some benefits and drawbacks of the existing HIV/AIDS mobile applications?

Never.

7. What features do you as a case manager believe would be beneficial in an HIV/AIDS mobile application?

It should contain FAQs. The apps should tell a user if their behavior is risky or not. It should tell them what to do if they have risky behavior, to use condoms, how to prevent HIV, and where to get tested.

8. What types of data would case managers hope to gather from using HIV/AIDS mobile applications? What benefit would this have on reducing the impact of HIV/AIDS?

I think most people [patients] would like information about their medicines, potential side effects, or potential choices for them, like how to take care of themselves.

8. Additional 1: What do you think about the mobile application providing advice on how fit into society? Would it be too controlling?

It can be viewed as two-sided. It should be information that's in the middle: not too controlling but not giving too much comfort. More like information that will make them feel good about themselves after reading it.

9. How easily do you believe a person in the target populations - MSM and TG women - could access an HIV/AIDS mobile application or other type of technology-based medium? Why or why not?

I think it can be easily accessed because these people like to use applications for chatting or for Internet surfing.

10. How willing do you think a person in the target populations would be to use an HIV/AIDS mobile application or other type of technology-based medium? Why or why not?

I might have to say [that they would] not use it much if it's directly related to AIDS. If someone sees it [when it is downloaded onto a user's phone], it might be branding and if a person's friends see it, they might question the user and ask, "Why do you have to download it?" But on the other hand, the user can be viewed as a person who cares about their health.

10. Additional 1: Do you think it is a good idea if the mobile application includes information about other diseases, too?

Well that's a good idea, but it might have too many diseases and people might not be interested in it. But it's a good thought. Try to make it in the middle but still have enough information. Make it interesting or make it similar to communication applications like *LINE* or other similar ones.

10. Additional 2: What if the application made it possible for a user to chat with the doctor instead of just giving information?

With the doctor? That's good.

11. What features of an HIV/AIDS mobile application do you think the target populations would think to be desirable? Why?

It should have the ability to ask questions and get answers from doctors, have a self-risk meter, tell that the user if they might have a risky behavior, have games or questions to ask the users, and FAQs with answers from doctors. And information about the diseases, treatment, care centers, blood test centers, and an open page with people coming in asking question about health to show that it's not embarrassing to talk there.

12. What features of an HIV/AIDS mobile application do you think are most important to reduce the impact of the disease among members of the target populations?

I think the most important features are a self-assessment, evaluation of behavior, telling the user if they have high risk, recommending them to take a blood test, and telling them the locations of centers. Information, the ability to file a form for staff, and the ability to contact them or notify them if they have a blood test today are all important too.

12. Additional 1: What if the application has notifications and alerts as features?

Very well, [it'd be good] to notify them automatically. I think that'd good.

13. How much money do you think it would cost to develop and maintain an HIV/AIDS mobile application? Who would bear these costs?

About 100,000-200,000 baht.

14. Do you think people in the target populations would be willing to purchase a phone with application capabilities and/or pay to use an HIV/AIDS mobile application? Why or why not?

I think very few [would be willing to pay], but if it's free people will be more interested.

14. Additional 1: What if the application has a trial version, with maybe a 30 day trial?

Very well, I think more people might be interested.

15. Do you have any additional concerns or comments about promoting an existing or developing a new HIV/AIDS mobile application to target MSM and TG women in Thailand?

Worries...No I don't have any. I think that if it's an application directly for gays there are both good and bad sides, like branding them as an at-risk population. There are other applications for gays specifically, but I think there should be new media or applications because the way people access information has changed since there are more smartphones. We should use this channel to reach out to users of this media.

## Interview with case manager at The HIV Foundation

The following interview questions were asked through an in-person interview by Pantitra Sankatumvong on February 12, 2014. The responses are provided by a case manager at The HIV Foundation in Bangkok.

### 1. What do you believe are the benefits to technology-based health care?

The information about HIV is quite pessimistic and the information is hard to find, so people find it by searching on Google. [They] read the information from web forums. That is the only way for them to get the information. The problem is that they could get false information and if they do they would feel even more pessimistic. If there's an app it would help people get truthful information and it'd be easy to access. It'd be great.

### 2. What are some technology-based media through which health care is currently delivered in Thailand or elsewhere?

[There are] not many. There's one app but people didn't really use it because it's hard to understand the medical terms. People usually find the information on Google and read from forums and if the person who started the forum didn't monitor it then the information could be false.

### 3. Do you believe mobile applications would be an effective strategy for technology-based health care? How and why or why not? For what aspects of health care?

[In terms of HIV], there's so much [potentially false] information, and not only about the medications. There are not so many [credible] facts and information, and they are hard to find. If people are HIV-positive, then they would use an app to look for the information specifically. The language has to be easy to understand - don't use medical terms.

### 4. Have you performed any research on existing health care mobile applications? If so, which ones and what do you believe were some benefits and drawbacks of the existing mobile applications?

No not really. If I do then I search for specific stuff like which drugs I don't know about. I search for what people say about that drug. It's hard to find that information. There's OI and all the symptoms are very generic so there's not much information about it. Information about AIDS is hard to find because if I looked to a website for information on STDs, the information is very generic with little information about symptoms and no information about treatment. There was no in-depth information. The information on websites is very generic. Even when you go to see the doctor they only diagnose you without telling you anything about AIDS. For example, syphilis, there are many ways to treat it. The treatment ways are like 1, 2, 3, 4, 5, but when I look up [information] on STI there's not much about it. The only way for me to get information is to search on Google and look for ways to treat it. If there's an app it should have all the information, and have it be easy to understand.

### 4. Additional 1: What information do you think is necessary to have in an application?

If the app is about HIV then include prevention, infection, illness, and treatment information - all of it.

5. What features do you believe are beneficial to include in a mobile application for the spreading and gathering of health care information? Please explain why.

Contact with doctors or people who can answer questions, like an FAQ. For example, include [answers to] simple questions like “What is this blister in my arm?” and stuff about medicine because nowadays they mix medications together, and [questions like these are] being asked and people tend to panic even with little symptoms like that. For a drug there're so many names: the brand name, the common name, and the scientific name. The person who answers questions should answer correctly and the answer should not be confusing. Reminders to take the medicine are a great idea, because each individual takes different drugs, so a reminder would be great. But don't have it [go off] every thirty minutes. Not many people have to take the medicine every half an hour. Make it every hour like 1AM, 2AM, 3AM, 4AM, 5AM etc. Everyone can set their own reminder and it'll go “ding” when it's time to take the medicine. It's like setting an alarm clock but they don't have to set and actual alarm clock anymore. One app should support all. Like, if there's an app, it would have this function too. Like having a doctor consulting function would be great because the doctor function is not enough. A chat room function where positive people could talk to each other would be good. If the chat room can be divided into categories, like general people, all ages and gender with, male, female, and TG, it'd be better. If you're talking about HIV, you have to consider the gender too so people can talk about specific topics.

5. Additional 1: What features would be useful from the patient's point of view?

Contacting doctors, and answering their questions. If there's a person that can always answer their questions it would be great, even though it would be impossible. If no one answered their question but there's other information for them to read it'll still be good. Before, information about HIV was hard to read, like if I open it and ‘ta-da’ it's all medical terms. If you want the information, there is information, but it's all in doctor terms and it's hard to understand. When people read it, they have this thought like “Will I be able to understand this?” HIV-positives can't understand these medical terms. [They think] “What are the meanings of these words?” It would be most helpful to have [the information in] easy to understand words.

6. Have you performed any research on existing HIV/AIDS mobile applications? If so, which ones and what were some benefits and drawbacks of the existing HIV/AIDS mobile applications?

I have not done much research.

7. What features do you as a case manager believe would be beneficial in an HIV/AIDS mobile application?

Oh we expect a lot, everything related to health care. For example, if a person gets diagnosed as HIV-positive, there are lots of problems that could follow. Questions like “Would I be like that? Would that happen to me?” would come after the diagnosis. In reality, those things don't happen yet the person thinks that it'll definitely happen to them. If we make an app, the person who is diagnosed with HIV should know is [about] CD4, so we will define CD4 and include information about CD4 that would make the person understand it. People don't know what CD4 is. Usually when they get their blood tested and if it's HIV-positive the doctor will be like “Here's your result: it's positive,” then they send you back home. Another important type of information is that the person needs to know about their rights and the ‘gold-card’. The application should have information about social security too. There's one app in Android that is about the ‘gold-card’ or the ‘30 baht treat all disease’ card that was developed by the National

Broadcasting and Telecommunications Commission, or NBTC. It's great; you can look up how to check your gold-card rights. If you're HIV-positive it is important. Right now in order to check the 'gold-card' rights we use this Android app to check the people who come to the CBO to see if they have the right to get the '30 baht treat all disease' or not and if they do where should they go and claim their right to get 30-baht-treatment. If they live far away there should be a way to move that right to the nearest place. We use the app to for that and to find the telephone number of the government office to talk to. In the past, they announced that moving the rights can be done at any government office but it's not true because when we go there, the NBTC officials are not in. There are few government offices that have the NBTC officials, because they don't have enough money to hire the NBTC officials to sit at every government office. So when we plan to go there to move the 'gold-card' rights we have to call and check if the NBTC officials are there or not. This is all about the 'gold-cards.' There needs to be connections to social security too, e.g. how to move your social security rights, what to do if your rights got cut, and what should you do in order to maintain those rights. Something along those lines. There should be information about what the social security would cover too.

Medication [information is important]. If this is included it would be great too, since right now information about medicine is extremely hard to find. Even the basic things, like the common name that is not the brand name, are hard to find, not to mention the picture of the medicine. When we search on Google we have to go through so many names and it's very confusing. Different brands made different shapes of medicine. We need all the common name of the medicine, and pictures would be helpful too. We have only around 20 HIV medicines, not including the mixed ones, so if the application included those it'd be great. The mixed medicine can be mentioned later, for example this medicine mixed with that one will have both of them and if it's called this. The mixture could have many names. The dose of the drug is very important because there are only a few type of drugs with different doses. If you can't think of anything, look at the dose on the medicine. What is the number on it? 150, 200, 300, 250, 600, something like that. You can guess what medicine it is. That, and the color of the medicine would help you identify it. When you go see the doctors and then go to the pharmacy, they'll say take the medication after breakfast, lunch, and dinner. Oh my, nowadays the pharmacist still write that, which is not true at all you have to take HIV medication every 12 and 24 hours, not after breakfast, lunch or dinner. This not consistent at all with when you eat breakfast, either at 8AM or 9AM or sometimes later than that. There's the 24 hour one. They'll say take before you go to bed. When do you go to bed? 8PM, 9PM, 10PM, 11PM? This information, both the case manager and the person themselves can gain access to it. Another good option is to change language, Thai, English or even Myanmar, but please make it Thai / English first; the Burmese can read English.

*8. What types of data would case managers hope to gather from using HIV/AIDS mobile applications? What benefit would this have on reducing the impact of HIV/AIDS?*

[saying stuff about before he was a counselor/nurse...] I feel that a disease that is caused by behavior is hard to stop. For example, diabetes and hypertension. Look now, do you think it's preventable? They even have to open a diabetes specialty clinic, and it's so crowded in the rural area. [There] the hospital's capacity is not enough for diabetic patients. HIV is also caused by behavior so it's hard. One way I could think of is the prevention. The prevention medium [like the promotion of prevention] is more easily accessed by people in the city than people outside of

the city. The prevention medium is looked at pessimistically by the people and the only prevention medium available is the condom. I sometimes talk with my friend, like is this the end of condoms? We've talked about condoms for how many years now? People are still not using it. We rarely talk about other types of prevention that are not the condom. Who would be brave enough to say what type of protection should be used when we having sexual intercourse? If the counselor is a woman and the case/patient is a man, would the counselor ask the patient how the guy had sexual intercourse and why didn't he use condoms? If you can't use it what would you do? The only protection they can use is condom if they can't use condom they won't use it. If they have other STDs because they can't use condoms they still won't use it even though there's a chance they'll get HIV. There are some cases of HIV-positive people that did not use a condom and chose not to use condoms, not that they don't know about protection, or not afraid of dying, but they still choose to not use it because they just can't use it.

If there was another way of protection it would be loads better. The applications are information mediums and people get information about protection from it but it depends whether the person will choose to do things the application recommend. If not, it is another problem. We even have case managers to look after individuals who are HIV-positives, that look after the positives every step, and they still did not use protection. When they can't use prevention 100% [of the time]. The only way we can help people is to lower the infection rate. To decrease the risk as much as we can. Their behavior is what they choose to do. If you don't want people to be affected by HIV when they are diagnosed with HIV, get them to take the medicine and then boom, all our problems are solved.

There's this belief that if HIV-positives take medication right away then their viral load will decrease, decreasing the infection rate [as in, there's less chance of the person spreading HIV to others]. However, that's in the future and it depends on what people plan to do. Right now in order to get people on treatment, their CD4 has to be lower than 350 but it's not like all the hospitals can give out the medication.

9. How easily do you believe a person in the target populations - MSM and transgender women – could access an HIV/AIDS mobile application or other type of technology-based medium? Why or why not?

Yes [it'd be easy to access], especially in Bangkok, since people use the Internet and social media. Even the Burmese construction workers have Facebook accounts. They can gain access to the Internet but the problem is can they use it correctly, or would they know how to search for information? For example, many anonymous cases have some symptoms and they don't know who to ask about it, so they search for the information online via Google. They read the information and there are so many possibilities, which makes them anxious so they get tested. That is one of the reasons why they get tested, because they have some kind of symptoms. Many cases that we work with now knew about us because of the Internet, like Facebook and other places. When they know that they're positives they don't know what to do so they search for HIV on the Internet and then find us. So yes, they have access to the information but the thing is will they find the right information or not? Will they find us or not. If there's an app, where should the app be in order for them to see it?

9. Additional 1: How can they search for the app?

Yes, like when there's an app for a smartphone my friend would recommend it to me and then I'll see it. Otherwise I wouldn't be able to find it. It's not like there's a pop-up recommending this app, because there are so many applications in the application store that the only way I'll know about it is when my friend recommends it to me. If you're making an app the way to promote it is like, do anything to make it pop-up to the target group. The other way is to show it to them and make it easy to access.

10. How willing do you think a person in the target populations would be to use an HIV/AIDS mobile application or other type of technology-based medium? Why or why not?

Very little, but when I say very little I mean they don't see a way [to get the app] or how to search for the app. If there's an existing app it's possible to download it onto their phone. For most people I don't think they'll download it, especially if there's AIDS/HIV in the title of the application. Even normal health applications. I won't open or use them because it don't know what's in them, [I don't know what type of health application it is]. If there's a specific HIV/AIDS application I won't download it anyways. Another suggestion is to have some info about HIV in the application description in the app store and that the application icon not be AIDS/HIV related. For people in general, if they see HIV/AIDS in the title or the icon they won't be interested in downloading the app. The only people who are going to be interested in it will be the HIV-positive people.

