The Asian Epidemic Model (AEM)

Projections for HIV/AIDS in Thailand:

2005-2025

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ANALYSIS & ADVOCACY

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Copies of this publication can be obtained from:

1) Bureau of AIDS, TB and STIs, Department of Disease Control, MOPH
   Tel: +662 590 8411, +662 591 8411 Fax: +662 591 8413, +662 590 3210

2) Policy Research and Development Institute Foundation Tel. +662 270 0921-2, Fax. + 662 618 7073

3) Family Health International, Asia/Pacific Regional Office Tel. +662 263 2300, Fax. +662 263 2114

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ACRONYMS

A^2	Analysis and Advocacy Project
AEM	Asian Epidemic Model
AIDS	Acquired immunodeficiency syndrome
ART	Antiretroviral therapy
ARV	Antiretroviral
BSS	Behavioral surveillance survey
FSW	Female sex worker
GPOvir	A generic antiretroviral medicine manufactured by Thailand's Government Pharmaceutical Organization
HIV	Human immunodeficiency virus
IDU	Injecting drug user
MOPH	Ministry of Public Health
MSM	Men who have sex with men
MSW	Male sex worker
NAPHA	National Access to Antiretroviral Programme for People with HIV/AIDS
NGO	Non-governmental organization
NNRTI	Non-nucleoside reverse transcriptase inhibitors
PLHIV	People living with HIV
RDS	Respondent driven sampling
STI	Sexually transmitted infection
TB	Tuberculosis
TUC	Thailand MOPH - U.S. CDC Collaboration
USAID	United States Agency for International Development
U.S. CDC	United States Center for Disease Control and Prevention
VCT	Voluntary counseling and testing
VD	Venereal disease
WHO	World Health Organization

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This document presents the results of the updated Asian Epidemic Model (AEM) Projections for HIV/AIDS in Thailand 2005-2025 prepared by the Analysis and Advocacy Project (A^2) in Thailand in collaboration with the Thai Working Group on HIV/AIDS Projections, and with funding from the United States Agency for International Development (USAID). These updated projections were prepared to serve the preparation of the development of the Thailand 10th National AIDS Plan.

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The updated Thailand HIV projections use the epidemiological and behavioral data collected by numerous researchers and public health officials in Thailand over the year. The data used include sentinel serosurveillance data and behavioral surveillance data (Bureau of Epidemiology, Department of Disease Control, MOPH), conscript seroprevalence data (Royal Thai Army and Armed Forces Research Institute of Medical Sciences), sexually transmitted infection data (STIs Cluster, Bureau of AIDS, TB and STIs, Department of Disease Control, MOPH), injecting drug user (IDU) data (Bangkok Metropolitan Administration and Thailand MOPH - U.S. CDC Collaboration), men who have sex with men (MSM) data (Thailand MOPH - U.S. CDC Collaboration and MSM groups) and antiretroviral therapy data (Bureau of AIDS, TB and STI, Department of Disease Control, MOPH).

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The Thai Working Group on HIV/AIDS Projections (2005)

Bureau of AIDS, TB and STIs, Department of Disease Control, Ministry of Public Health
Dr. Sombat Thanprasertsuk
Dr. Anupong Chitvarakorn
Dr. Somyot Kittimunkong
Ms. Kittaya Yothaprasert
Ms. Vipa Phawanaporn

Bureau of Epidemiology, Department of Disease Control, Ministry of Public Health
Dr. Kamnuan Ungchusak

Armed Forces Research Institute of Medical Sciences, Royal Thai Army
Major General Suebpong Sangkharomya

Thailand MOPH - U.S. CDC Collaboration
Dr. Achara Teeraratkul

National Institute of Health, Department of Medical Sciences, Ministry of Public Health
Dr. Pathom Sawanpanyalert

Office of the National Economic and Social Development Board
Mr. Jirapan Kalaprawit
Ms. Waranya Teokul

Institute of Health Research, Chulalongkorn University
Dr. Vichai Poshyachinda

The Thai Red Cross AIDS Research Centre
Dr. Praphan Phanuphak

Chulalongkorn University
Prof. Dr. Kua Wongboonsin

A^2 Project in Thailand

Policy Research and Development Institute Foundation
Dr. Wiput Phoolcharoen

East-West Center, USA
Dr. Tim Brown
Dr. Wiwat Peerapatanapokin

Family Health International, Asia/Pacific Regional Office
Dr. Jittinee Khienvichit
Dr. Jeremy Ross
Dr. Somchai Sriplienchan
Ms. Kulcharee Tansubhapol
Ms. Ganrawi Winitdhama

A^2 Data Analysis Working Group and contributors

1. Ms. Chutima Akaleephan, International Health Policy Program
2. Dr. Kanittha Boonthamcharoen, Bureau of Planning and Strategy, Ministry of Public Health
3. Dr. Frits van Griensven, Thailand MOPH - U.S. CDC Collaboration
4. Dr. Payon Hanpadungkit, Bureau of AIDS, TB and STIs, Department of Disease Control, Ministry of Public Health
5. Dr. Sophon Iamsirithawon, Bureau of Epidemiology, Department of Disease Control, Ministry of Public Health
6. Lt. Col. Dr. Kunakorn Kana, Armed Forces Research Institute of Medical Sciences
7. Dr. Mana Kongpatanayothin, Anonymous Clinic, AIDS Research Center, Thai Red Cross Society
8. Dr. Cheewanun Lertpiriyasuwat, Bureau of AIDS, TB and STIs, Department of Disease Control, Ministry of Public Health
9. Ms. Viphada Maharatanaviroj, Bureau of AIDS, TB and STIs, Department of Disease Control, Ministry of Public Health
10. Dr. Thanarak Plipat, Bureau of Epidemiology, Department of Disease Control, Ministry of Public Health
11. Col. Dr. Ram Rangsin, Phramongkutklao College of Medicine
12. Dr. Orratai Rhucharoenpornpanich, AIDS Control Division, Department of Health, Bangkok Metropolitan Administration

13. Dr. Patchara Rumakom, USAID
14. Ms. Oraphan Sangwonloy, Bureau of Epidemiology, Department of Disease Control, Ministry of Public Health
15. Dr. Petsri Sirinirun, Bureau of AIDS, TB and STIs, Department of Disease Control, Ministry of Public Health
16. Dr. Patchara Siriwongrungsan, Bureau of AIDS, TB and STIs, Department of Disease Control, Ministry of Public Health
17. Dr. Chaiwat Ungsedhapand, the HIV Netherlands Australia Thailand Research Collaboration, AIDS Research Center, Thai Red Cross Society
18. Ms. Anchalee Varangrat, Thailand MOPH - U.S. CDC Collaboration
19. Dr. Kasem Wetchasuthanon, Health System Research Institute
20. Ms. Chawewan Yenjitr, International Health Policy Program

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EXECUTIVE SUMMARY

The Asian Epidemic Model (AEM) Projections for HIV/AIDS in Thailand: 2005-2025

The Asian Epidemic Model (AEM) Projections for HIV/AIDS in Thailand 2005-2025 were prepared by the Analysis and Advocacy Project (A^2) in Thailand, in collaboration with the Thai Working Group on HIV/AIDS Projections, and with funding support from the United States Agency for International Development (USAID). The present projections are an update of the projections prepared in 2000. While the projections were calculated with a model similar to that used in 2000, two new components including MSM and ART were added. These updated projections were prepared to support of the development of the Thailand 10th National AIDS Plan.

In summary, the state of the Thai HIV epidemic in 2008 is:

- 1,115,000 adults have been infected with HIV in Thailand since the start of the epidemic.
- 585,800 of these people have subsequently died of AIDS since the beginning of the epidemic.
- 532,500 people are currently living with HIV.
- 12,800 new infections will occur in the year 2008.
- 48,000 people will develop serious illness in the year 2008.

It needs to be noted that the number of new infections projected was based on the assumption that risk behaviors and STI rates remain unchanged from 2005 onwards. If changes in levels of risk behaviors or STI occur, the number of new infections will increase or decrease accordingly.

The 2005–2025 projections showed a slow decline in number of new infections and a shift of the dominant modes of HIV transmission from sex work to sex between married couples and sex between MSM (Figure E.1 and Table E.1). The projections also showed a substantial and growing number of people needing ART, indicating the need for long-term resource commitment on the part of the Royal Thai Government. The country critically needs effective prevention interventions to reduce new infections. Moreover, efforts to improve adherence and to keep ART at low costs are critical to ensure the sustainability of publicly-financed ART.

Figure E.1: Changes in contribution of risk groups to the total number of new HIV infections over time

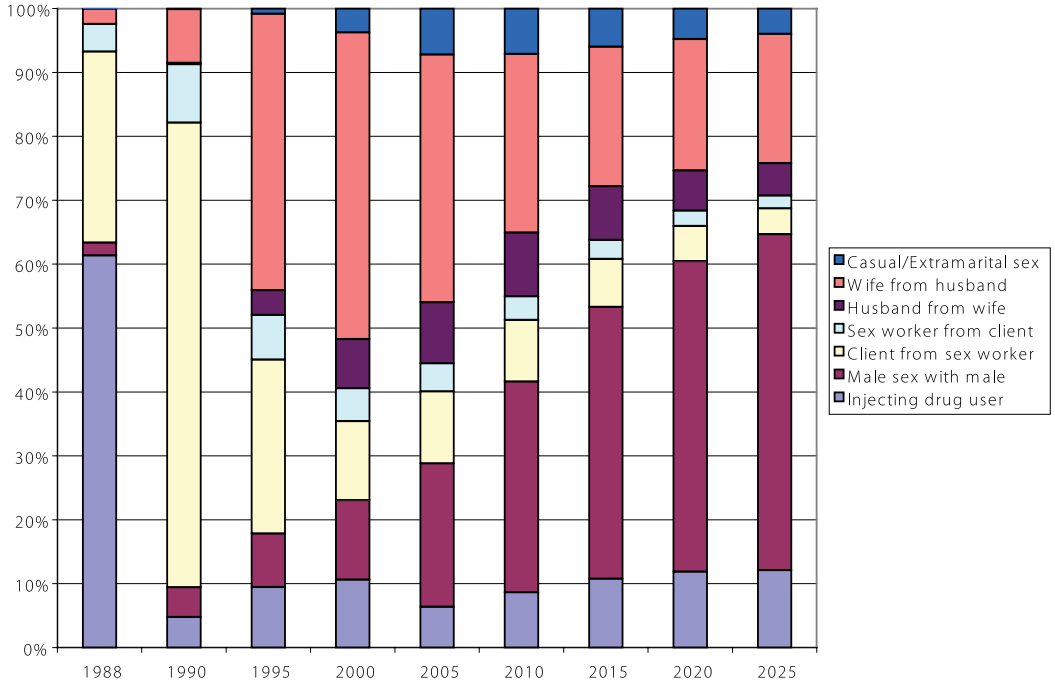


Table E.1: Percentage of new adult infections from each sub-population

% new infections from each transmission route	1988	1990	1995	2000	2005	2010	2015	2020	2025
Wife from Husband	2	8	43	48	39	28	22	21	20
Husband from wife	0	0	4	8	10	10	8	6	5
Male sex with male	2	5	8	12	22	33	43	49	52
Injecting drug user	61	5	9	11	6	9	11	12	12
Client from sex worker	30	73	27	12	11	10	8	6	4
Sex worker from client	4	9	7	5	4	4	3	2	2
Casual sex	0	0	1	4	7	7	6	5	4
Total from all mode of transmissions	100	100	100	100	100	100	100	100	100

Recommendations for strengthening prevention and care from the projection work

1) Control of STI remains an urgent priority

STI control is critically important for HIV prevention as the risk of HIV transmission is higher with concurrent STI. While changes in levels of STI can sometimes be related to changes in uptake or quality of STI services, it most often indicates changes in levels of condom use and can serve as an early warning system for rising HIV transmission. Quality friendly STI services need to be developed and expanded not only for FSWs and their clients as in the past, but also for MSM, MSWs and young people who engage in high-risk sexual behaviors.

2) Targeted user-friendly prevention programs need to be available to at-risk populations

The at-risk populations driving the HIV epidemic (sero-discordant couples, MSM, MSWs, transgenders, drug users, FSWs and clients, PLHIV and at-risk youth) need to have access to user-friendly HIV prevention, VCT and STI services that are designed to meet their needs and are adapted to the context. In addition, some specific settings with potential high risk behaviors (e.g. prison, detention home) will need programs that address the conditions of each setting and comply with their respective regulations.

Programs to promote HIV/AIDS prevention awareness and skills targeting youth in the general population before they engage in risk behaviors could be useful; however such programs should also try to target youth with higher risk such as delinquent youth, vocational school students, out-of-school youth, and street children.

All prevention programs should involve the community and aim at reducing stigma and discrimination.

3) Ensure effectiveness of interventions.

Prevention programs should consist of interventions that have proved significant effects in reducing HIV/STI risk behaviors or increasing HIV/STI-protective behaviors. Interventions will need to be adapted to the contexts and the populations' specificities. In all cases, the programs will need to be monitored and evaluated on a regular basis to ensure that interventions are efficient, and properly implemented, as well as pertinent to a specific population or setting.

4) Strengthen the linkage between programs

Each program should have information on existing HIV interventions and services in each target area so clients can be referred for available services when required. Referral systems and linkages between STI services, VCT, treatment programs, and other supporting programs (e.g. social welfare, PLHIV support) should be established. This would increase access and utilization of services by target populations.

5) **Support both prevention and treatment programs to build sustainability**

Considerable resources and long term commitment are required to continuously promote and maintain sufficient behavior changes to control the HIV epidemic and to serve the growing treatment needs. Implementing effective prevention programs to reduce the new infections will help save on treatment costs in the future. While sufficient resources need to be secured for the development and expansion of these programs, sharing resources by integrating these programs into the other existing health or social programs when appropriate and possible will help. Improving adherence and keeping ART at low cost are key factors to ensure the sustainability of treatment programs.