10. Additional 1: How about a general health application without HIV/AIDS in the title. It could have general info on other medical problems, such as diabetes, hypertension, heart disease, etc.

Yes, it'd be better but you should put that in the app description so people can see what the app is about before they download it. Some people do not have access to these apps, or they have superstitions, like that HIV-positive people who spend time with other people can spread it. It does not spread that easily, except through sexual intercourse.

11. & 12. What features of an HIV/AIDS mobile application do you think the target populations would think to be desirable? Why? What features of an HIV/AIDS mobile application do you think are most important to reduce the impact of the disease among members of the target populations?

Doctors answering questions or like an FAQ and counseling. The app should connect to someone that can give advice. For the FAQ, please get reliable facts. Also if there's a forum function for people to discuss their problems, it'd be good. For example, one case I had recently was this person who read all of my posts on Facebook for two days before deciding to add me on *LINE*. The person looked at everything, like what I post, who am I, what is my job etc. before they messaged me and asked for my *LINE* ID. So for people who have problems, if it benefits them, they would be willing to spend time doing research and search for information. When you search on Google, the website that should be reliable and have good information is [aidsthai.org](http://aidsthai.org), however when I looked at their website I did not get anything from it. It'll be easier getting information from Google.



13. How much money do you think it would cost to develop and maintain an HIV/AIDS mobile application? Who would bear these costs?

I don't know.

14. Do you think people in the target populations would be willing to purchase a phone with application capabilities and/or pay to use an HIV/AIDS mobile application? Why or why not?

Yes, but even for a free application there should be some kind of example of what the app is or what's its function is. On Android, the example pictures in the description before we decide to download are very little, like 2 pictures, so it's not enough to let people know what the application is about. So if they have to buy the app, use it the most important thing is the example pictures in the app description, showing that it's useful. If they paid and it's not useful, the word would get out that the app is not good and then people will not download the app at all.

15. Do you have any additional concerns or comments about promoting an existing or developing a new HIV/AIDS mobile application to target MSM and TG women in Thailand?

We didn't see many health care apps but if there are apps then it'll be good and it'll be even better to have an HIV app because the people who are HIV-positives have this feeling that they are anxious about whether they'll live or not, would the medicine work or not, how long can I live, etc. We didn't even see normal health care apps it'll be good to see an HIV app.

15. Additional 1: How should the application be advertised?

It should have things that people want to know. For example, medication, they can read about medication until they are treated. It'd be great if the application can record CD4 results too because they would get tested about every 6 months. Also, recording medication would be great since the medications are adjusted every time the HIV-positives see the doctor. They would want to know why the doctor changed their medication, when new medication comes out, and what medication their friends are taking. I don't know if other diseases would require this much information, but for HIV-positives, they are eager to learn about HIV. [They have] new questions and new medications are always popup. All of this information will be new to them. Even when they receive treatment for two years and their CD4 increases a lot, there's still some weird symptoms they would [make them] worried. If we promote the application and if it has information that people want, they would be willing to pay for the app because at least smartphones are personal things that are kept at the user's side. Lots of people lock their phone and if they don't want people to see it they can hide in inside folders and make it not obvious. Unlike books that if they buy one and put it on the dining table their family would wonder whose book is this and how did it get in there? For private chat groups, even if there's no password, before we invite a person into the group we inform the people in the group and we tell the person what the chat group's about and once in a while we'll talk about love and how to maintain their [negative] status. This chat group would talk about the same topic so they would be encouraging each other, like family members or friends. If we advertise or promote interesting information people would be willing to download the app.

## Interview with case manager at SWING

The following interview questions were asked through an in-person interview by Phuripob Wichaijiranath on February 12, 2014. The responses are provided by a case manager at SWING in Bangkok.

### 1. What do you believe are the benefits to technology-based health care?

[Texting applications like *LINE* provide health care benefits.] I use *LINE* to talk to nongs [a member of the center] because sometimes calling them might be inconvenient, especially when nongs are with their friends. [With friends] they will become more sensitive. But *LINE* is just typing. For example, a nong might tell me “I got a cold”, or that they feel like their body is not strong, and what caused it. Then we will ask them if they have had enough rest? Did you eat nutritional food? There’s only *LINE* that I use.

### 2. What are some technology-based media through which health care is currently delivered in Thailand or elsewhere?

[The media] which can be found [is usually] in general book stores. Nongs will search for things they can and cannot eat, and any food that will improve their health. They will go to SE-ED, Nai Intr [these are book store names] or small columns in the newspaper.

### 3. Do you believe mobile applications would be an effective strategy for technology-based health care? How and why or why not? For what aspects of health care?

As for me I look at two sides, talking through an application will [not] get as deep [of a] feeling as talking face to face, because if we get to talk directly or get to see each other, the feeling will be better and greater compared to talking through an application.

### 4. Have you performed any research on existing health care mobile applications? If so, which ones and what do you believe were some benefits and drawbacks of the existing mobile applications?

I just got to talk to our team about which one we will use. [It’s called] *Monitor Plus*. It will not ask if the user’s medicine has run out, but it will provide choices on which kind of help the user needs, like running out of condoms, or waiting for a blood test. It’s a very good application, but it seems like we’re using it to pave way for newer applications, and we’re just testing it for now.

### 4. Additional 1: How did you know this application?

Our partners gave it to us. They have used it and it worked very well so they forwarded to us so we can make changes to it to fit our work.

### 5. What features do you believe are beneficial to include in a mobile application for the spreading and gathering of health care information? Please explain why.

We give the most importance to secret [privacy]. We did not focus that which application is good, because privacy is the most important thing since nobody wants others to know they’re HIV-positive. The second importance is the continuous care of health. If they don’t know about taking care of themselves, they will not dare to console with someone. Most of them revealed [their health status] to us, and they consult to use everything, but they are afraid of revealing this to their friends.

6. Have you performed any research on existing HIV/AIDS mobile applications? If so, which ones and what were some benefits and drawbacks of the existing HIV/AIDS mobile applications?

I don't go into details [when researching applications]. I mostly just look for medicinal information from Google.

7. What features do you as a case manager believe would be beneficial in an HIV/AIDS mobile application?

Related information, because some places or hospitals have contradictory information which confuses the searcher, [and they don't know] which one is actually correct. Even the staff are sometimes confused too because each place or center has their own recipe or formula [for helping people].

8. What types of data would case managers hope to gather from using HIV/AIDS mobile applications? What benefit would this have on reducing the impact of HIV/AIDS?

Now, for nongs that received effects of HIV, they will be concerned about their health, and will be afraid of rashes and symptoms that will signal others that they have HIV. Or about food, like there was belief that eating bamboo shoot or coconut milk will give you rashes. Previously, we asked some of our nongs to consume them, and nothing happened.

9. How easily do you believe a person in the target populations - MSM and transgender women – could access an HIV/AIDS mobile application or other type of technology-based medium? Why or why not?

[The technology] is accessible for all sexualities, and ages, no matter if they are MSM or WSW. They all can access them all, with no limitation. It's open wide and those who come to see us are using smartphones because their job provides high incomes, enabling them to buy them.

10. How willing do you think a person in the target populations would be to use an HIV/AIDS mobile application or other type of technology-based medium? Why or why not?

The curiosity of each person is not the same. Like, those who take [a kind of] medicine, they would want to know about this medicine. [Will it] have what long term effects on him, or if I he uses this medicine forever, what more do I need to eat to balance the out.

10. Additional 1: If "HIV" is in the name of our application, do you think they would download it?

If you have HIV in the name, it will conflict with privacy. It's okay for both normal people and infected people to be curious about it. As for privacy, it depends on the user. Are they ready to use the app? If it's me, whom is working with applications, I will use it, but if I'm the Paragon's mall owner, I might not use.

10. Additional 2: What if it's a general health care application?

That will be very good and useful because there is no branding about HIV, and this will attract normal people too.

11. What features of an HIV/AIDS mobile application do you think the target populations would think to be desirable? Why?

They would want their health as the priority, with an emphasis on their immune system status, CD4 counts, or how they can have long life. Most people, after knowing they have HIV, ask the question “How long can I live?”

11. Additional 1: What do you think of the application having notification for alerting people to go for blood test or take pills?

Not having that is better. Sometimes a friend borrows your phone and if it’s a message popping up telling you to see a doctor, it could look bad. But if it’s password locked, it’s okay. We must emphasize on security.

12. What features of an HIV/AIDS mobile application do you think are most important to reduce the impact of the disease among members of the target populations?

Information in an application must be one directional [meaning that it’s consistent and matching to other sources]. It will be very useful for those living with HIV, but if the information doesn’t match, the user will hesitate deciding which one is true.

13. How much money do you think it would cost to develop and maintain an HIV/AIDS mobile application? Who would bear these costs?

I don’t have knowledge in this field.

14. Do you think people in the target populations would be willing to purchase a phone with application capabilities and/or pay to use an HIV/AIDS mobile application? Why or why not?

We must look at the income of the user. If it’s 100B for unlimited usage, then it’s okay and will be fine because the application is inexpensive and accessible. [But if it’s] 150B [or more] it will depend on the user’s job. For sex workers it would be easy, but for others, pricing will be a factor in buying.

15. Do you have any additional concerns or comments about promoting an existing or developing a new HIV/AIDS mobile application to target MSM and TG women in Thailand?

I don’t want them to specify that it must be MSM or TG or MSW, because that would be stigmatizing, I want them to be accessible to all people.

15. Additional 1: What can encourage the target populations to use the application?

I think there must be an example user [or idol]. Like, a person who is found in books, and he came for a checkup and is found to be healthy. He will explain to others living with HIV and make them understand. He’ll make them want to follow in his footsteps, motivated by him, and continue living.

## Interview with case manager at The Poz

The following interview questions were asked through an in-person interview by Pantitra Sankatumvong on February 17, 2014. The responses are provided by a case manager at The Poz in Bangkok.

### 1. What do you believe are the benefits to technology-based health care?

It's a good thing, which will help us in many ways, such as starting to take care of your health by yourself before asking for help from others.

### 2. What are some technology-based media through which health care is currently delivered in Thailand or elsewhere?

There is no clear technology media about health care, not that I know of. However on the forums in the Internet, as much as I see, most of them are about information, but the real technology, I haven't seen or haven't heard of, so I can't confirm on that. Most people do use Internet to search for questions, but for those that doesn't have any basics or knowledge on how to use the Internet, the forms are not useful to them at all.

### 3. Do you believe mobile applications would be an effective strategy for technology-based health care? How and why or why not? For what aspects of health care?

That can be believed, however, it is only for specific groups that have access to smartphones and already have much knowledge. As for I, I actually come from an older generation which most of us are not accustomed to technologies. So on connecting health care with this technology, it will only cover some populations but not all target populations.

### 3. Additional 1: What do you think are the differences between the older generation and the newer generations?

In aspects of technology, the older generation has less information, if they don't feel like searching for knowledge, then they cannot utilize any benefit from that. But for newer generations, they are closely following technologies.

### 4. Have you performed any research on existing health care mobile applications? If so, which ones and what do you believe were some benefits and drawbacks of the existing mobile applications?

No, I'm still slow about mobile phones.

Questions 5 & 6 were not asked because the interviewee had insufficient knowledge about smartphones.

### 7. What features do you as a case manager believe would be beneficial in an HIV/AIDS mobile application?

About reminders, I think it's good to have if we're using it regularly, it'll be interesting. Information is already a must. But about chatting with doctors, I still have old beliefs that to cure someone, it should be a face to face interaction. I don't think taking care of your health through chatting is going to work, because to diagnose someone is not just about hearing information only.

7. Additional 1: If our application can keep record of CD4 levels, do you think it's beneficial?

I think so, it's like we have personal health record with us so we can evaluate ourselves. If it can compute data too after recording such as the decrease in CD4 level, not only the user can see that their health is declining, but it is also easier for them to talk to their doctor as they already have their information prepared.

8. What types of data would case managers hope to gather from using HIV/AIDS mobile applications? What benefit would this have on reducing the impact of HIV/AIDS?

I think people would want information in every aspect. But the most beneficial part will be the information about taking care of your health. But it should be divided too, as there are many levels of health care. It should connect with the application too, if CD4 is this level, how should I take care of my health?

8. Additional 1: What can lessen the spreading of HIV?

Prevention, like information or self-risk meter. If they're at risk, there should be information provided of what to do next.

8. Additional 2: By self-risk meter, do you mean like several questions people can answer to see if they're at risk?

Yes and as I've said earlier, if they're at risk, there should be information provided of what to do next. They probably will become aware that they need to take blood test at that point. Most of the people after becoming aware of their HIV status, they try to control the virus load and would not affect people. The most important point is those who do not know of their own status.

9. How easily do you believe a person in the target populations - MSM and transgender women – could access an HIV/AIDS mobile application or other type of technology-based medium? Why or why not?

It's possible, but we don't know how much percentage it will be. Since older generations are slow when comes to technology.

11. What features of an HIV/AIDS mobile application do you think the target populations would think to be desirable? Why?

For a person living with HIV, the most important thing is information on health care, having self-health record is also important. Supporting information on several things. Since people after they are aware of their status and have accepted it, the next thing is that they are hungry for information that can prolong their life. That's for the one who know their status, then for the people who just recently know, they might feel depressed and their thirst for information is twice as much.

Questions 12 & 13 were not asked because the interviewee had insufficient knowledge about smartphones.

14. Do you think people in the target populations would be willing to purchase a phone with application capabilities and/or pay to use an HIV/AIDS mobile application? Why or why not?

I think no, because most people in our society thinks it's something irrelevant to them, like very distant. But if it's not that expensive then maybe 10 to 20 people. It depends on the pricing, it should not be a lot to the point that it burdens the user.

15. Do you have any additional concerns or comments about promoting an existing or developing a new HIV/AIDS mobile application to target MSM and TG women in Thailand?

Well the program must be advertised in a way that is truthful. It must not be an ad that overly persuasive or infomercials. It should have references and should connect with daily lives.

15. Additional 1: What can motivate or become an incentive for people to come to use the application?

I think it's about love, love your health, if they have knowledge, it'll be fine. Maybe we love our body and sometimes need a tool to help us take care of the beloved body. It also depends upon the person. And also the pricing, the lower the price, the more they are motivated.

## Interview with case manager at Caremat

The following interview questions were asked through a phone interview by Pantitra Sankatumvong on February 17, 2014. The responses are provided by a case manager at Caremat in Chiang Mai.