CHAPTER 1:

OVERVIEW OF THE 2005 REVISION OF THE THAI NATIONAL PROJECTION

1.1 Background and rationale for the 2005 projection

HIV remains a significant public health issue in Thailand despite prevention successes in the early to mid-1990s and the expansion of access to antiretroviral therapy (ART) in the 2000s. Data from the sentinel surveillance system and surveys among at-risk populations and the general population suggest continuing spread of HIV and ongoing risk behaviors that underlie this spread.

The quality and availability of HIV seroprevalence data and data on associated behaviors are good in Thailand. However, important additional strategic information to direct policy and program responses and resource allocation decisions must be derived indirectly. For example, data on the current number of people living with HIV (PLHIV) and the number of new infections by each mode of transmission cannot be measured directly and cannot be obtained from the reporting system. Data from HIV sentinel surveillance is only available for some target populations and in some geographical areas. There are gaps in surveillance coverage among MSM, and increasingly among IDUs as the composition of the IDU population seeking treatment changes in response to government policies. Furthermore, reported AIDS cases from hospitals reflect only a fraction of the number of PLHIV as many PLHIV remain asymptomatic or unaware of their HIV status and are not recorded in the system because they do not seek treatment. Most people coming into treatment in Thailand are generally at very advanced stages of illness, implying that the majority of Thais living with HIV remain undiagnosed until they develop an AIDS-related illness.

Given the limitations in available data, the total number of PLHIV and the number of new infections in each important sub-population can only be determined through an estimation and projection process that uses the available time trends in serosurveillance data in conjunction with other information on trends in risk behaviors, levels of protective behaviors and the size of affected populations.

In order to help bridge this information gap, support strategic planning and improve national responses, the Bureau of AIDS, TB and STIs, Department of Disease Control, MOPH embarked upon a process of updating the national HIV projection and determining appropriate HIV prevention and care targets, strategies and resource needs under the 10th National AIDS Plan 2007 - 2011. The tool of choice for this updating exercise was the Asian Epidemic Model (AEM). The AEM was last applied in the process to produce the national projections in 2000 that informed the 9th National AIDS Plan 2002 - 2006. The outputs of that process have been widely used and trends from the 2000 projections still match the observed declining HIV surveillance trends reasonably well.

However, much has changed since that time and an update of the projections is needed to account for a number of important developments that have taken place in the last several years. Critical among these are the large-scale government initiatives to increase access to ART under the National Access to Antiretroviral Programme for People with HIV/AIDS (NAPHA) and the accompanying development and provision of a locally produced combination of antiretroviral (ARV) drugs called GPOvir. The expanded ART coverage will significantly increase the number of PLHIV due to the life-prolonging effects ART.

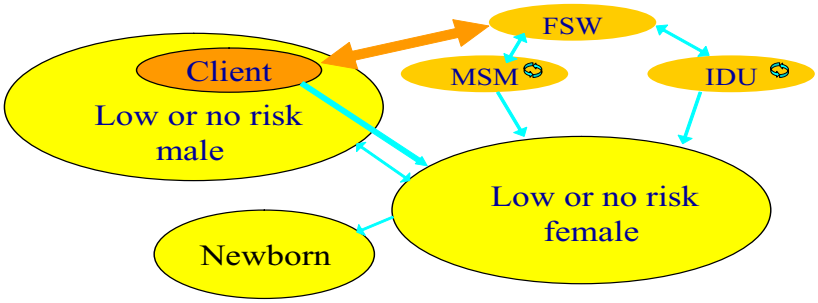
Studies have also revealed new patterns in HIV infection and changes in HIV-related behaviors in the country, including an alarmingly high HIV infection prevalence among MSM, a growing and widespread use of methamphetamines and changing patterns of sexual and drug-using risk among youth. The government's 'War on Drugs' policy has changed the prevention landscape for IDUs. If national responses are to remain relevant in this dynamic situation, it is necessary that the national projections are updated to include the effects of these changes on the Thai HIV epidemic.

This document describes the data, the revised inputs and the changes that have been made to the AEM, as well as the updated national projections in 2005. These revised projections capture the changes in survival related to ART and the contextual shifts in HIV related risk behaviors which are influencing the course and direction of the epidemic. The model outputs highlight priorities and challenges to the national response if it is to remain effective.

1.2 The Asian Epidemic Model (AEM)

The AEM is a semi-empirical process model that replicates the transmission dynamics of HIV in Asian settings (see Figure 1).

Figure 1: HIV transmission dynamics in Asia



Using trends in risk behaviors among the important sub-populations in Asian epidemics as inputs, the model determines the HIV transmission probabilities necessary to fit observed epidemiological patterns, as seen in surveillance data. It then calculates the number of new infections through key routes of transmission including marital sex, extra-marital (casual) sex, sex work, male-male sex, needle sharing, and mother-to-child transmission. Specific outputs of the model include number of new, current and cumulative HIV infections and AIDS related deaths for each year.

Building on the version of the AEM used in the 2000 projections, two new components were added to the version of the AEM used in the 2005 projections: a component for MSM and an ART component. The MSM component accepts inputs specific to MSM populations including their behaviors and linkages to other populations and calculates the new HIV infections resulting from those sexual networks. The focus of the MSM component is on anal sex, which is the primary male to male sexual behavior carrying substantial risk of HIV infection. The ART component estimates the number of people in need of ART and various ART impacts including delays in mortality associated with ART, effects on the time trends in number of deaths and changes in HIV to death progression for those on ART. The World Bank provided partial support for the development of the ART component under the project leading to the report, "The Economics of Effective AIDS Treatment: Evaluating Policy Options for Thailand" [Revenga et al. 2006]. For more details on the model, the reader is referred to the fuller documentation of the AEM [Saidel et al. 2003, Mills et al. 2004, Brown and Peerapatanapokin 2004].

1.3 The process of preparing the revised projections

The revised AEM projections were prepared as part of the A^2 project in Thailand which is implemented through a partnership between the Thai MOPH, other government stakeholders and international and local non-governmental organizations (NGOs) working in the country. The project receives financial support from USAID and technical support from a number of international partners: Family Health International, the East-West Center and the USAID Health Policy Initiative. The A^2 in Thailand is one component of a larger USAID-supported multi-country regional initiative working in Bangladesh, China, Thailand and Vietnam. The projections presented here were prepared with the participation of the Thai Working Group on HIV/AIDS Projections and the A^2 Data Analysis Working Group, in support of the development of the 10th National AIDS Plan 2007-2010.

The process started with a meeting to discuss the need to update the national projections to reflect recent changes in the country situation, the process by which the projections would be updated, outstanding data issues and the support that would be required from the Thai Working Group. Following this consultation, the modeling team conducted a comprehensive review of national epidemiological, behavioral and response data. The A^2 Data Analysis Working Group was established to review available data and identify most relevant estimates for key input data and assumptions.

In order to develop and cost policy scenarios after the revised baseline projections were prepared, the GOALS model [Stover et al. 2003, Forsythe and Chepkwony 2004] was used in conjunction with the AEM. This allowed exploration of the impacts of different program alternatives and estimation of the resources needed to strengthen national prevention efforts. The GOALS model developed by Futures Institute takes inputs, including prevention unit costs, program coverage and population sizes, and uses them to estimate the expected outcomes of various interventions, programs and policies aiming to change behaviors driving the epidemic. This is done using an impact matrix drawn from the scientific literature that estimates the amount of behavior change that can be expected from a specific prevention approach. These behavioral changes are then fed directly into the AEM, through a specially designed AEM/GOALS linkage, to allow calculating the impacts of a program package. The Resource Needs Module of GOALS also calculates the total costs of the programs chosen, providing direct estimates of the overall cost and human resources needed of the package.

This report does not cover the GOALS data collection and analysis process or the Thai-specific outputs of the GOALS exercise. The interested reader can find further information on these issues in the document "Achieving the goal of reducing new HIV cases by half in 3 years in Thailand: Resource Needs Implications" [Martin and Sangrujee 2006].

1.4 Dissemination of projection outputs

The resulting projections, which will be discussed in greater detail later in this report, were in reasonable agreement with observed epidemiological trends in the country. They showed a slow decline of new infections and a shift of the dominant modes of HIV transmission from sex work to sex between married couples and sex between MSM. The projections also showed a substantial and growing number of people needing ART, indicating the need for long-term resource commitment on the part of the Royal Thai Government. The 2005-2025 projections and the key policy findings resulting from the projections were presented to Thai policy makers at the MOPH on December 9, 2005.

This report presents the key inputs used in the 2005 revision of the national projections along with the key findings and their policy implications. It also outlines how the results of the projections have been used to guide strategic planning of the country's response to the HIV epidemic. The baseline scenario presented here describes the likely course of the epidemic in Thailand if prevention programs are not further strengthened and risk behaviors remain the same as they were in 2005.

CHAPTER 2:

KEY INPUTS TO THE 2005 PROJECTIONS

This chapter provides a summary of the data inputs and sources of data used for the modeling. It is based on a comprehensive review of population size estimates, behavioral and biological data, and trends in Thailand since the last modeling exercise in 2000. The period from 2000 to 2005 in Thailand has seen some substantial changes in behaviors, increasing evidence of high HIV levels among MSM and the implementation of widespread access to ARV treatment.

2.1 The sizes of sub-populations and average duration in the group

The sizes of the sub-populations at higher risk and of the population at large are essential inputs for the model. This section presents the estimates used for the size of these key sub-populations, the average duration people remain in each sub-population and the sources used to establish these values.

General population males and females

Time trends in the population aged 15 and above were drawn from three published sets of National Economic and Social Development Board projections [NESDB 1991, NESDB 1995, NESDB 2003] using the medium birth rate assumptions. The populations aged 15 and above were formed by summing the standard demographic five-year age categories separately for males and females.

Male clients and non-clients

The proportion of men visiting sex workers in general population surveys was determined from four studies with national coverage at different points in time: 1) the Survey of Partner Relations and Risk of HIV Infection in 1990 (Thai Red Cross Society and Chulalongkorn University) [Sittitrai et al. 1992]; 2) the Media Effectiveness Survey in 1993 for men aged 15-49 (Mahidol University) [Thongthai and Guest 1995]; 3) the 100% condom use evaluation male population studies conducted by Mahidol University in 1997 [Chamratrithirong et al. 1999]; and 4) the behavioral surveillance survey (BSS) among the general male population aged 15-49 in 2004 [Bureau of Epidemiology 2005]. Client populations were then estimated by multiplying the age-specific percentages from these surveys by the projected male population in the corresponding age ranges. Non-clients were calculated as the remainder of adult males.

Direct and indirect female sex workers (FSWs)

The trends in the number of FSWs from the start of the projections through 1999, which are used as inputs to the model, are based on the estimates of numbers of direct and indirect female sex workers from the STIs Cluster, Bureau of AIDS, TB and STIs, Department of Disease Control, MOPH; multiplied by a factor of 2.0 (increased by 100%). This multiplication factor is based on enumerations of the number of sex establishment sites in Bangkok and other provinces done by the Thai Red Cross Society in the early 1990s. These studies suggested that the lists of the former Venereal Disease (VD) Division, MOPH may not have captured all sites [Sittitrai et al. 1994].

However, in recent years there have been two major changes in this enumeration: 1) sex work has shifted from brothels to more general entertainment sites (such as karaoke, modern massage places and restaurants); and 2) the reforms in the STIs Cluster and changes in those responsible for recording and reporting the number of establishments and sex workers at the provincial level. As a consequence, the numbers of sex workers reported by the STIs Cluster declined after 1999. In the projection it was assumed that the number of FSWs remained roughly constant from 1999 through present, making the assumption that the apparent decline happened largely because it was more difficult to identify and locate sex workers given the aforementioned changes.

Furthermore, it is well-documented in both the published literature (Hanenberg et al.1994 and Hanenberg and Rojanapithyakorn 1998) and in the STI Cluster's reported numbers that there has been a substantial shift of clients away from direct sex workers to indirect female sex workers, going from roughly equal numbers in 1980 to roughly 18% visiting female direct sex workers in more recent years.

Injecting drug users (IDUs)

Obtaining national values for the number of IDUs in Thailand has proven consistently difficult. For the earliest parts of the epidemic, the number of IDUs was estimated using AIDS case reporting. By assuming that the number of AIDS cases reported among IDUs in Bangkok was proportional to the number of injectors, the national AIDS figures could then be used to make an estimate of the total number of injectors nationwide. In 1994, Mastro et al. used a capture-recapture method in Bangkok to obtain an estimate of 36,000 IDUs [Mastro et al. 1994]. From 1980 through 1999, the Epidemiology Division data reported a total of 2,128 IDU-associated AIDS cases in Bangkok and 9,489 nationwide, which produces a ratio of 9489/2128 = 0.224. It was judged appropriate to apply this ratio to a 1994 estimates because there is a few years lag between infection and AIDS. With 36,000 IDUs in BKK, this gave a national estimate of 36,000/0.224 = 160,528 IDUs. Therefore a value of 160,000 was used as the number of IDUs in Thailand from 1980 to 1995. This method is subject to potential reporting biases in AIDS case data, including failure of some individuals to admit to drug use; but it probably provides better estimates than any of the other possible sources (such as clinic records and arrest records) of the size of this population nationwide.