### 1. What do you believe are the benefits to technology-based health care?

For the work I do, there is social media that we can give consultations [through media] like Facebook, *LINE*, and *Jack'D*. [These are useful for] cases where members can't walk in to see us. And if you ask about advantages, it's an advantage for them, the members. And it's also a part of an advantage for us because then for anonymous members, they can freely say "I have done a risky behavior." On the other hand it's a disadvantage in that we don't know if someone asked us for other reasons, like testing or knowledge for a friend.

### 2. What are some technology-based media through which health care is currently delivered in Thailand or elsewhere?

The innovations today are to the point that we don't have to see each other face-to-face. Wherever you go, you can just find others through applications. Information from doctors, nurses, and NGOs can be accessed 24 hours. But if you go to the hospital or NGO, you must go at specific working hours. If it's [through] application, whatever you want to know you can just search, but the down side is how much will it update? For example, antiviral drugs aren't at a constant level. There are new formulae being developed every day. There are other diseases, and which drugs must we take to contain it? That's the downside.

### 3. Do you believe mobile applications would be an effective strategy for technology-based health care? How and why or why not? For what aspects of health care?

Yes [I do believe that]. I just bought a tablet and used it in order to find answers when nongs [members of the organization] ask about which drugs to take. But if the information in the application doesn't match what I know, I would ask a doctor.

### 4. Have you performed any research on existing health care mobile applications? If so, which ones and what do you believe were some benefits and drawbacks of the existing mobile applications?

My research is with HIV applications.

### 5. What features do you believe are beneficial to include in a mobile application for the spreading and gathering of health care information? Please explain why.

If [that app has] reminders, it must ask the user first if they are ready to use it. Some members still keep [their condition] a secret, and if a notification pops up while they are with other people, it might spark interest and inquiry. But if the application has a fixed time of when is it going to send some news or notifications, that'd be great. The messages can be "Don't forget to take your medicine!" so that it is only understandable to the user and other people cannot guess what medicine it is.



5. Additional 1: What if there is a lock for the application, so that from the notification, you can't view the message unless you type in the correct password?

If [the app is] for teenagers with education or those younger than 35 years old, it'd be good. But for people 40 and over or people with less education, they will struggle and might not understand how the application works. But if it's us, even though we're over 35, we can still follow.

6. Have you performed any research on existing health care or HIV/AIDS mobile applications? If so, which ones and what were some benefits and drawbacks of the existing HIV/AIDS mobile applications?

I can't remember their names because there are too many of them. Most of them are informational applications and for sharing videos, similar to *Social Cam*. I always watch and receive news about antiviral drugs from Doctor Nittaya's channel. She works in the Red Cross.

7. What features do you as a case manager believe would be beneficial in an HIV/AIDS mobile application?

[Apps] are convenient and fast for groups that can access them. The downside is that older people don't know what to do with applications, and that the information might not be up to date. There are a lot of factors, because not everyone takes the same pills and not everyone has the same side effects. So the application might not give the correct information to everyone.

8. What types of data would case managers hope to gather from using HIV/AIDS mobile applications? What benefit would this have on reducing the impact of HIV/AIDS?

My personal idea is that everything [should be collected]. Because we can access [this data] from anywhere, so it should be including all aspects of the disease. But there has to be someone updating the [general] information [people see] too, like doctors.

9. How easily do you believe a person in the target populations - MSM and transgender women – could access an HIV/AIDS mobile application or other type of technology-based medium? Why or why not?

Informational media must be easy to understand and [thus have] less English words. And the application developer must be able to insert information about pill, dosage, time, weights, side effects, etc.

10. How willing do you think a person in the target populations would be to use an HIV/AIDS mobile application or other type of technology-based medium? Why or why not?

It depends on how aware the person is. If he is not aware, then anything is useless. But if they are involved in a risk, and check the application immediately, it might help comforting them, causing less panic.

10. Additional 1: What if the application can search for clinics, centers, or other places that give out condoms. Do you think that would be useful?

[That is] definitely a good idea, yes. Currently, the locations of NGOs are wanted by the nongs. Because getting condoms from other sources, like clinics or 7-11 is not favorable. Even though it's a convenience store, our people still are not comfortable buying condoms because they feel stigmatized and that people will question them inside their head about the purchase, like "This guy will actually have sex with someone." Well, we actually don't know what the seller is thinking. Maybe they think nothing at all, but we are sensitive and start stigmatizing ourselves.

11. What features of an HIV/AIDS mobile application do you think the target populations would think to be desirable? Why?

It depends that at that moment; can the application answer their needs? Like, for sauna, we can only bring a towel, and your mobile is in the locker. If you have intercourse in there, you wouldn't come running out to ask the application about what to do if you had engaged in a risky behavior. But after three days, when the symptoms appear, at that moment then, will they become aware of the situation and panic. And they will search for information to realize that it's already too late. So most people will not access to the application until symptoms shows up.

11. Additional 1: Why would some people not go to doctors?

They feel ashamed, and secondly they are afraid that the doctor will scold them.

12. What features of an HIV/AIDS mobile application do you think are most important to reduce the impact of the disease among members of the target populations?

Since teenagers these days like to search in the Internet for sexual partners, prevention information is the most important. However, knowledge alone is not enough; there must be awareness to use protection.

13. How much money do you think it would cost to develop and maintain an HIV/AIDS mobile application? Who would bear these costs?

20,000 baht maximum.

14. Do you think people in the target populations would be willing to purchase a phone with application capabilities and/or pay to use an HIV/AIDS mobile application? Why or why not?

I don't think people will download it, both high risk and both living with HIV. Because if they don't know how to use it, or are not aware, they would not be interested. And different target users are different - MSM, MSW, TGs - all have different kinds of personal needs, while the top and bottom person also have different needs. MSM like idols like Annanda Everingham, TG want sweet colors. Top people want medias [with people] photographed from behind, while the bottom people like masculine medias... because the application should not consist of only letters or words.

14. Additional 1: Do you have any ideas of incentives we can use to get people to use the application?

Awareness of one's own actions. The motivation is the appearing of one's own symptoms or abnormalities on their body.

15. Do you have any additional concerns or comments about promoting an existing or developing a new HIV/AIDS mobile application to target MSM and TG women in Thailand?

Updates should be frequent, maybe once a week, and there should be explanations of the consequences of use and not using protection. And include motivations for people to use prevention methods. And if you're going to really make an application, make sure you answer each target populations' needs. Applications that have community elements should not become a tool for people to use just to find a new sexual partner.

## Appendix G: Community-based organization leader interview responses

### Interview with CBO leader at Sisters

The following interview questions were asked through a phone interview by Phuripob Wichaijiranath on February 6, 2014. The responses are provided by a CBO leader at Sisters in Pattaya.

1. What are the demographics of the people who utilize this facility? How many people visit daily? How many utilize this facility regularly?

TG mainly, 3,500-5,000 people. Pattaya actually has 3,000 TG, and if you include Sriracha and Sattahip it has 5,000. The number depends on high/low seasons like winter or the rainy season.

2. What types of services and care do these people receive?

The services we provide are free advice on how to have good health, methods to prevent HIV, use condoms, a healthy lifestyle, a way live your life, and sexual freedom. We also have activities which started a year ago like education, a clinic on the 3rd floor, and a free quick one hour test. We have professionals like nurses, counselors, and doctors here. Actually, the activities include promoting sexual freedom, giving law advice, what to do upon applying for military service, and providing information about the laws regarding marriage or for homosexuals.

3. Have any people who visit this facility disclosed their HIV status to you? Why or why not?

We have a lot of sisters with HIV, and some reveal their status with counselors upstairs. Since we have a testing center, most of them will be told of their status after taking the test. If positive, the information will be passed on into the system in order to refer the patient to hospitals to receive treatment. However, the comfort [for revealing their status] will depend on the patient herself. She will reveal her blood result to whomever she feels comfortable with. For example if she's not comfortable to reveal to her acquaintances, everything will be kept secret. It will be her choice as to whom she is comfortable revealing her status. The important thing is that there are a lot of people with HIV and that they are able to live with it today happily by taking antiretroviral medicine and entering the system for correct treatment.

4. Do you believe there is a stigma about HIV/AIDS in Thailand? Why?

I think that Thailand is a country in which its people act in a manner where face to face you're okay and acceptable, but behind your back you're detested. This cannot be fixed in our country because it's the cultural frame of our nation and culture. However, I think that compared to the past 20 to 25 years ago, this problem has decreased greatly. I mean the looking down upon, the detest, and the stigma. Because in the past people did not understand HIV/AIDS and were scared. They had an irrational fear and did not want to get close to [people with HIV]. Nowadays, the situation is starting to get better, however the stigma still exists towards some specific groups. People think people with varied sexualities are prone to getting AIDS when it's actually involving everyone regardless of sexuality. So that's why we are also working on decreasing the stigma. We try to promote that AIDS will not be contacted through living together, but by not using condom.

5. What do you believe are the attitudes of MSM and TG women towards HIV/AIDS? Why?

I think that there's social and moral values in our group that's different from other populations [sexuality wise]. We got oppressed from the society a lot and it's not only because of our HIV, but a lot of other problems like family rejection, being looked down upon from the society, not having opportunities for a good job, the company rejected you, and not having the same [pay] between male and female and that makes us avoid working. We sold ourselves a lot, however the important thing is that we are professional and use condoms because we don't know if our customer or guest has the virus or not. But the important thing is that most people still have the perception like, "TG is an outsider, still have ideas that if she's a TG and doesn't have HIV she isn't completely TG." As for MSM, their views are that to have and change partners frequently is okay. This is because sexual intercourse is an easy thing for them because they can change partner upon visiting pubs and gay saunas. They have a different point of view on AIDS and a lot of them are afraid and think that they don't want to test because they are scared of the result. This includes both MSM and TG. Trust issues too, like they don't think they're at risk by being with regular partner, like a husband and wife. Some who have been living together for 9 years, 10 years also don't use a condom. So trust is one obstacle to work with; it's very hard for us.

For example, if you have a girlfriend [the interviewer is a male], of course in the beginning you'll wear condom because you just got to know her. However, if 5 years pass by, you'll think it's not risky anymore. These thoughts and sayings are very hard to fix. Most of us know how to prevent but most don't have the sense to do it when they're about to have sex, so the risk of HIV is increased.

6. Do you think MSM or TG women receive adequate information about HIV/AIDS prevention? Why? What prevention tools do you provide them with, if any?

To tell the truth, just as I've said previously, there are some leaks. [Some people leaked from protective system. They already know how to protect themselves, they just lacked the sense and proceeded without protection.] Most of the people know since we were taught forever ago about what STDs and AIDS are. Condoms will surely reach the hands of the sisters because the funding from the UNAIDS and other NGOs like Sisters also distribute them all over the country in almost every province. And because of that, we can say that most people can have access to condoms because 7-11 also carries them and they [the condoms] are not very expensive. I think that they are easy to access and that people have knowledge about where to find them already. They were taught how to use condoms and how not to tear it. It's a technique that was written just beside the condom box, and was introduced over and over. I think the challenge is that people are not aware. Like people know the consequences of smoking but still smoke until they got cancer and at that time then they will become aware. I think it's a similar situation.

7. Do you think MSM or TG women are at-risk for HIV/AIDS get tested often enough for the disease? Why or why not? What do you think causes these people not to go for initial or repeated HIV testing?

They're afraid of the results since they, even more when they work with the service industry or work with regular customers, are at a higher risk. There is a higher chance that the condom might tear or that they might get into contact with the virus. Truthfully, it's everyone's sexual behavior that's at-risk, not only for the target population, but also all males and females out there. If they don't wear condom they're all at risk. But some might not be afraid since they are confident that

they are not at-risk because they only have one partner. The important thing is that the Thai health care system isn't "for all". It isn't covering most and isn't reaching out to some populations. Like the information regarding blood tests. It will only be known among people who have access to media or the Internet. There are populations which are not able to access the information because they cannot access those media. They don't know their own rights and privileges. For example, our grandparents might not know that they can get free blood tests twice a year if you have the "golden card". Thai people learn very little about basic privileges, unlike Americans. American gets blood tests, they know the privileges they can get and they go for it, but for Thai, we don't use our privileges that much. Like, Thai people were given the privileges but the people themselves don't use it.

8. Do you think MSM or TG women with HIV/AIDS always report their disease status to health care professionals? If not, why?

I think that if they come here to get tested, or maybe other [similar] centers, they would be more comfortable getting testing compared to getting tested in a hospital. They can't just walk in to the hospital since because there is a large amount of stigma. For example, when I am a transgender with long hair walking to get tested in the hospital, the first thing I encountered were eyes and stares from other people while waiting in the queue. The second [thing I encountered] was when the doctor or the nurse called for me [to get be seen by the doctor] in many government-supported hospitals in rural areas. Most hospitals in Bangkok have adjusted, and the private hospitals have no problem at all since they put their hearts into servicing. In rural hospitals if they called me "Mister" with my name, I am not going to get up. Because if I get up with my name announced on the microphone, I feel that if I am dressed as a girl and you still called me "Mister" then people will laugh if I get up. I think it's not proper for basic things like this. If they had called me "Khun" I'm okay; everyone is equal and and it seems like they are giving me respect. If they called me "Mister" I would feel shameful. So people are more inclined to come test here at sisters or other CBOs more than hospitals. Having our clinic definitely benefits our sisters.

9. Do you think MSM or TG women with HIV/AIDS always report their disease status to health care professionals? If not, why?

There are nice nurses and doctors, however some aren't nice. Some question us, like older people who lived through war, asking "You got bottomed?" or, "You got inserted in the back?" Some [people] are sensitive about this and are afraid to reveal [this information]. We understand that the doctor is trying to make a health history record, but this is a sensitive thing to give an answer to. The target populations will deny and tell lies to the doctor such as, "No, I did it with a female and I never have done anything with a male," so that they will not be looked down upon [including being treated differently]. The problem is that the service provider doesn't understand the sexual sensitivity, as they have remained in their frame of "male-female" interaction. Only there are more [and more] "male-male" and "female-female" interactions. [Also] as for the sisters that have had gender reassignment surgery, medical places don't cover inspections of their inner parts. Like if the surgery caused pus inside and then complicated systems, they can't really do anything about it since there are no ovaries. And what can we do since these problems happened due to the surgery, since the knowledge about this in Thai doctors are very low? How does the ministry of health deal with that? The staff of the ministry lacks knowledge and there's not enough staff to deal with questions from the TG.

10. Do you think MSM or TG women with HIV/AIDS are receiving access to disease treatment? Why or why not? How do you think this can be improved?

Thai people have access to and can use the golden card, and if you work for the government you can use the government worker card at hospitals. There are three types of cards: the government worker card, social security card, and the golden card. It [the card] covers the testing but the thing is, will they continue to get tested or not? At Sisters, we promote and encourage people to get tested and go to health care clinics. The problem that happens is that people get late test results and then it's too late for them to take care of their health. The faster you know the faster you can take care of yourself and become healthy again. Nowadays, you won't die from HIV because there's treatment and antiretroviral drugs. What I found in Pattaya are migrants from other countries: Laos, Burmese, Filipinos and other non-Thais. They don't have Thai ID cards and if they are tested positive in Thailand it's hard because they don't want to go back home. They want to work and send money back home. It's hard but they have to support and help themselves. Sisters has tried to help them get into the health care systems. The good thing about the Thai health care system is that there is a gap and Sisters tries to use that gap to help these non-Thai people get tested.

If you get tested at Sisters they'll all know because it's in the system and we're linking with the hospital or nearby hospitals. For both positive and negative people, counseling [or giving advice] is needed. Like if you're positive this is what you have to do and vice versa for those with a negative status. It's the same package and we should make this a normal test. The same package: blood test and counseling. Another case is that if you are not-Thai or did not walk in to get tested at Sisters but you get tested at a normal clinic that does not have pre-test post-test. Then what? At normal clinics for 500 baht they take your blood and tell you your HIV status. There's no counseling session pre/post-test at all. Some people, when the doctor announces, "You're positive," they kind of go, "OMG!" Some people even tried to commit suicide or they are traumatized.

11. Do you think MSM or TG women would be able to use a mobile application or other technology-based medium for HIV/AIDS to improve prevention, monitoring, reporting, and treatment? Do you think they have adequate access to the Internet or smartphones?

Everyone has an iPhone. You can definitely promote in the application about using condoms and getting tested. If you're using features like reporting blood test results via application then you have to be very careful, because it's a very sensitive spot and it could lead to stigma in the future for the target population. You can have a 'catchphrase' to promote the campaign like 'If you love me, use condoms'. The most important thing is the anonymity. I think that the general gay population differs from TG, their lifestyle is very different. The similar thing is that the students [college students] have the ability to buy the applications. Please consider the target group that does not have money to buy a smartphone or an application like the TG next door. I think if you target people who are in college, the general gay population or younger TG who have smartphones, it would work [for the younger generations].

12. Do you think these populations would be willing to use mobile applications or some other type of technology to receive and send information to a case manager? Why or why not?

It's good because it means that people can have access to the knowledge everywhere without having to talk face to face. Like one day if I record a video via social cam and go "Hello everyone, hi! My name is Doy! I'm going to teach you girls about hormones and surgery!" This video can be accessed by people from all over Thailand and these girls can open the videos at home watch it privately. I think this information can be spread faster and [be made more easily] accessed immediately by the target group [by this method]. If these videos are posted in Facebook it's definitely faster than doing an orientation or a one-to-one talking session.

13. Do you think integrating technology-based health care with community-based programs would be possible in order to improve the HIV/AIDS situation? How?

TG will definitely download because they're open-minded and it's already acknowledged that they are TG. One problem will be the general gay people who don't want their family to know that they're gay. They won't download it. People who are open-minded about their status would get all the privileges. If I have a Facebook page that gives information about hormones and surgery for TG, including giving advice on taking contraceptive pills every day, and some of them want to do gender reassignment surgery and other types of surgery but they don't have access to this information and then search for this information on Google, [they might find that] the information is not reliable. It can be dangerous if they follow some weird people giving out false information. If, for example, there's a Facebook page that has lots of knowledge about this information, or pharmacists and doctors posting information for TG to read [then the information is safer and more credible]. Either that or inviting them to be in an episode of the video and then post it into the page. People will be interested in information about hormones and surgery, the harder question to answer would be how to make the conversation about HIV be interesting for people.

14. Do you think it would be beneficial to MSM and TG people to integrate technology-based health care with community-based programs? Why and how?

I want new technology and have made requests to the SI department many times already. We have had a Facebook page for over a year now. We have about 3,000 followers. The important thing is to design a new information medium to use instead of using brochures because brochures are boring. iPads and iPhones can make it easier for the people who work in the field by showing the video on iPads. I kept saying to the TGs "Everyone! I'm here to invite you to do blood testing at Sisters." Before this I've explained so many times that, at Sisters, our office is pink and the staffs at the examination and blood testing rooms are very friendly. Every staff member and doctor is very friendly and all of them are always smiling. You cannot picture this, but if I bought an iPad and showed them pictures of the office or showed them a short clip giving them a tour through the organization [it would help convince people to get tested]. I wouldn't have to explain about the friendliness of the staffs and it would help me tremendously when I go work outside of the office.

15. What else do you think can be done to lessen the impact of HIV/AIDS among MSM and TG women?

If people didn't use a condom every time they have sex, the number of HIV-positive people would increase. I think HIV will always exist. I think it should start by changing the target group's behavior - like using condoms regularly. New innovation - [knowing] how to change people's behavior would reduce the chance of people getting infected. By having a certain

behavior like using condoms, getting tested every three months, and maintaining their [negative] status [the number of infected people would be reduced].



## Interview with CBO leader at Mplus

The following interview questions were asked through a phone interview by Pantitra Sankatumvong on February 7, 2014. The responses are provided by a CBO leader at Mplus in Chiang Mai.

1. What are the demographics of the people who utilize this facility? How many people visit daily? How many utilize this facility regularly?

There are MSM, TG, MSW, and other people. [In terms of numbers], if we're talking about both in the center and out in the field, then in one year we can reach out to 3,000 people, but in regards to coming to the center, then there's around 300-500 people per year. The general gay population and transgenders are included in the 3,000 people, and the 300-500 individuals are mostly MSM and TG; more MSM compared to TG.

2. What types of services and care do these people receive?

They will receive counseling, and participate in group activities, which will have information about HIV/AIDS, sexual health, mental health, and other general information.

3. Have any people who visit this facility disclosed their HIV status to you? Why or why not?

Yes, we [Mplus] also work with people who are HIV-positive and also work for to care for and support [those people], so there are people who come here to ask for services.

4. Do you believe there is a stigma about HIV/AIDS in Thailand? Why?

If there is a part of a normal society that doesn't understand [HIV], then there will be stigma, but in working societies it has been less and in most societies, people are starting to understand more [about HIV]. From normal people's point of view, they still think it's scary. It's a disease that the public still reject and feels unacceptable, but in the views of any working people, they see it in a better way.

5. What do you believe are the attitudes of MSM and transgender women towards HIV/AIDS? Why?

Most of them are starting to be able to accept it [HIV], but most of them still don't want to reveal their status to others that they do not trust, whether it's family or friends, because they still think that the diseases may make people hateful or afraid. But for the targets themselves, they are accepting to what they're facing.

6. Do you think MSM or transgender women receive adequate information about HIV/AIDS prevention? Why? What prevention tools do you provide them with, if any?

They have received much information, and they know a lot but don't follow through with it. They know AIDS can be prevented by using condom, but when the time comes, they don't always use condoms. We provide them with condoms and lubricants.

7. Do you think MSM or transgender women at-risk for HIV/AIDS get tested often enough for the disease? Why or why not? What do you think causes these people not to go for initial or repeated HIV testing?

Since they think they don't have a disease yet, or they haven't shown any symptoms, or have insufficient information, they end up not wanting to receive services. [They do not get a test

because] they're afraid that if they know their status they would not be able to accept it, and that society or communities around the person would not be able to accept it either and [then they would] create stigmas according to their traditional beliefs.

8. Do you think MSM or transgender women with HIV/AIDS are receiving adequate health care? Why or why not?

It is accessible. Even if they're not of Thai nationality, they can buy health insurance.

9. Do you think MSM or transgender women with HIV/AIDS always report their disease status to health care professionals? If not, why?

I think that may be true, because the majority of people coming here or who have been here came through Mplus services or counseling. [In this counseling] we recommend them to the acceptable channels; mostly we recommend them to hospitals that have specific knowledge and have doctors who understand varieties of sexualities. We recommended them to paths that will make them comfortable when receiving services.

10. Do you think MSM or transgender women with HIV/AIDS are receiving access to disease treatment? Why or why not? How do you think this can be improved?

As of now, it's a basic privilege of Thai citizen, with social insurance and the golden card, but most of them that don't get treatment because they aren't aware of their own status.

11. Do you think MSM or transgender women would be able to use a mobile application or other technology-based medium for HIV/AIDS to improve prevention, monitoring, reporting, and treatment? Do you think they have adequate access to the Internet or smartphones?

Yes, because most of them already have smartphones.

12. Do you think these populations would be willing to use mobile applications or some other type of technology to receive and send information to a case manager? Why or why not?

I think they might be less [willing], because loading application about HIV AIDS onto the phone might be something that the society will question. Like, "Why are you reading this?" or "Why are you interested in this?" People will wonder if you are infected. But on the other hand, people might view the person as being worried about their health or only looking to find information.

13. Do you think integrating technology-based health care with community-based programs would be possible in order to improve the HIV/AIDS situation? How?

If there are people who really want this information, they might download it, but for normal people they might not download it. [The application] should use indirect words.

13. Additional 1: Do you think more people would download the application if it included other disease's information as well?

I think it would be okay that way.

13. Additional 2: Should we mix advertising into the application? Or make an application about your organization?

I think there should be a connection between the working people and the application's developer before this, to have a chance to talk and find communication channels in order to see which of these channels the target population can reach.

13. Additional 3: What features do you think the application should have? Reminders? The ability to track records or previous medications?

There should be general information for those that have tested. There should be reminders for them to take the test again every 3 months, or reminders for those who are positive to report their CD4 every 3 months. There should be reminders about taking pills. Make it cover everything, including things about doctors and support too.

14. Do you think it would be beneficial to MSM and transgender people to integrate technology-based health care with community-based programs? Why and how?

It is possible, and it might be a good thing to have new innovations continuously so that the information can be reached by more of the target populations.

15. What else do you think can be done to lessen the impact of HIV/AIDS among MSM and transgender people?

Aside from present projects, there should be promotions for prevention tools and awareness, because it should be put in back of the mind of the society that AIDS is not scary. We must do more work with society to decrease stigmas and stereotypes. If people view AIDS as not scary, more people will come for blood tests, and less will be afraid of the test. I think is a way to fix the problem to some point.

## Interview with CBO leader at The HIV Foundation

The following interview questions were asked through an in-person interview by Victoria Melchert on February 12, 2014. The responses are provided by a CBO leader at The HIV Foundation in Bangkok.

### 1. What are the demographics of the people who utilize this facility? How many people visit daily? How many utilize this facility regularly?

In terms of demographics we are particularly focused on men who have sex with men, whether they identify as gay or are married or have kids or have a girlfriend or don't identify as gay. And also what get called as "kathoey" which is a bit of a dangerous term because it's used pejoratively and is meant to insult transgender women even though they use it themselves. Some of whom are men who have had sex change operations but the majority of whom are biological men who are viewed as women but don't have a vagina. They won't have what's called a neo-vagina or a man-made vagina. They'll have breasts and a penis and live that way for the rest of their lives. And there are a lot of them in this area partly because of the Hindu influence in this country from India that has created a kind of transgender subpopulation in places like Cambodia, Lao, Burma, and here. So we are particularly looking for men who have sex with men and transgender people from low socio-economic backgrounds with less education. So we're really trying to reach people who don't have university qualifications and who have only really completed junior high. And we're looking in slums and we're looking on the streets where the poor gather. Half of our entire caseload is probably poor people while the other half are people who probably have a little bit more money because that's the nature of outreach; you get who you get.

In terms of the numbers we generally have about 120 new clients each month. So I think since October our new cases are about 560. So our goal is to try to test or have 2,000 new clients every year. Most of those are people who we go out to find and test. Some of them are people who are referred in because they are diagnosed with HIV so we are providing them with really intensive case management support. So I don't really know how much that would mean a day. Maybe 5 or 6 [new clients] a day? So what we're doing is really only tracking new people. Our mission isn't to serve the same people over and over again like other organizations.

### 2. What types of services and care do these people receive?

We don't have a drop-in center, so we don't have people who visit. Instead we go out and find people to test for HIV - gay men, men who have sex with men, and transgender women. We go out because they don't come in. So part of the gap that CAP3D and PSI asks us to fill is a gap called outreach activity. So a lot of outreach is done to distribute condoms and information about HIV, but not a lot of outreach gets done to test people for HIV. So testing rates among Thai gay men, Burmese gay men, and transgender women are incredibly low so what happens is there's a lot of HIV among those communities and they don't find out until they're sick. So what we try to do is get to people early before they're sick and try to find positives.

We only provide support for 3 months. So what happens when you get diagnosed with HIV is your whole world falls apart, it's like there's an earthquake and you wake up and all the mountains and seas are in different places, and everything is different. So what we do in that time that you are adjusting to your new world is try to intensively support you so you can draw the map of your environment, of your life, of your new life, so you can get the skills you need to

live your new life. And that means having a doctor, having a hospital, knowing your immune function, having a routine for health care, telling your parents, telling your partner, how to not transmit HIV to other people, how to manage sexually transmitted diseases, how to take treatment, having other friends with HIV. All of that we try to do in that 3 month period and then we let you go. If you want to come back again or if you're in trouble again, and we tend to use our online delivery system to track people, then that's fine and they can come back again. So we don't have a drop-in because a lot of people when you have a drop-in won't access it because of the amount of people gossiping. A lot of community-based organizations have a lot of confidentiality issues when they run a drop-in.

Besides that we run a group called the "Good Life Workshop" which is an orientation about living with HIV. We run that every 2 weeks and it's for people who just got their diagnosis. It ends up being about 3 times per month, twice in Thai and once in Burmese language. And that is an opportunity to talk about how you feel about your diagnosis, listen to how other people feel about their diagnosis, and learn about basic information regarding treatment. And we do a phone tree so people get connected with each other, and they leave the meeting with friends.

And we do case management which is quite complex, so it could be really anything. But that's about it; it's those core components that we do.

3. Have any people who visit this facility disclosed their HIV status to you? Why or why not?

It's less than 1% who choose not to [disclose their HIV status]. Our service is quite different from other services because our model is an HIV-positive prevention model. So we try to find people to test who are HIV-positive, and we don't really care if you're HIV negative. If you're negative we'll send you to another agency and follow up with you to see if you want to do another test in 6 months. If you have syphilis though we'll probably think about putting you into case management and treatment.

If you're a 19 year old boy and you get HIV who do you tell? You don't go back to your family. So part of what we provide is a type of family of people that you can talk to. So when we take you for testing you're often going to be tested for the first time because you know someone's going to be there for you if you test positive. So almost everyone tells us the [test] result. Because part of the reason they go for testing is because they're not alone and they know they're not going to be alone.