After 1995, data from drug treatment centers showed a declining trend in the number of IDUs. It was estimated that the number of IDUs decreased by approximately 13% annually from 1996 to 2001. Therefore, starting from 160,000 IDUs in 1995, the population size is assumed to decrease by 13% annually to 70,000 in 2001. In 2002, using the IDU in-treatment data from the Office of the Narcotics Control Board (5,336 in-treatment cases in Bangkok and vicinities) and the proportion of in-treatment IDUs (55%) from the Respondent Driven Sampling (RDS) study in Bangkok [Wattana et al. 2004], it was estimated that there were 9,612 IDUs in Bangkok [Rhucharoenpornpanit 2005]. Considering that the government 'War on Drugs' policy may have artificially lowered the number willing to participate in the RDS study, especially those who were not in treatment, the number of IDUs in Bangkok in 2002 was adjusted upward to 12,800 (a 30% increase). This gave a national estimate of 57,000 IDUs. As a result of the punitive nature of the 'War on Drugs' policy, a higher rate in reduction of the number of IDUs in Bangkok and the country from 2002 may be expected. From 2002 to 2004, it was proposed that the number would decrease by 18% each year. Therefore, in 2004, the IDU population size in the country was estimated to be approximately 38,380.

Men who have sex with men (MSM)

The size of the MSM population was estimated from the Survey of Partner Relations in 1990 (Thai Red Cross Society and Chulalongkorn University) [Sittitrai et al. 1992] and the BSS among the general male population aged 15-49 in 2004 [Bureau of Epidemiology 2005]. The Partner Relations Survey reported that 3.4% of males aged 15-49 had any same-sex behavior in the preceding year. The BSS in 2004 with data from 24 provinces found 2.7% of the adult male population aged 15-49 reported same-sex activity in the past year. It was assumed that while male-male sexual behavior may be underreported in these surveys, not all men with same-sex behavior would practice anal sex, which carries high risk of HIV transmission, or engage in sex with other men more than once or twice in the last year. Therefore, the figure was adjusted to 3% of males aged 15-49.

Male sex workers (MSWs)

The number of MSWs was estimated from reported numbers in the annual reports of the STIs Cluster, Bureau of AIDS, TB and STIs, Department of Disease Control, MOPH. As there is no other enumeration of MSWs to be compared with the numbers reported by the STIs Cluster, the estimated number for 2004 was set to 10,000. This is twice the number reported to the STIs Cluster; the same multiplication factor used in estimating the number of FSWs from STIs Cluster data. For subsequent years, the MSW population increased proportionally to the size of the MSM population; the ratio of MSM to MSWs was kept fixed.

Table 1: Summary of key population inputs in the 2005 AEM projections

Population	Estimated number	% of 15-49 males or females	Average duration
IDUs	40,000	0.2	10 years
Direct FSWs	25,000	0.1	4 years
Indirect FSWs	120,000	0.6	4 years
MSWs	10,000	0.05	18 months
MSM	560,000	3.0	20 years
Male clients	2,300,000	12.0	5 years

2.2 Sexual risk behaviors

Frequency of sexual contacts by FSWs

Information on the number of clients per night for direct sex workers has been collected in many studies. The average number from the studies available to the modeling team was 3.7 clients per night. Based on a large number of studies, indirect sex workers have consistently fewer clients per night than direct sex workers, with a much lower average of 0.75 clients per night. The data shows no significant evidence of a major change in this number for either direct or indirect sex workers

Frequency of sexual contacts for married or regularly partnered couples, and in extramarital sex

The Partner Relations Survey [Sittitrai et al 1992] estimated coital contacts between husband and wife. Because this survey did not include individuals aged above 49, coital contacts among those older than 49 are assumed to decline linearly. After adjusting for unmarried women, the final number of coital contacts per year among general couples both in and out of wedlock is 45. The Mahidol Media Effectiveness Survey [Thongthai and Guest 1995] looked at extramarital contacts (non-sex work related) and found an average rate of 16.11 per year. These two values are also kept fixed over time.

Percentage of general population males and females with casual non-commercial premarital or extramarital contact

From the beginning of the projection through 2000, the percentages of having sexual contact outside of relationships with someone other than a sex worker were set at 5% for males and 2% for females, based on surveys done among factory workers and ID card applicants in Bangkok in the mid-1990s. After 2000, the values were drawn from the BSS among general male population aged 15-49 in 2004, which found that 20% of males and 5.3% of females had sex with non-commercial, non-regular partners in the previous year. Another study [Lertpiriyasuwat, Plipat et al. 2003] found 19.9% of males and 12.7% of females aged 15-44 years old had sex with non-commercial, non-regular partners during the previous year. Thus, from 2001 onwards, the values for non-commercial casual sex were set to 20% among males and 10% among females.

Frequency of sexual contact among MSWs

This value was drawn from behavioral studies of MSWs. A survey among Bangkok's male bar workers in 1989 [Sittitrai et al. 1989] found that the average number of male clients in the last two weeks was 5.8, or 2.9 per week. A similar study in Chiang Mai [Kunawararak, Beyrer et al. 1995] found that the median number of clients in the last two weeks was 5, or 2.5 per week. Another study [Guadamuz et al. 2004] found a median number of clients in Chiang Mai of 2 per week. Results from qualitative studies in Bangkok also showed a range of clients per week between 1 and 4 [Koetsawang and Topothai 2003]. Based on this data, the average number of clients per week for MSWs was set at 2.5 from the start of the projection, decreasing to 2 clients per week by 2000. In general, MSWs may have even higher number of clients but clients may not practice anal sex in every contact with a MSW as in many cases only oral sex or masturbation occurs.

Frequency of sexual contact among MSM

An MSM social and sexual network report found the average number of sexual contacts was 4.4 times per month [Danthamrongkul et al. 2005]. This is in reasonable agreement with national studies for MSM in the United States. If only anal sex is included, the frequency of sex will be roughly 3.5 times per month or 42 times per year; very similar to the frequency reported by heterosexual couples. However, this figure represents MSM who have disclosed their status and participated in the survey. The value used in the model is adjusted down somewhat to 36.5 times per year in order to better represent the larger population of MSM. However, it should be noted that this number is drawn from a very limited number of studies. Data from MSM in the community, which includes MSM who have not disclosed their status or those engaging in situational homosexuality, is not available.

2.3 Levels of condom use

Condom use in sex work

Frequency of condom use at last sex between direct sex workers and their last client was assumed to be 15% before 1989, based on the earliest findings in that year from the sentinel surveillance among direct sex workers conducted by the MOPH. In line with the significant expansion of condom promotion efforts from 1989 through 1992, condom use at last sex increased to 30% in 1989, and then by 10% each year through 1992 when it reached 60%. From 1992, the rates were set to increase gradually, reaching 82% in 1998 and remaining at that level from then on. These results are consistent with the levels of condom use seen in the national surveys at that time, although in later years they are slightly lower than reported in the surveys. While 95-98% of direct sex workers was reported using condoms in recent years, there is significant over-reporting of condom use and also much lower condom use with regular clients. Surveys on the client side tend to plateau at roughly 80%, consistent with the values assumed above. The frequency of condom use among indirect sex workers was set about 10% lower than the frequency for direct sex workers and followed a similar upward trend, stabilizing at around 74%.