4. Do you believe there is a stigma about HIV/AIDS in Thailand? Why?

Huge. It's absolutely huge and it's totally different from the West. In the West it's largely because of the religions of Abraham, which are particularly hostile to the same-sex sex, so it's perfectly legitimate to be violent towards them. In Thai culture it's not the same. There's a really strong stigma about same-sex sex or same-sex activity or transgenderism, but in spite of that stigma there isn't in most cases a violent response from society. But what happens is if you're gay and you come out and you're open about being a gay man then you can't be a bank manager, university worker, business manager, or government worker. All you can do is sell your body or work in a 7-11, that's it, that's as far as it goes. And this is changing very slowly and is similar for transgender. They're just starting to get degrees and we have the first transgender politician now. The level of discrimination and stigma is very high. It's one of the ways stigma drives HIV because if you're a transgender and you want gender reassignment surgery the only way you can get that money is to sell your body.

5. What do you believe are the attitudes of MSM and transgender women towards HIV/AIDS? Why?

I generally think most people want to ignore it. Most gay men and transgender people are very afraid of HIV. Most people talk about the way AIDS is depicted in society. What get shown on television are people who are sick and just about to die. There's also that famous temple, Wat Prabhatnamphu, that's a hospice for people with AIDS. And they have this museum filled with dead bodies of people with AIDS that they've taken and arranged in positions to look like they're dying. So school children and little kids get taken to this place and get shown this as a demonstration about what happens when you get AIDS. Despite a lot of education to inform people about treatment and how you don't have to die from AIDS anymore, this is the impression that people have. People don't stand up and say, "I have HIV and I'm well." There aren't movements where people go on TV and say they have HIV. So all people have is that story of people living with HIV so they just think "Well I have HIV, now I'm going to die." People are very afraid so they tend to ignore it, which means we have to build personal relationships with people and take them to get tested. Mass media isn't going to reach them, so we have to do it person by person, community by community.

6. Do you think MSM or transgender women receive adequate information about HIV/AIDS prevention? Why? What prevention tools do you provide them with, if any?

No, it's not enough. It sometimes depends on where you live, like in the city there's a lot of information about prevention while in the country there's really none. That's really significant because MSM and TG tend to grow up in the country and then come into the city to be able to live the life you want to live and be free. So if there's no information in the country, by the time they know anything about HIV they usually already have it. You have to remember 1 in 3 of these people have HIV. So every 3rd time you have [unprotected] sex you have HIV. And for some of these kids they're having sex 3 times a day with 3 different people.

Well nobody here knows about PrEP (Pre-Exposure Prophylaxis), not even doctors. If you go to a hospital and ask for it you won't get it. PrEP uptake around the world is very, very low except in some communities of San Francisco and New York where people treat themselves have more money. So in Thailand the main prevention tool is the condom. The question is how would you deliver this information through mass media to gay men? For instance there isn't really a publication [about HIV information] reaching out to these people, and that's a really big problem.

7. Do you think MSM or transgender women at-risk for HIV/AIDS get tested often enough for the disease? Why or why not? What do you think causes these people not to go for initial or repeated HIV testing?

No, they don't test enough. Large numbers of the people that we find have never been tested before, some of them already have symptoms and have had them for a long time. They've been too frightened before to do anything about it and that is just tragic, the amount of disability they'll have to live with and the number of other people they've transmitted HIV to. So if you're a sexually active MSM or TG you should be tested every 3 months, and if not every 6 months.

It's fear and...what's the right word...knowledge, skill, understanding [that prevent people from going for testing]. People also think "Well if I just have unprotected sex every now and again my risk for HIV is very low." It's similar to being a diabetic. They might think "If I have sugar today, that's okay because I didn't have it yesterday." But you can't do that when you're diabetic. People apply the same logic to HIV and having unprotected sex. The other thing people do is make decisions based on how people look. They think "He doesn't look like he has HIV so it's probably okay not to wear a condom with him." And what we know is when you treat [people with HIV] they don't look like they have HIV.

8. Do you think MSM or transgender women with HIV/AIDS are receiving adequate health care? Why or why not?

Absolutely not in this country, absolutely not. The public health system in Thailand is broken and for HIV it is particularly poor. There is a free public health care system and it is appallingly bad. It's why for case management, in the first free months someone is diagnosed, we go with them to every appointment at the hospital because we have to be there to make sure they get what they need, and even then they don't get what they need. [For instance] someone only had 4 CD4 cells, basically no immune system at all, and it took them 3 months to get that person on treatment. So there's really good health care for the rich and incredibly bad health care for the poor. We've gone with clients who've had no money and sat in a room with 300 people in it and waited all day for a 15 minute appointment.

Even though all Thai nationals are supposed to have free public health care and free retrovirals it doesn't happen as quickly as it should and sometimes hospitals turn people away because they don't have the drugs. Hospitals tend to close their books to free clients. For example, by the end of last year there was only 1 hospital accepting free patients and it was 3 hours out of the city. And the way to solve that problem is for the government to [make legislature for which they] choose a set of diseases which they must treat [people for] and never turn [them] away. The other thing is that you have to know you have the right to free treatment in order to access it, and most people don't know this.

For non-Thais they don't have access to free health care. We serve a lot of gay Burmese people and we have to pay for their treatment through fundraising. There's a new health insurance scheme that's 3,500 baht a year [for non-Thais] and if they pay that they should be able to access health care. But then they face all the problems I just described, where the hospitals close their books and plus they are not Thai. A lot of doctors have hostility towards Burmese, for example, and we have to step in to tell the doctor that he made a Hippocratic oath that says he must treat anyone who walks through the doors.

9. Do you think MSM or transgender women with HIV/AIDS always report their disease status to health care professionals? If not, why?

No, I don't think they do. The fear of discrimination would stop them. And also if you live in the same community as your parents and go to the local doctor and tell them you have HIV then everyone in that community is bound to know. Confidentiality isn't very good. So what people with HIV do is get treated for their general health in their parent's community but they get treated for HIV on the other side of the city. So they manage their status in a way, and do the same thing for testing.

10. Do you think MSM or transgender women with HIV/AIDS are receiving access to disease treatment? Why or why not? How do you think this can be improved?

No, I don't think they are. The Thai government says if you have a CD4 count of 350 or lower you can have access to treatment, but that isn't always true. Most of the hospitals only treat you if your CD4 count is below 200. So I think there's still a lot of unnecessary suffering in the country regarding treatment.

I think treatment can be improved if the government completely removes the CD4 requirement. If you're diagnosed with HIV you should immediately be given access to treatment no matter what. This will also interrupt transmission because if you're treated and your viral load is zero, then your capacity to transmit HIV is also zero. And then whether they use a condom or not these people will not transmit HIV. People should be able to treat at any point after diagnosis.

Another way that treatment can be improved is if sex workers and junkies and faggots receive better access to treatment. The health system just needs to get better.

11. Do you think MSM or transgender women would be able to use a mobile application or other technology-based medium for HIV/AIDS to improve prevention, monitoring, reporting, and treatment? Do you think they have adequate access to the Internet or smartphones?

Yes, and they already do. Even the poorest of people have smartphones. There are a lot of myths in this community among community-based service providers around what MSM and TG will and won't do involving HIV. We found that when we test people for HIV and they're positive and we put them into online communities of about 40 other positives they're very open about their status with each other. They use *LINE*, *WhatsApp*, Facebook closed groups, and it's a way we can connect HIV-positives to share information and stories. We monitor that by having a moderator that's online in the morning and evening, and we try to get other organizations to moderate with us. Right now we have about 3 of those online communities, so 120 people.

12. Do you think these populations would be willing to use mobile applications or some other type of technology to receive and send information to a case manager? Why or why not?

Yes. There currently isn't an app where they can do that though. Through already-existing online sources like Facebook or Twitter, people are already sending a ton of information on their HIV situation to other people. At the moment people are passing [HIV] information over those online communities without any type of security at all. They trust the people and they trust the case manager and the moderator.

13. Do you think integrating technology-based health care with community-based programs would be possible in order to improve the HIV/AIDS situation? How?

Yes. I think it's absolutely essential.

14. Do you think it would be beneficial to MSM and transgender people to integrate technology-based health care with community-based programs? Why and how?

So the way it could be integrated... The way that we do it now is that we take you to get tested for HIV, and you're positive, and then we add you to one of the online communities for as long as you want to be, for as long as it's relevant and useful for you. We do that because part of what



we're testing is if you can deliver support online for a really cheap price, to try to reduce the cost per case. We're testing to see if online systems really work to help people manage their health better. Even people in rural areas have access to smartphones so by using an app these people can get information and communicate with other people.

15. What else do you think can be done to lessen the impact of HIV/AIDS among MSM and transgender people?

I think I've said enough, far too much actually.

15. Additional 1: What type of incentives do you think would be necessary to get MSM or TG women to use the app? What about incentives to get testing?

So we give people two movie tickets to test and get their results. What another organization does is hire really hot guys, TV stars and stuff, to take off their shirts and help gain interest [in health and HIV information] and run chat lines. Some have give-aways too. We're somewhat different because we're dealing with positives who don't need to be incentivized. Once you're positive you want to live, you don't want to die, and that's incentive enough.

15. Additional 2: Can you think of any attractive app features that would make an HIV-positive person use an app to help maintain their health?

I think one of the most attractive things is for a person to be able to track their CD4 and viral load counts. They should be able to put in information about their treatment and it will create visual feedback. A lot of people don't end up in control of their [medical record] information, so that would be an important feature to have. It would make their lives easier and maintain their health with less effort. Also a lot of people have many doctors so it would be good to have a feature to put their phone numbers and locations and any information about the doctor. Since a lot of people in rural areas have smartphones but not access to HIV information, it's important to have a lot of general HIV information on the app. Once a person is diagnosed with HIV they become an ambassador for HIV, they need to be able to tell accurate information to their families and partners.

## Interview of CBO leader 1 at SWING

The following interview questions were asked through an in-person interview by Kantamon Choekawong on February 12, 2014. The responses are provided by a CBO leader at SWING in Bangkok.

1. What are the demographics of the people who utilize this facility? How many people visit daily? How many utilize this facility regularly?

We only have nongs [younger siblings that can be either male or female] that work in the service industry. We reach about 30-50 people per day.

2. What types of services and care do these people receive?

[Our members can get their] GED and health checks. We currently have an ongoing project that helps nongs take care of their health. There is also STD check, because we mainly work with testing, checking and preventing HIV for nongs that work in service industry. And for SWING, we can provide support for other STDs too. We also teach English, Thai, and computer usage, and have fitness center for nongs to take care of their health and staff that can give advice when nongs are working or have personal or health problems There'll always be a counselor to give advice.

3. Have any people who visit this facility disclosed their HIV status to you? Why or why not?

We have staff here that take care of that, who are called "case managers." So if any nong is comfortable revealing their status to a CM, everything will be kept confidential and only two people will know about it: the nong and the case manager the nong told.

4. Do you believe there is a stigma about HIV/AIDS in Thailand? Why?

As of now, I think the [negative] perception of people towards those with HIV has decreased. We have worked more, because there's more people working and more people who stood up and worked [to help those with] HIV. There are more people understanding that HIV is not an easy to contract disease. There must be some point that enables contamination or infection; I think a lot of places [or communities] have been able to understand more.

5. What do you believe are the attitudes of MSM and transgender women towards HIV/AIDS? Why?

I'm not sure about him, or his perception. [These things can] sometimes come from him making a mistake from trusting his boyfriend. I think it's not just some groups [referring to TG MSM MSW], but everyone who have trust so they didn't use protection or have haven't had talks before. If they have talked before or before falling in love, they might have used protection.

6. Do you think MSM or transgender women receive adequate information about HIV/AIDS prevention? Why? What prevention tools do you provide them with, if any?

I think [they receive] enough information because there are staffs who work for these target populations directly. There are also non-governmental organizations who stood up to work and formed a group to work with nongs. A lot of them [NGOs]. But TG or MSM which are younger or live in rural area might have less access, because information distribution or support might not be that covering. But if there is promotion, like talking about it on TV, or the media more, I think that the young ones will understand more.

We have condoms, lubricants, female condoms and information on how to use the condoms. We also recommend which size of condom to use and how many sizes they have. And after talking about prevention, we will tell them about how to take care of themselves like what to do so that we would not be infected, like for sex, no matter who you're doing it with, you always need to use condoms every time with lubricants.

7. Do you think MSM or transgender women at-risk for HIV/AIDS get tested often enough for the disease? Why or why not? What do you think causes these people not to go for initial or repeated HIV testing?

No, because MSM and TG still don't have enough hospitals that can service them. Like for government hospitals, there are limited doctors and for health care centers there is limited time [to see them]. And for government based services, they still cannot give a comfortable service. But now we have a center of our own, which makes more nongs regularly use it. But if you also meant center like these, then it's not enough, we have only a few of them.

8. Do you think MSM or transgender women with HIV/AIDS are receiving adequate health care? Why or why not?

If they have come, then they will receive the right treatments in each and every step.

8. Additional 1: Sometimes while browsing on Facebook, there are ads about medicines that can cure HIV. Did any nongs take these kinds of medicine before?

If you mean our nongs, then never. If they come to us, we will provide all the knowledge for starting from blood tests to taking pills. We have counselors that will give advice and track their progress closely.

9. Do you think MSM or transgender women with HIV/AIDS always report their disease status to health care professionals? If not, why?

No, because there are questions that made them uncomfortable. These questions don't come out sounding understanding. Like, "Why are you a guy and still have sex with a guy, are you abnormal?" There are a lot of things that will stress the person.

10. Do you think MSM or transgender women with HIV/AIDS are receiving access to disease treatment? Why or why not? How do you think this can be improved?

Yes, because we always direct them to other places, like hospitals, that are friendly. There are friendly centers but it's not enough.

11. Do you think MSM or transgender women would be able to use a mobile application or other technology-based medium for HIV/AIDS to improve prevention, monitoring, reporting, and treatment? Do you think they have adequate access to the Internet or smartphones?

Yes, because our center is using applications like LINE. Most of them [the nongs] have a smartphone.

12. Do you think these populations would be willing to use mobile applications or some other type of technology to receive and send information to a case manager? Why or why not?

Yes, we are doing that too and we see that our nongs give great feedback and are interested. [They like] that they don't have to waste their time coming here and can use [the application] to get information directly because it's an instant communication.

13. Do you think integrating technology-based health care with community-based programs would be possible in order to improve the HIV/AIDS situation? How?

Yes, because nongs use smartphones.

14. Do you think it would be beneficial to MSM and transgender people to integrate technology-based health care with community-based programs? Why and how?

I think very much, because we reach MSM and TG women.

14. Additional 1: Will people use an application with "HIV" in the title?

No. If you are going to create an application, make it balanced so that everybody can use it. You should ask special people for advice on using words that will not hurt anyone.

14. Additional 2: What about using general health application without HIV in the title?

Make sure that everyone can use it. Talk to experts about wordings. If it makes anyone feel down or disheartened, [don't use it]. I think it [using a general health care application] is okay and softer, but if you make an application with AIDS or HIV [exclusively], people will think it's scary and will not download it.

14. Additional 3: What if we include popular diseases and divide it into categories?

This is okay. Make cartoons that explain things like how to use protection or how to use a condom.

15. What else do you think can be done to lessen the impact of HIV/AIDS among MSM and transgender people?

Actually, using media for [promoting] protection is already on point. I think it's more about talking to your partner. Most of them don't think the condom is needed if they're lovers. The point is what can you do to make them change this thinking and use condoms?

15. Additional 1: What about emotional effects? If we can reduce the stigma do you think it'll lessen the emotional effects?

Sure, lessen. If we can make people understand that HIV is not scary, and that it is not easy to contact [it will lessen the emotional effects]. This must come from friends, from families, from working people. If those people can understand, it will reduce the stigma, and [the effected people] can begin to take more care of their health.

15. Additional 2: How do you promote understanding? Posters?

We do have posters, but mostly we do our list and make group activities like workshops and after that we have a peer leader who will go through our orientation and who will act as the representative of that area.

15. Additional 3: In Thailand, how do you fix the problem regarding the stigma for people about getting blood tests before applying for a job?

We don't fix them, we try to promote a campaign to not violate the person's privacy after the blood test. There are bars that enforce blood test, and we went to talk with them. They can take the blood test but the [bar] owner will not know the result, and then the nong can know how to take care of themselves. And if they know they have HIV, then they will have the think that they should not spread HIV to others and will be careful. But you might ask why we talk to bar owners, [or think] that it sounded easy, but actually it's not. We've been working for 10 years, every day, they are used to us. We take care as if we're a family. And upon talking we try out best not to be a burden or become a problem in their work. We are bringing good things to them. We give special care to special occasions like Valentine's Day, which we tell our staffs to work carefully.

15. Additional 4: What can be an incentive that can get people to use an application?

Start from working [with CBOs to get] people to use it if it's okay. But careful on the wordings and messages, and watch out for stigmas.

## Interview of CBO leader 2 at SWING

The following interview questions were asked through a phone interview by Pantitra Sankatumvong on February 12, 2014. The responses are provided by a CBO leader at SWING in Bangkok.

1. What are the demographics of the people who utilize this facility? How many people visit daily? How many utilize this facility regularly?

Every gender [visits us] because SWING works with workers in every gender: women, men, and TG. We focus on MSW, not all MSM. You want to know the overall numbers from Pattaya and Bangkok right? You want to focus on MSW not MSM? [The interviewer answered “Yes” to both of these questions]. In one day, 50-60 MSW come to SWING to receive services. Per year, the number of MSW who drop-in at SWING is at about 1,000 people. If we combined all people, the drop-ins and the groups we approach, the number is closer to 5,000. TG is included in the 5,000, but if I remember the number correctly the number of TG is around 1,000.

2. What types of services and care do these people receive?

I’m not sure what you want to focus on. There are all kind of services we give them, like orientation, counseling, giving out condoms, blood testing, getting treatment, and the transferring of the ‘gold-card’ privilege. So, it differs between people. For example, when we first meet the person, we give them knowledge, like how to have safe sex, or we take them to see doctors when they are sick [with something] that was caused by an STD infection. We have all kinds of services, so people with different issues come to us and we give them services that they need.

3. Have any people who visit this facility disclosed their HIV status to you? Why or why not?

SWING looks after HIV-positives in both Bangkok and Pattaya, and that would give a total of 100 people. This includes people who go get their blood tested at SWING or elsewhere and come to SWING to receive services.

4. Do you believe there is a stigma about HIV/AIDS in Thailand? Why?

As we know, we gave out the wrong information and the government also gave out wrong information. This wrong information caused the stigma that still exists until today. Some people are just infected with HIV, and they are not sick yet and the society still looks down on them. If we compare the situation to 5 or 10 years ago, more people understand about HIV/AIDS [now]. If you were to ask me if there is still a stigma about HIV/AIDS, [I will say that] yes, there’s still a stigma.

4. Additional 1: In general, what do you mean by stigma?

For example, people look down on or act differently towards other people. When those people said that they’re gay or when the person started to lose weight, people would assume that the person is HIV-positive. That this person works in the sex industry and that they are definitely HIV-positive. Something like this creates an image in people’s minds that people who are sex workers or gay, people who have sex with their own gender, are infected with AIDS. It creates an image of how these groups of people cannot avoid getting HIV. In truth, HIV is about everyone. Well, when you have sexual intercourse and do not use protection, that is. When you do not use protection you can get infected with HIV. In this case when people have these images

in their mind about certain groups of people and HIV, they would stigmatize those groups of people.

5. What do you believe are the attitudes of MSM and transgender women towards HIV/AIDS? Why?

Some HIV-positive people that never receive the correct information would stigmatize themselves, and in some cases they think “My life is over.” This is a horrible thing that should not exist but it still does, there are still some who get diagnosed with HIV and then commit suicide. If these people got the correct information that they could have easily understood from the beginning, people would be more accepting and live more comfortable with HIV. There are many people who are HIV-positive and then learn about HIV and have us CBOs with them, or have mental support from people who cared about them. They would have different perspectives on HIV. Nowadays, there are many cases of people who go to school [after having HIV], work or do what they want, and be successful. It’s normal now. It depends on who has access to the correct information. For people who don’t have access to the right information, they would think that AIDS is fatal and they would die anyways so they just kill themselves now and save themselves from the suffering.

6. Do you think MSM or transgender women receive adequate information about HIV/AIDS prevention? Why?

If you ask if they receive enough information or not, we have to understand that nowadays the information is still limited. There are still groups like people who are working, MSM, MSW, and TG that are small groups. If you ask me how many people are in the subgroups, MSM and TG, no one really knows the number. People who are open about their status have more chance of receiving the information compared to people who are not open about their status, like those who don’t tell others that they are gay. So, MSM and TG did not receive enough information about HIV. We don’t know the exact number of MSM and TG, so there must be more information mediums and the information we give must be consistent.

The information about HIV, like I told you is not about their occupations, so the information we are giving out to the public must be given to the people in general. The information must be unbiased so the stigma would be decreased. For example, the information about AIDS must be grouped with gay, TG, MSW so this information would be emphasized to these groups only. We should adjust our perspective that we should give out the same information for all people, publicly and consistently. So when all the people receive the same information, the stigma of HIV would not be focused on certain groups because people would see HIV as their own problem, [when in fact] it’s everyone’s problem.

6. Additional 1: What prevention tools do you provide them with, if any?

The prevention methods are only the condom but if you ask me who should use protection I would say that there are many ways to get infected is not only through sexual intercourse. It can spread other ways too. If you want to protect people from getting HIV the only way to do so is by using condom. So, we give them condoms but not only condoms though, we also gave them lubricant too since it’s like a pair of prevention methods that are needed to be used together. Other types of preventions are the condoms for females, etc. If you work with people who used drugs via injection, they need to be given clean needles. Different individuals have different

risks, like from mother to child. So in order to prevent HIV we have to know how it spreads and prevent the cause of the spread.

7. Do you think MSM or transgender women at-risk for HIV/AIDS get tested often enough for the disease? Why or why not?

If you say 'enough' there won't be a correct answer for that. What's the meaning of 'enough' in our country? There are more HIV-positives but less budget for treatment, how is that enough? The government has this policy that people with CD4 counts lesser than 350 [copies/mL] should receive treatment but in truth NHSO cannot make all hospitals give treatment for people with CD4 counts lower than 350. When people need counseling or blood testing, do they receive all the processes that are necessary? No. Do they receive all the counseling they need before they get tested? No. Do they receive the correct and thorough counseling at every hospital after they hear the diagnosis? No. So I cannot answer you if it's enough or not. When you say 'enough' it should be both creating the need of testing and have enough testing facilities. If they are HIV-positive they have to have enough treatment for the person, so there are different levels of testing not like you want to get tested and just walk-in to the hospital to get tested. It's not like they take your blood sample and test it and say it's positive and that's it. They have to give out information first then get tested and get other services and treatment. In conclusion, Thailand is so far away from 'enough' if you ask me.

7. Additional 1: What do you think causes these people not to go for initial or repeated HIV testing?

Well, let me ask you back, if it was you, would you go get tested?

[Interviewer answer: If there's no necessity for me to get tested, if there's a necessity for example, I have to go oversea, I would go get tested.]

Why don't you want to get tested?

[Interviewer answer: It's not necessary.]

Many people think like you, that there's not a need, they are not at risk or they always use protection. This is what people think, that the risk of getting HIV is low and that they only have sexual intercourse with their lover. How did they know that their lover only have sexual intercourse with them too? Lots of people think like this, it's not my business; I'm not at risk yet. Another thing is that people fear the result because of the image of being HIV-positive freaked them out. Like the pictures at Wat Prabhatnamphu presented, people look at those picture believe in it. This is being mentioned to the temple saying that the image that they give out of HIV-positives is so scary. When the temple is the one who sends out this information they look very credible because it's the temple, so people believe in them. When people get diagnosed with HIV, these scary pictures haunt them and scare them. Some people are afraid of the result because they are afraid of stigma, that they would be unemployed they are afraid of so many things so they won't get tested. So, not getting tested equals HIV-negative but it can also mean that they are positive as well. No one ever informs the people about testing that it's fast, the counseling is fast, you can take care of yourself and become healthy. No one talks about it so people are afraid of going to the hospital to get tested and they don't want to get tested. People are thinking that it's not their business to get tested it's so far away from their lives and that they are not at risk. These are the current situations right now.



8. Do you think MSM or transgender women with HIV/AIDS are receiving adequate health care? Why or why not?

If people get into the right organizations or hospital systems that are responsible regarding HIV and it's their specialty. There's someone who said "Oh if you take this one herb then you'll be cured," which is wrong. So what is the correct information? There are some people who create this information and spread it around that their way is correct and it's good. If people are in the correct health care system like at the hospital or at the organizations like ours, of course it's the right place to get treatment. However, there are still ways that other people like to take advantage of the HIV-positives, saying that they have the (herbal) medicine that could cure AIDS. People who are in treatment take antiretroviral drugs and they receive this information saying that HIV is incurable. When they hear the advertisements they stop taking the antiretroviral drugs and try taking these herbal medicines. After taking herbal medicines there's no effect at all but they cannot go back to taking their antiretroviral drugs because now they are resistant to the drug. There are other people who give out false information, which then confuses the HIV-positives all the time. In conclusion, there are the two ways of treatment: the correct way and the incorrect way.

8. Additional 1: On Facebook, there are people advertising drugs that can decrease viral load. What are your opinions about these kinds of people who make this advertisement?

The antiretroviral drugs people are taking nowadays are viral-controlling drugs. If there are these types of advertisements, there is a possibility that they receive these drugs from the organizations and advertise them. They might be advertising the antiretroviral drugs that they got from overseas or they bought the drugs from overseas and sell it in a higher price. If you ask if it's possible or not I'll say it's possible because it might be able to help with viral load. If people take these drugs regularly then in some cases the viral load decreases to the point that it cannot be found when they get tested. "It cannot be found when they get tested" doesn't mean that there's no virus, but if the blood sample that gets tested has less than 50 [copies/mL] then it won't show up on the blood testing result.

9. Do you think MSM or transgender women with HIV/AIDS always report their disease status to health care professionals? If not, why?

[This question was not asked.]

10. Do you think MSM or transgender women with HIV/AIDS are receiving access to disease treatment? Why or why not? How do you think this can be improved?

You meant get access of the medication? Yes.

Well right now no, because all the quota at the hospitals and clinics are full. I'm trying to help non-Thais by raising funds for their treatment, but some of the days I have to use my own money to buy the antiretroviral drugs because it's not easily accessible. The Thai government has this policy of making the treatment accessible to foreigners. There are policies, there are laws, but it's not practical. If we make this policy practically possible. If you ask me if that would happen I can answer you right now that it's not going to happen.

11. Do you think MSM or transgender women would be able to use a mobile application or other technology-based medium for HIV/AIDS to improve prevention, monitoring, reporting, and treatment? Do you think they have adequate access to the Internet or smartphones?

There are different levels of HIV-positives, from rich to poor. If they own a phone that has the ability to use application they would use it. There are still some people that use feature phones like Samsung Hero, which is a few hundred baht per phone, so it cannot use the applications. Some people who are HIV-positives are homeless definitely cannot have access to the application on the phones. There are HIV-positives among all the level of society. For people who have access to applications they can be confused by all the information. For example, there's one TG who was just diagnosed with HIV who called us, trying to find as much information as possible. When the person searched for the information from various sources, the information was different and she got so anxious and confused that she called us saying "What should I do? People are saying that I should take the strongest antiretroviral drug, but other people said if I take the strongest medicine then my body would be resistant to that drug. I'm so confused." This can happen with the application too if so many people comment on it they usually put their own opinion in the comments which would change the information's context and other people would be confused. So after reading all those comments they won't know what the correct information is. The case of the TG who called me, I have to spend like half an hour or more to give her the correct information, and correct the wrong information she heard. There are many perspectives for people who are using this technology, there is the bright side and the not-so-bright side to it.

12. Do you think these populations would be willing to use mobile applications or some other type of technology to receive and send information to a case manager? Why or why not?

If you ask me if it's interesting, everyone would want it. I believe that if you make an application that is attractive and did not stigmatize people, it would be good. If you're going to develop an application, I say make it unbiased, [one] that would not stigmatize a certain group. If the presentation of the information is a positive perspective it would attract more people than a depressing, sad application.

12. Additional 1: Do you think people would be more willing to use a general health care application with HIV/AIDS features?

This [type of] application would make people understand more about HIV because it's a general health care application with HIV information included. It would create an understanding through the society. I believe you should do it, not only that people with HIV would benefit from it but also people who have other health problems that need information. These people can download the app and see that in reality there are so many health issues, like people with diabetes would concentrate getting information about diabetes and think that diabetes are terrible. The application would make them see from a different perspective about other diseases as well. The application would make people feel like the disease that they have is not the worst disease in the world. If you make an application that has optimistic information then I think it'll be just fine.

13. Do you think integrating technology-based health care with community-based programs would be possible in order to improve the HIV/AIDS situation? How?

[This question was not asked.]

14. Do you think it would be beneficial to MSM and transgender people to integrate technology-based health care with community-based programs? Why and how?

I can't say yes or no since I didn't see it yet. If we see that this application works we'll support you since we are an open organization. I have to see that if you make an okay application, it'll be great. We're working with students who are making the website that has the go get tested campaign or the understand HIV website. We can work with those groups.