Condom use with spouses and regular partners

Condoms are not the contraceptive of choice among married couples in Thailand. Condom use for contraception among currently married women for the period 1981 to 2001 is presented in Table 2. Based on surveys of contraceptive prevalence, condom use was set at 1.9% in 1981, 1.8% in 1984, 1.2% in 1987 and 1.9% from 2001 onwards. Linear interpolation was used to set the values for the years before 2001. The values for the years after 2001 were set at 1.9%.

Table 2: Percentage currently using condom for contraception among currently married women aged 15-44

Year	Surveys	%	Sources
1981	CPS2	1.9	[Knodel et al. 1987]
1984	CPS3	1.8	[Knodel et al. 1987]
1987	TDHS	1.2	[Chayovan et al. 1988]
2001	ECODDF	1.9	[Chayovan et al. 2003]

CPS = Contraceptive Prevalence Survey
TDHS = Thailand Demographic and Health Survey
ECODDF=Economic Crisis, Demographic Dynamics and Family in Thailand

Condom use in extramarital sex

Frequency of condom use at last sex in premarital and extramarital sex was set at 35.8% for all years of the projection [Thongthai and Guest 1995]. The frequency is higher than that for sex with spouses and regular partners but much lower than the levels of condom use in sex work.

Condom use among MSM

The frequency of condom use at last sex among MSM was drawn from various behavioral studies. It was set at 15% at the beginning of the projection and increased to 75% by 1996. The trend follows the same pattern as the frequency of condom use at last sex between the general male population and FSWs. In 2005, condom use at last sex among MSM was set at 70% to reflect the factors leading to increases in HIV prevalence as found by the TUC surveys among MSM around the country (from 17% in 2003 to 28.3% in 2005 in Bangkok, for example). It should be noted that the existing data represents the behavior of MSM in the cities, who are more exposed to the use of condoms than MSM in rural areas, who receive little or no information on the need for such protective measures.

2.4 Injecting risk behaviors

Percentage of needle sharing

Values for needle sharing were calculated based on various sources providing the percentage of IDUs sharing needles as shown in Table 3. From 1980 to 1987, the May 1988 value of 66% was used and from 1998 forward, the April 1997 value was used. Values for the intervening years (1990, 1991, 1992, 1994, and 1996) were calculated by interpolating the values in the table.

Table 3: Needle sharing among IDUs in Bangkok

Time	% Sharing	Sources
May-88	66	[Vanichseni et al. 1989]
Sep-88	60	[Vanichseni et al. 1989]
Apr-89	52	[Vanichseni and Sakuntanaga 1990]
Apr-93	46	[Des Jarlais et al.1998]
Aug-95	43	[Kitayaporn et al. 1998]
Apr-97	36	[Des Jarlais et al. 1998]

Frequency of injection

A 1998 study [Kitayaporn et al. 1998] found the frequency of injection to fall in the range of 2-3 times per day. Therefore, the projection assumed the daily frequency of injection was roughly 2.5, giving an annual figure of 913 injections. This was kept constant over the course of the projection.

2.5 Level of sexually transmitted infections

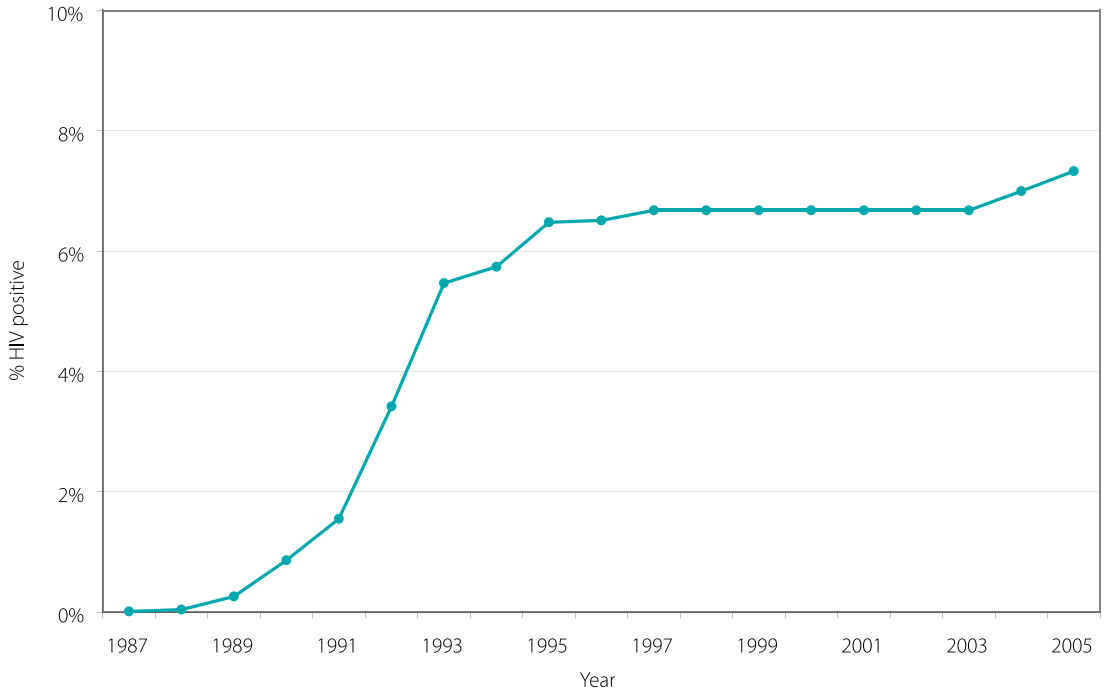
From the STI Cluster's examinations of sex workers, the STI prevalence among direct female sex workers was roughly 25% in 1989, but fell steadily to 1.6% in 1999. However, in response to the restructuring of STI treatment services at the provincial level which disrupted services to some extent, the STI rates slightly increased from 1.7% in 2000 to 2.3% in 2005. The Multisite Intervention Research Project on Sex Workers and HIV Transmission (MIRP) study in Bangkok in 1994 found the STI rates among indirect female sex workers to be about 60% of that among direct female sex workers. This ratio was applied since the VD Division does not routinely collect data on indirect FSW, giving a figure of 15% of indirect sex workers with other STIs in 1989 and 1.4% in 2005.

2.6 Sources of HIV prevalence data and adjusted prevalence trend for Thai MSM

For some populations (direct and indirect FSWs, IDUs and MSWs), HIV prevalence data for comparison with the projections was taken directly from the national sentinel serosurveillance system. For the general male population, the prevalence levels were calculated by age-adjusting the HIV prevalence data gathered annually among young military conscripts, a large sample from around the country. For the general female population, the levels came from adjusting the data among pregnant women for age, marital status and fertility rates. The AEM directly compares these observed or adjusted prevalence trends with the calculated results based on the behavioral inputs provided.