15. What else do you think can be done to lessen the impact of HIV/AIDS among MSM and transgender people?

The society is not the biggest impact. From all the people I've been working with the biggest factor that would impact them the most is family. Family would be the first stage. For example, when the person just got diagnosed with HIV they would be afraid that the society will judge them. The most important reason that people fear are that people would not be able to accept them. In order to decrease the impact you have to give out information that is unbiased and distribute it to the society so that people in the society would understand HIV, that HIV is not as scary as it seems, that HIV is not a contagious disease. If this new set of information is out to the public it would help reduce the stigma and people would not judge people who are living with HIV. After the understanding the public, general people would understand HIV and then people in their family would understand HIV. Many cases that I worked with, they stopped caring about the society because they want to go back to their family but some of them can't since certain families are not open-minded about this and fear about them. There's this very handsome guy who is very popular and has lots of friends, and he's afraid to tell the society that he's HIV-positive and in the end when he surpassed that fear he had, he wanted to tell his family but he's still not brave enough to tell his family so in conclusion he got to the AIDS stage. When he's so sick it's like now or never he has to tell his family. We helped him get in contact with his family saying he is sick but we didn't tell them that he is HIV-positive because his family is not ready to accept it yet. The family said they would help the guy get treatment but when he got back and his family still didn't know he was HIV-positive, the family treated him so nicely that he thought that they would accept him. So he told them that he was HIV-positive, then the family kicked him out and called us to take him back. They said "Do not take these types of people to us to look after." In the end, after they sent him back to the CBO, within a week he died. In conclusion, to lessen the impact in my opinion it is important to start making people understand since we cannot reach every family so we have to target the public, general people, which would then penetrate into the family. I hope someone would be able to accomplish this.

15. Additional 1: Do you have any ideas about incentives that will make people want to use the app?

I'm not sure about what incentives people have in using an app because the cases I'm working with right now did not find [people] to download health care applications. They would search for something fun and entertaining more than a health care app. A health care app is one of their lowest priorities, so I'm not sure what their incentives are so I cannot give any recommendation.

## Interview with CBO leader from The Poz

The following interview questions were asked through an in-person interview by Pantitra Sankatumvong and Phuripob Wichaijiranath on February 17, 2014. The responses are provided by a CBO leader at The Poz in Bangkok.

1. What are the demographics of the people who utilize this facility? How many people visit daily? How many utilize this facility regularly?

Previously it's 300 people per year. The groups are MSM and TG living with HIV. There are very few TGs, less than 5%, most of them are MSM.

2. What types of services and care do these people receive?

There are personal counseling, group activities which we call 'family day', giving educations, or occasional festivals as New Year, Songkran for people to join us.

3. Have any people who visit this facility disclosed their HIV status to you? Why or why not?

Every one reveals.

4. Do you believe there is a stigma about HIV/AIDS in Thailand? Why?

Currently there is still stigmas in the traditional headed group, but in the present, because of the technologies is improving, most teenagers have knowledge about it and only a few of them that have knowledge but is still afraid of it.

5. What do you believe are the attitudes of MSM and transgender women towards HIV/AIDS? Why?

In this group, yes they are afraid, but they are not aware, this increases the new patient every day, because they are afraid of contracting HIV but does not comply to use any protection.

6. Do you think MSM or transgender women receive adequate information about HIV/AIDS prevention? Why? What prevention tools do you provide them with, if any?

The information is enough, but the people are not aware, sometimes emotions lead them, or sometimes they're drunk.

7. Do you think MSM or transgender women at-risk for HIV/AIDS get tested often enough for the disease? Why or why not? What do you think causes these people not to go for initial or repeated HIV testing?

Most of them are condoms and lubricants, because they must be used together. Every time we give them we also tell the why they must be used together.

7. Additional 1- What makes people unaware?

In the perceptions of those that doesn't know their statuses yet, they only look at the appearance of their partner, so if the partner looks clean or handsome, they might not use protection. Another reason is drunk.

8. Do you think MSM or transgender women with HIV/AIDS are receiving adequate health care? Why or why not?

Actually we can get blood check anywhere, but the person will stigmatize themselves before entering, such as “If I go in, will people question about my condition?” We told everyone, and they know that the treatment is free, but no one dares to go to government-based hospital, because the nurse would questions something that makes our nongs uncomfortable. First is that they think that they are not at risk. Secondly, there is nothing happening to their bodies. About treatment, if they come to us, they will surely receive the correct treatment.

9. Do you think MSM or transgender women with HIV/AIDS always report their disease status to health care professionals? If not, why?

The first thing is shame. If I say I’m a gay, will I get a different treatment? Next, it’s about stigmatizing himself, “if I go to the hospital, the nurse will surely scold me.” “How should I tell the doctor I’m leaking puss?” Because before meeting the doctor, nurses will sort the patients according to the symptoms, and our people will wonder “just how many questions do I have to go through?” and become uncomfortable. But if we went with them, we will say we have already sort him/her for you, and the only thing left is just to see the doctor. We also prepare our nongs, telling them how to tell the nurse if you have specific symptoms so that they would not be ashamed to do so.

10. Do you think MSM or transgender women with HIV/AIDS are receiving access to disease treatment? Why or why not? How do you think this can be improved?

Actually, both groups know that there are treatments available, but it’s separated. For Thai, it is free, but for non-Thai, they must pay even though there are laws about it but practically they still have to pay. Actually in ASEAN, Thailand has the cheapest medicine for us, and if they bought our medicine, and go back to their country, they will face a problem that the medicine in their country is more expensive. These says we also try to help like foreign labor, to get them equal treatment even though there might be parts that he needs to pay extra, but there are volunteers to comfort them, and tell them how to handle future approaching problems. Giving advises on money management, how much to save for your future medication cost. As for Thai people, we are not worried in treatment, but more on talking medication. Because the medicine is free, there are a few people that think that, “I take free pills, I can or cannot eat it, I can eat it late, or later.” This caused drug resistance, and when that happens, it’s not only about resisting a drug, a test must be done to find which drugs does the body resist, and what medications can they take. Which, the medications that they can take, may not be under the government’s coverage, and they must pay by themselves.

11. Do you think MSM or transgender women would be able to use a mobile application or other technology-based medium for HIV/AIDS to improve prevention, monitoring, reporting, and treatment? Do you think they have adequate access to the Internet or smartphones?

Yes. It’s good to have mobile application to remind the patient about taking pills. Next, mobile phones are personal items that they must use, so each person has a different way of protecting their privacy, like passwords. Most of the people now are using alarm clocks for reminders. I also use applications for drugs, which is *YaAndYou* and *DoctorMe*.

About access, I think almost everyone, because where ever we go, there are always people looking at their phones.

12. Do you think these populations would be willing to use mobile applications or some other type of technology to receive and send information to a case manager? Why or why not?

If it's an application that's not too exposing, and is secrecy for one person, I think they will just, not for anyone, but for themselves.

12. Additional 1: We plan to make a general health care application that has HIV inside, what do you think of it?

That's a good idea, one, when people taking pills, there are risks of having other diseases like liver and kidney problems, but if they monitor themselves, they will become aware of how should they see the doctor, what food should they not eat, what should they eat extra?

13. Do you think integrating technology-based health care with community-based programs would be possible in order to improve the HIV/AIDS situation? How?

Yes, it helps anyone when they know they have commit a mistake, to know that there are CBO waiting around to comfort, care and support. However, since we mainly work with positives, we are a negative media, anyone who walked here are viewed as being positive, so the promoting for our organization is very hard.

14. Do you think it would be beneficial to MSM and transgender people to integrate technology-based health care with community-based programs? Why and how?

If we can do that, then it'll be great, to know where to go when they make mistake.

15. What else do you think can be done to lessen the impact of HIV/AIDS among MSM and transgender people?

From our experiences, mental support is the priority, since there is a Thai saying "Mental health is above physical health." Whenever we are stressed, it will affect the body. Secondly, is their health, they must see a doctor. But we will see first if they can manage their problems, if they can, we will help them in other ways, if not, we will pass them to others who can.

15. Additional 1: What can be incentives for people to use the application?

First, it must be free. Next, it must be interesting. Third, it must be able to do what we want. For example, I'm using *DoctorMe*, because I always travel, and *DoctorMe* can tell the location of the nearest hospitals. In the application it also lets us evaluate ourselves based on our symptoms.

There are things I want to tell the application developer, about places that gives out free condoms, it would lead people to centers that might be able to give knowledge on HIV too.

## Interview with CBO leader from Caremat

The following interview questions were asked through a phone interview by Phuripob Wichaijiranath on February 17, 2014. The responses are provided by a CBO leader at Caremat in Chiang Mai.

### 1. What are the demographics of the people who utilize this facility? How many people visit daily? How many utilize this facility regularly?

Caremat is an organization which works with mainly HIV-positives that are both MSM or TG. There are also people who come to our Twin Center, like 3 or 4, where we are not categorizing them as positive or negative.

### 2. What types of services and care do these people receive?

We give services like counseling for STDs. If anyone coming here has problems like blood test or anything that relates with HIV or AIDS, we will take them to Disease Prevention Control, Chiang Mai. If they already know their blood test results, we will help them in informing them about how to prepare themselves, how to do basic health care to maintain CD4 at normal level for as long as possible before they have to take antiviral medicines. And make nongs feels encouraged, make friends for them so that they are not lonely, depressed, or lonely and become ready to live with HIV. We who work here will always cheer them on until they have better health, and after that we will look into their future, there might be many things happening such as unemployment or resignation due to various factors. We mainly support nongs in body, mental, social, economic ways.

The numbers of MSM, not mentioning about positive or negative just that they think of themselves at risk, for daily drop by is 4 to 5 per day and around 100 per month. We could have more, but we were working with more specific groups, MSM and TG with HIV+. There is already another NGO working with prevention.

Depends on the case, some want information, which we can provide with a course or reading materials. While others will be cases that have problems with sexual health, like they were involved in risky actions, or did not protect themselves earlier, we will take them to body check case by case. We also do client visits for our members who are sick at home to give them morale and let them know we're there for them. Other than that we work with hospitals by providing staffs for helping at the clinics or hospitals in distributing antiviral drugs. Lastly is our drop in center, as I've said earlier, it's about counseling, information, Internet, library, meeting room and collaboration with other organizations.

### 3. Have any people who visit this facility disclosed their HIV status to you? Why or why not?

There's no one revealing at their first step here, it must be through talking for each case. Some came because they wanted to know their status, which we will bring them to blood testing, which both they and us will know, most of the cases will be like this. It's a step-wise process, although some might use phones and tell us they are HIV+ and ask for antiviral drug information.

### 4. Do you believe there is a stigma about HIV/AIDS in Thailand? Why?

There are still some stigmas, but lesser compared to before. It's because the people stigmatizing is about perceptions. Before, the organizations working with HIV showed posters and pictures

about HIV that is very scary, creating an unofficial slogan “Have AIDS and die”. That made a large group people believe that having AIDS will surely [cause them to] die in a short time. These days there are two groups, one with understanding, and the others in rural areas that still have fears. The most important thing is to receive knowledge about HIV, which normally people would not be interested in it, unless they have it, then they will start to worry.

5. What do you believe are the attitudes of MSM and transgender women towards HIV/AIDS? Why?

The perceptions of nongs are getting better because of the works of CBOs in each area working hard to support and give information for nongs that are MSM or TG including MSW. For centers that are near to areas that have services that include the sex industry, there must be organizations to help and provide information and knowledge to raise awareness in nongs about the risks in having unprotected sex. We also teach the how to use condoms, however there are many factors that make nongs unable to access us, such as students with good family status or their parents are working for the government, so they can't reveal their status or have not accepted it.

6. Do you think MSM or transgender women receive adequate information about HIV/AIDS prevention? Why? What prevention tools do you provide them with, if any?

I must say that Caremat is an organization working with HIV+, so we do not give as many tools.

7. Do you think MSM or transgender women at-risk for HIV/AIDS get tested often enough for the disease? Why or why not? What do you think causes these people not to go for initial or repeated HIV testing?

If the target population is MSM and TG in Chiang Mai, I think there's a lot. They are afraid of the fact that they are at risk since they change partners a lot and might catch HIV, and once they are positive, they cannot accept it, afraid that parents, friends, will know or if they are still studying, there will be fatal effects.

8. Do you think MSM or transgender women with HIV/AIDS are receiving adequate health care? Why or why not?

Of course they will receive the correct treatment. Each hospital has the same standard of treatment, such as giving advice before and after the blood test, and giving information about privilege to receive antiviral pills, which these are already in a package for going to the doctors.

9. Do you think MSM or transgender women with HIV/AIDS always report their disease status to health care professionals? If not, why?

We also don't know. Because nongs that are able to reach doctors do not do that first step. Who would want to go to a doctor without having gone through some risk? Then they will receive proper treatment from the hospital after the blood test. It's not that they don't tell us, but we have only seen those that already know their result. There are a few of the cases though, that they have positive result on the first test and went for second blood test to check himself.

10. Do you think MSM or transgender women with HIV/AIDS are receiving access to disease treatment? Why or why not? How do you think this can be improved?

Yes, of course, it's an instinct that if you're sick, you go to hospitals, so the channels that people will know about treatment centers is a lot. As for nongs that are MSM, most of them are non-



Thai, some of them will know information through organizations that work with AIDS or prevention, which the organization would go to them and provide information about hospitals they should go or clinics. But there are also portions that don't know anything.

10. Additional 1: How do you inform the people about hospitals or centers for HIV?

We promote or advertise, events on occasions like Global HIV Day, would promote us and let us give them information of where the services are provided.

11. Do you think MSM or transgender women would be able to use a mobile application or other technology-based medium for HIV/AIDS to improve prevention, monitoring, reporting, and treatment? Do you think they have adequate access to the Internet or smartphones?

Yes but not all, depends on them if they have knowledge about using new innovations or not, unless someone goes to them and teach them how. Internet access is the same.

12. Do you think these populations would be willing to use mobile applications or some other type of technology to receive and send information to a case manager? Why or why not?

Yes, they always use [geo-social networking] applications for communications. If it wasn't for these innovations, there would be far less spreading of HIV. I'm not saying that these are the reasons for spreading, but it's how the nongs use these applications to meet new people which might lead to having intercourse.

13. Do you think integrating technology-based health care with community-based programs would be possible in order to improve the HIV/AIDS situation? How?

Possible, we have promoting services, which we use these tools. Aside from making signs brochures, we can make a community in the Internet for MSM or application, these applications can help us.

14. Do you think it would be beneficial to MSM and transgender people to integrate technology-based health care with community-based programs? Why and how?

Yes, it's one of a choice other than going into the field.

15. What else do you think can be done to lessen the impact of HIV/AIDS among MSM and transgender people?

There must be more collaboration between the government and CBOs, because some policies are matching but in the working, it's not matching at all. The CBO might do things one way and the government does things the other way, creating gaps in working, making works not as completed as they should be.

15. Additional 1: Do you have any ideas about incentives?

Personal recommendation, there are always 'trend' in nongs' groups. Like one have, and the other don't, it creates interests, challenges, I want to have, I want to own it. Like we see our friends use it, and we want to use it too. People who have less chance of accessing to use might find this application useful. The application should include the questions that most people cannot ask anyone, like what should I do, I had sex without protection.

## Appendix H: Description of values for QFD

The following appendix is a list of 19 values identified by the stakeholders and used in the final QFD, shown in Appendix K. A more in-depth description of what each value entails is provided by the corresponding bullets.

### Privacy

- Protect private medical info
- Keep HIV status confidential
- Password protected
- Anonymous testing
- Nothing forces you to reveal HIV status
- Discreet presentation

### Medication Info

- Medication compatibility
- Interactions
- Medication options
- Dosage
- Descriptions

### General Education / About HIV/AIDS

- FAQ
- What is HIV?
- Overview of treatment, prevention, testing...
- Information about other STDs
- History

### Contact with Doctor

- Ask specific questions
- Advice
- Diagnosis

### Reminders

- Medication
- Treatment
- Testing
- Appointments

### Location Services

- Hospitals
- Clinics
- Testing sites
- Pharmacies
- Counseling

- CBOs
- Where to find certain items

### **Reporting Results**

- Blood test
- CD4
- Viral load
- Status

### **Specific HIV Information**

- Treatment
- Prevention
- Testing

### **Health Information**

- Healthy living
- Recommended diet
- Recommended exercise

### **Find Out Risks**

- Find out what behavior is risky
- Calculate my risk

### **Reduce Fear and Stigma**

- Gain a positive mindset
- Teach other people about AIDS
- Learn how to tell your partner, friends, and family about HIV status
- Increase overall awareness

### **Meeting New People**

- Dating people with HIV
- New friendships with HIV+

### **Counseling**

- Talk to a professional counselor/ therapist
- Emotional support

### **Track Progress**

- Make a CD4 count graph
- Keep track of medication that has been taken
- Track test results

### **Entertainment**

- Games
- Having fun

- Take quizzes
- Read factoids

### **Payment Information**

- Cost of medications
- Cost of testing
- Cost of prevention methods
- Cost of appointments
- Cost of transportation to testing/clinics

### **Take Notes**

- Thoughts for doctor
- Diary
- How you are feeling

### **Support from Community**

- Get support from HIV+
- Get support from TG/MSM
- Read people's stories

### **HIV news and current events**

- Learn updated news about HIV
- Learn about current events going on related to HIV

## Appendix I: Description of features for QFD

The following appendix is a list of 10 features identified by the researchers and used in the final QFD, shown in Appendix K. A more in-depth description of what each feature entails is provided by the corresponding bullets.

### Security

- Password protection
- Protected system to store data

### Information

- Glossary
- News
- FAQs section
- Guide of how to tell people your status
- Cost information
- Referrals
- Medication Interactions

### Self-monitoring

- Tracking graph for CD4
- Tracking graph for viral load
- HIV risk meter

### Records

- Notepad/journal
- Medication records
- Appointment records
- Testing records

### Reminder System

- Reminders for meds
- Reminders for appointments
- Reminders for tests
- Calendar for reminders/other dates

### Maps

- Maps to clinics
- Maps to testing sites
- Maps to CBOs
- Maps to counseling
- Walking maps
- Public transportation maps

### Talk With Medical Professional

- Chat system with doctor
- Chat system with counselor
- General contact with doctor

### **Entertainment**

- HIV-related game
- Attractive interface
- Videos and diagrams
- Interactive gaming

### **Community Features**

- Social network connection
- Chat with HIV+ persons
- Other people's stories

### **Dating Service**

- Find partners that are HIV+

## Appendix J: Framework for assessing mobile applications using QFD and MAUT

**QFD:** Quality Function Deployment is used in this project to determine which features of an HIV/AIDS mobile application are most valuable to our stakeholders. The results of the QFD are normally presented in a tabular form. For this work, we have modified standard QFD to fit the problem we were addressing.

### Structure of the QFD table:

	$F_1$	$F_2$	$F_3$	$S_1$	$S_2$	$S_3$	$\bar{S}$
$V_1$	<b>B</b>			<b>A</b>			
$V_2$							
$V_3$							
	<b>C</b>						

In this example of a QFD table we use the following notation:

- $F_i$  is a feature that an application might have, such as the ability to make a phone call or send a message from within the application
- $V_i$  is a customer value, which is something that the customer, or some other stakeholder, might want the application under construction to support
- $S_i$  represents a particular stakeholder or class of stakeholder, such as the person who uses the application
- $\bar{S}$  represents a normalized stakeholder that is a representation of all of the  $S_i$  columns. For this we used a rounded mean value.

Note that the size of each series is inconsequential to the functioning of the QFD table - as long as the cell values are constructed correctly, stakeholders, features, or values can be added and removed. The above example has only three stakeholder, features, and values for the purposes of illustration.

### How to evaluate a QFD table:

**Step 1:** Gather information from the stakeholders about how important each value,  $V_i$ , is to them. Ask each stakeholder to give a score for their preference of feature, or determine a score based on the gathered information. Do this on a linear scale from 1 to  $n$ , with 1 meaning the value is unimportant and  $n$  meaning the value is very important. In our usage of QFD,  $n$  was defined as 4. The results of these processes are reflected in section **A** of the QFD Table. The cells in the rightmost column of section **A** hold the mean stakeholder score for each value.

**Step 2:** The next step is to score how important each feature is for the mobile application to provide each value. If the feature is not necessary at all, the pair is awarded a 0. If the feature has some importance, the pair is awarded a 1. If the feature is considerably important for delivering the value, the pair is awarded a 3. If the feature is extremely important for delivering the value, the pair is awarded a 10. These rankings are done manually, and should be based on research about HIV/AIDS mobile applications. They are often determined by a group of

knowledgeable people, such as developers, customers, or others. These scores are reflected in section **B**, and should be entered so that they correspond to the same row and column for the feature and value they are based on.

**Step 3:** The last step is to find the products of the section **B** columns and the mean of the stakeholder weights for each value,  $\bar{S}$ , in section **A**. Then sum these products. This number is the final score each feature receives, and is reflected in the cells of section **C**.

**Example of completed QFD table:**

	$F_1$	$F_2$	$F_3$	$S_1$	$S_2$	$S_3$	$\bar{S}$
$V_1$	1	3	0	2	3	4	3
$V_2$	10	3	0	4	1	1	2
$V_3$	0	10	1	3	3	3	3
	23	45	3				

This is an example of a QFD table that has been filled with values and evaluated. For a more in-depth example, see our completed QFD in Appendix K.

**MAUT:** The Multi-Attribute Utility Theory is used in this project to score existing HIV/AIDS applications based on their abilities to provide the features we have found to be important from our QFD analysis.

**Structure of the MAUT table:**

Feature	Weight	$A_1$	$A_2$
$F_1$	$W_1$	<b>D</b>	
$F_2$	$W_2$		
$F_3$	$W_3$		
Totals	<b>E</b>		

In this example of a MAUT table we use the following notation:

- $F_i$  is a feature that an application might have, such as the ability to make a phone call or send a message from within the application. These features are the same ones use in the QFD table.
- $A_i$  represents an application that is being evaluated based on the set of features.
- $W_i$  represents the weights that for each feature. These values are the final scores of each feature from the QFD table.

Note that the size of each series is inconsequential to the functioning of the MAUT table - as long as the cell values are constructed correctly, applications, features and weights can be added and removed. The above example has only three features and two weights, for the purposes of illustration.



### How to evaluate an MAUT table:

**Step 1:** Rate each application on how well they provide each feature. Do this on a linear scale from 1 to  $n$ , with 1 meaning the value is unimportant and  $n$  meaning the value is very important. In our usage of MAUT,  $n$  was defined as 4. These scores are reflected in section **D** of the MAUT table. These scores are reflected in section **D**, and should be entered so that they correspond to the same row and column for the application and feature they are based on.

**Step 2:** The last step is to find the product of the weights and scores for each feature in the application. Then sum these products. This number is the final score each application receives, and is reflected in the cells of section **E**.

### Example of completed MAUT table:

Feature	Weight	$A_1$	$A_2$
$F_1$	23	3	3
$F_2$	45	1	2
$F_3$	3	4	2
<b>Totals</b>		<b>126</b>	<b>165</b>

This is an example of a MAUT table that has been filled with values and evaluated. For a more in-depth example, see our completed MAUT in Appendix L.

## Appendix K: Final QFD table

	Security	Information	Self-monitor	Records	Reminder system	Maps	Talk with medical professionals	Entertainment	Community features	Dating service	PSI	CMs	MAPs	Total	Normalized value
Privacy	10\37	0\0	0\0	0\0	0\0	0\0	1\3.7	0\0	0\0	0\0	4	4	3	11	3.7
Medication info	0\0	10\27	0\0	3\8.1	0\0	1\2.7	3\8.1	1\2.7	1\2.7	0\0	2	3	3	8	2.7
General education	0\0	10\27	0\0	0\0	0\0	0\0	3\8.1	3\8.1	3\8.1	0\0	2	2	4	8	2.7
Contact with a doctor	1\3	1\3	1\3	1\3	3\9	10\30	10\30	1\3	3\9	0\0	3	3	3	9	3
Reminders	0\0	0\0	0\0	3\8.1	10\27	0\0	0\0	1\2.7	0\0	0\0	3	3	2	8	2.7
Location services	0\0	1\2.3	0\0	0\0	0\0	10\30	1\2.3	1\2.3	1\2.3	0\0	3	2	2	7	2.3
Reporting results	1\2	0\0	10\20	3\6	0\0	3\6	3\6	1\2	0\0	0\0	2	3	1	6	2
Specific HIV info	0\0	10\40	0\0	0\0	0\0	1\4	3\12	1\4	3\12	0\0	4	4	4	12	4
Health info	0\0	10\27	0\0	0\0	0\0	1\2.7	3\8.1	1\2.7	1\2.7	0\0	2	2	4	8	2.7
Find out risks	0\0	10\33	10\33	3\9.9	0\0	1\3.3	3\9.9	1\3.3	3\9.9	0\0	3	4	3	10	3.3
Reduce fear and stigma	3\9	3\9	1\3	3\9	0\0	1\3	1\3	3\9	10\30	3\9	3	4	2	9	3
Meeting new people	0\0	0\0	0\0	0\0	0\0	3\6.9	0\0	1\2.3	10\23	10\23	1	2	4	7	2.3
Counselling	1\2.3	0\0	0\0	0\0	0\0	3\6.9	10\23	1\2.3	3\6.9	0\0	2	4	1	7	2.3
Track progress	1\3	0\0	10\30	10\30	10\30	0\0	1\3	1\3	0\0	0\0	3	4	2	9	3
Entertainment	0\0	1\3	0\0	0\0	0\0	0\0	0\0	10\30	1\3	3\9	2	3	4	9	3
Payment info	0\0	10\17	0\0	0\0	0\0	0\0	3\5.1	1\1.7	1\1.7	0\0	1	2	2	5	1.7
Take notes	0\0	0\0	3\3.9	10\13	0\0	0\0	0\0	1\1.3	0\0	0\0	1	2	1	4	1.3
Support from community	0\0	0\0	0\0	0\0	0\0	3\8.1	1\2.7	1\2.7	10\27	1\2.7	2	4	2	8	2.7
HIV news and current	0\0	10\13	0\0	0\0	0\0	0\0	1\1.3	1\1.3	1\1.3	0\0	2	1	1	4	1.3
Final value	56.3	201.3	92.9	87.1	66	96.6	126.3	84.4	139.6	43.7					

## Appendix L: Final MAUT table

Features	Weight	HIV iChart	Ohio	HIV Risk Calculator	Life Plus	Get Them Tested	HIV Plus Treatment Guide	inPractice	The Body for iPhone	Play Safe	iStay Healthy	The Positive Project	HIV Connect	Lovecare Check HD	AIDSinfo HIV/AIDS Glossary	HIV Explained	Prototype
Security	56	1	1	1	3	1	1	1	1	4	1	1	3	1	1	1	1
Information	201	3	4	4	1	3	2	4	4	1	1	4	3	4	4	4	4
Self-Monitor	93	2	3	3	4	2	4	1	1	1	4	1	1	2	1	1	3
Records	87	1	1	1	4	1	4	1	1	1	4	1	1	1	1	1	4
Reminder	66	1	1	1	4	1	4	1	1	1	3	1	1	1	1	1	4
Maps	97	1	3	2	1	1	4	1	1	1	1	1	1	1	1	1	2
Talk with Medical Professionals	126	1	1	1	2	1	1	1	1	1	1	1	4	2	1	1	4
Entertainment	84	2	1	2	1	1	1	1	1	1	1	1	1	1	1	3	3
Community Features	140	1	1	1	2	1	1	1	1	2	1	4	4	2	1	1	4
Dating Service	44	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1	1
<b>Final Scores</b>		<b>1573</b>	<b>1977</b>	<b>1964</b>	<b>2110</b>	<b>1489</b>	<b>2224</b>	<b>1597</b>	<b>1597</b>	<b>1302</b>	<b>1666</b>	<b>2017</b>	<b>2350</b>	<b>1956</b>	<b>1597</b>	<b>1765</b>	<b>3305</b>

## Appendix M: Summative team assessment

Over the course of this project we learned what it meant to work as a team. In order to complete a high-quality project that achieved our research goal, we had to realize that our different backgrounds, cultures, and ways of thinking could provide challenges. However, all team members were unified through a common understanding of the project, which was clarified even further during frequent meetings early-on with our sponsor. Each team member had different strengths and weaknesses. Over time, we learned that each team member should be responsible for the work that played to their strengths in order to complete tasks related to the project in the most efficient and effective way possible. As the project went on, team mates were given the chance to contribute more equally so that by the end a more balanced effort was achieved.

We established some techniques to work more effectively as a team. At the end of every meeting, each team mate stated his or her accomplishments for the day. This kept each team member aware of what others were doing and also encouraged others to work harder. By having open communication, we were more easily able to delegate tasks and address problems. The team discussed among themselves and with the advisors to reach a solution for any persistent problems.

This project experience was unique in that students from different cultures came together to accomplish a common research goal. Though we quickly found that there were differences among American and Thai students, we learned how to work with each other. Team members adapted to be more patient, understanding, and open-minded. This experience presented an opportunity for students from two different cultures to learn from each other and achieve personal growth, while also producing a successful project.