As surveillance data for HIV prevalence among MSM is not available in the sentinel system, the HIV prevalence trend for MSM was generated by indirect means. Data from the Thai Red Cross Anonymous Clinic showed high (roughly 20%) and constant prevalence through the late 1990s and early 2000s among MSM in Bangkok. Since the early 1990s, the serosurveillance data for MSWs showed a similar stability at fairly high levels of 10-15%. In 2003 and 2005, data was collected by TUC in several places around the country at sites where MSM meet, including Bangkok and Chiang Mai [van Griensven et al. 2005].

Figure 2: Adjusted national prevalence trend among MSM



In the upper North of Thailand, behavioral data was collected during the 1990s among several cohorts of young male military conscripts. Included in this behavioral data was information about previous experience with sex with other men. Data from this cohort study also included HIV prevalence data, making it possible to determine the relative rate of HIV prevalence between men with same-sex experience and those without. This ratio was 1.0 in the early 1990s, but grew to 3.0 by the mid-1990s and remained roughly stable at that value [Nelson et al. 2002]. If this ratio is multiplied by the prevalence among conscripts and age-adjustments are then made, the conscript prevalence trends over time can be used to calculate the approximate prevalence among the larger population of MSM in the upper North in recent years; this gives a value of about 11%. The data from MSM meeting places in Chiang Mai found 17% prevalence, which implies that data from meeting places overestimates the prevalence by about one-third. This information was used to estimate the overall prevalence among MSM in Bangkok, the upper North and the remainder of the country using the conscript prevalence in those regions which produces the national prevalence curve shown in Figure 2. This is in good qualitative agreement with the relatively stable prevalence seen in the Thai Red Cross Anonymous Clinic and MSW data. A slight upward adjustment was added for Bangkok between 2003 and 2005, given the rise in prevalence observed in venue-based surveys (from 17.3% to 28.3%).

2.7 Other parameters in the model

The population size and behavioral inputs to the model specified above were determined from external data sources, primarily surveys and research studies. There are a number of additional parameters, which determine the dynamic of the epidemic including:

- The start year of the sexual and injecting drug use epidemics.
- Probability of transmission from female with HIV to male sexual partner.
- Probability of transmission from male with HIV to female sexual partner.
- Probability of infection in a single use of a HIV contaminated needle.

These have been set by adjusting the start years and transmission probabilities to match the observed HIV prevalence trends with the prevalence trends calculated by the AEM from the behavioral trends provided by the user as inputs. This process is described in more detail in the 2001 national projection report [Thai Working Group on HIV/AIDS Projection 2001].

2.8 Key differences between the 2000 and 2005 projection models and inputs

Table 4: Key differences between the 2000 projection and the 2005 projection

Component/Input	2000	2005
MSM and MSW compartment	None	Included
ART compartment	None	Included
FSW population size	STIs Cluster reported number x 2	Fixed at the same level after 1999 with assumption that the observed decline in reported numbers was the result of changes in the tracking system and in sex work, which made it more difficult to identify sex workers
IDU population size	160,000	Reduced from 160,000 in 1995 by 13% per year through 2001 and then 16% per year from 2002-2004 to 385,000 in 2004
Male casual sex	5%	From 5% in 1996 to 20% in 2004
Female casual sex	2%	From 2% in 1996 to 10% in 2004
Condom use at last sex between direct FSWs and clients	Increase from 82% in 1998 to 85% in 1999 and remains at 85% afterwards	Remains at 82% from 1998
Condom use at last sex between indirect FSWs and clients	Increase from 74% in 1998 to 77% in 1999 and remains at 77% afterwards	Kept at 74% in 1998 but then dropped to 70% and remained at 70% from 2000 onwards

2.9 Key data gaps

Data collection efforts in Thailand have not been as strong in recent years as they were during the growth phases of the epidemic in the late 1980s and 1990s. Many people expressed concerns about presumed increases in risk behaviors among homosexual and heterosexual youth. There is uncertainty over the levels of condom use and trends in STI prevalence since 2000, especially with changes that may have weakened the STI treatment system. Only limited additional data has become available to clarify the situation and several key data gaps remain.

MSM behaviors

Although the MSM surveys in 2003 and 2005 provided some HIV prevalence and behavioral data for this population, the data was gathered in only a handful of major population centers and is not available for most of the provinces in the country. No data on rural MSM behaviors exists.

Sex work, level of condom use and STIs

The recent studies of the levels of condom use in different populations with different types of partners are quite limited. The difficulty of assessing the current situation is compounded by the fact that condom use estimated from female sex workers reporting has become increasingly biased in an upward direction. Today, sex workers report near universal condom use at last sex; the reality of which is firmly contradicted by continuing STI prevalence of several percent among sex workers and new infections occurring among young sex workers. In addition, changes in the delivery of STI treatment services at provincial level contributed to reduced uptake of such services, as well as reduced availability of data on STIs and the situation regarding sex work in the provinces.

Youth sexual behaviors

Many assume that as fewer men visit sex workers there will be a corresponding increase in casual sex with non-commercial partners. There is also a general concern about increases in sexual risk among youth. While young men may not be visiting sex workers as much as in the past, questions remain about the proportion ever having sex, their numbers and types of partners, how often they use condoms and their STI situation. However, there is little systematic survey data available to address these issues.

Behavioral data on PLHIV and those on ART

At present little is known about the risk behaviors of those treated with ART. Do they increase their risk behaviors once on ART; and, if so, what is the impact of this on HIV transmission? Do members of the population at large, i.e., those not on ART, take more risks knowing that ART is readily available? These questions may determine the future course of the epidemic in Thailand and there are no answers to them at present.

Ongoing changes in at-risk populations

Questions remain in a number of areas, including quantifying the shift of sex work to more indirect forms, back and forth shifts between injecting and non-injecting behaviors by drug users and the contribution of MSWs to the epidemics. Addressing these issues requires adjusting the existing surveillance system to better track and understand changes in prevalence and behaviors, coupled with targeted ad hoc studies to help fill the remaining gaps in knowledge.

CHAPTER 3:

THE ART COMPONENT IN THE AEM

In the AEM version used for the national projections in 2005, an ART component was developed to more accurately simulate the course of the HIV epidemic in Thailand. Since the Royal Thai Government started providing ART through NAPHA in 2001, access to ART has been expanded widely throughout the country and has significantly impacted the lives of PLHIV. The availability of treatment has prolonged the PLHIV's lives, thus increased number of PLHIV overtime.

The ART component was developed and first used in a study of policy options for AIDS treatment in Thailand by the World Bank and the MOPH. More details on the ART component are available in the report of this study [Revenga et al. 2006].

The ART features incorporated into the model include:

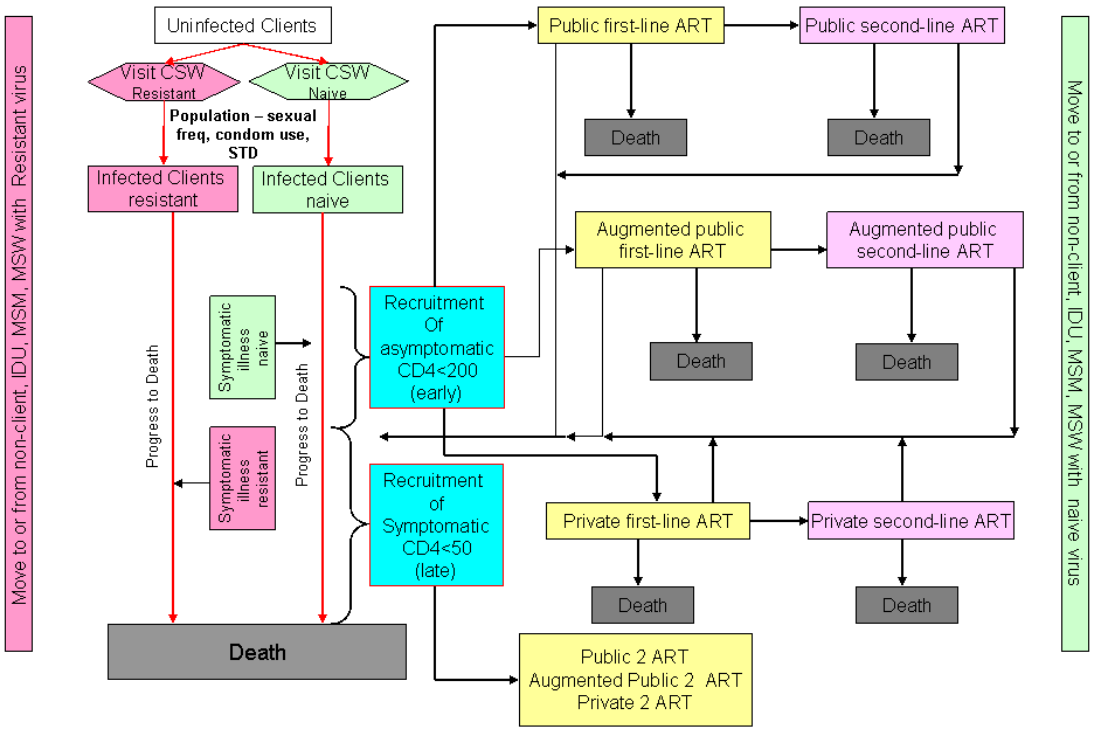
- Criteria for bringing people into treatment, both symptomatic and asymptomatic.
- Treatment alternatives, in particular first line and second line therapies and their impacts on progression to illness and death.
- Quality of care and adherence issues and their effects on progression. The model allows for three possible treatment arms with varying quality of care and adherence: public, augmented public (public hospitals in which PLHIV groups and NGOs provide support for those initiating therapy to reduce dropouts and improve adherence) and private. Each has its own dropout, survival and failure rates.
- Changes in infectivity associated with ART (those on ART are on average less likely to transmit HIV to others).
- Naïve and resistant viruses.

3.1 Methodology for calculating ARV impacts in the AEM with ART

The ART component of the model is illustrated in Figures 3 and 4. Essential steps taken in the AEM ART methodology include:

1. Infections are calculated based on behavioral inputs and transmission probabilities that give a match to past prevalence trends in the country, same as in the non-ART version of the AEM. Two forms of virus, one naïve and one resistant to the prevalent first line therapy, are modeled and tracked. Those who are on ART are assumed to have a lower transmission probability than those who are not, specified by a transmission reduction cofactor (currently set at 0.25, i.e., a 75% reduction in transmission of HIV by those on ART).

Figure 3: Client compartment of the AEM with ART



2. When an infection event occurs in the model, those infected are distributed into a set of compartments for the untreated specifying time until death, according to the expected curve for the progression to death in the absence of ART.

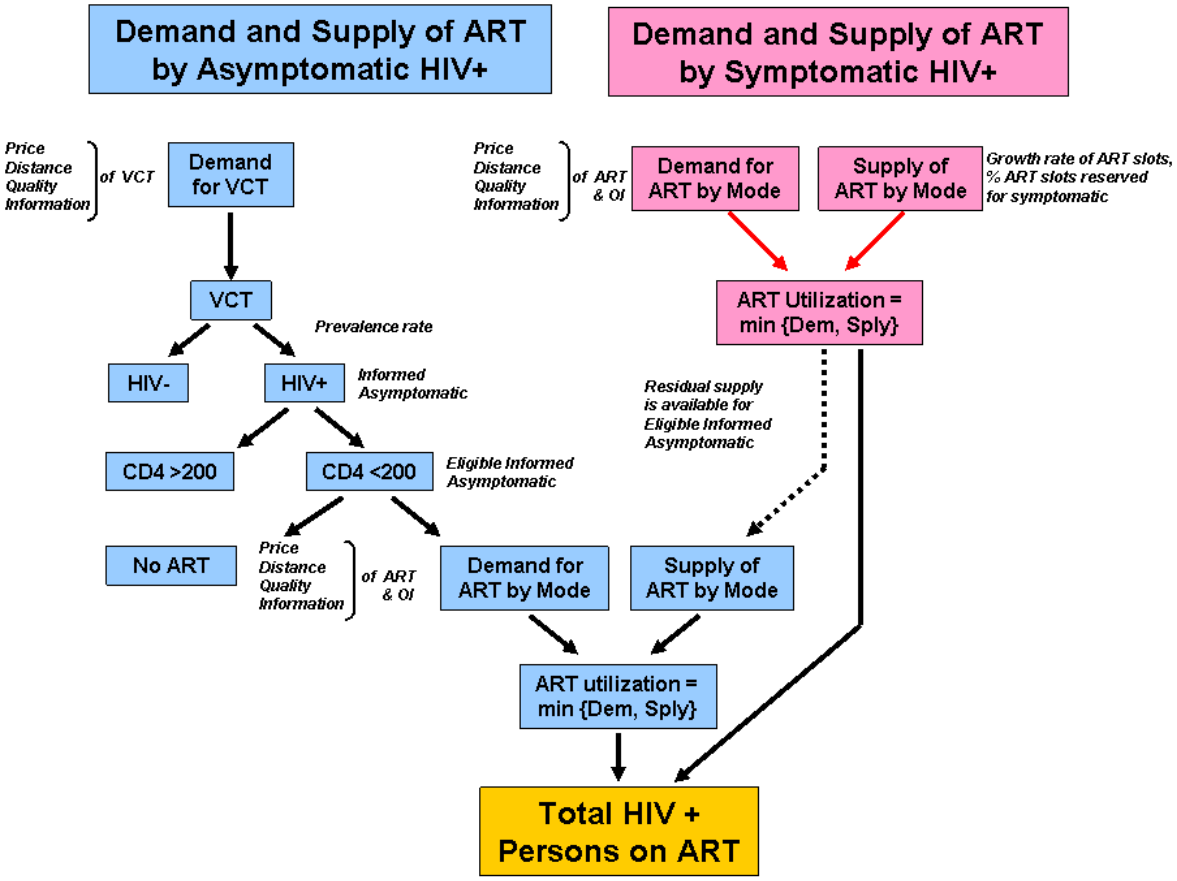
3. When a person reaches the first *asymptomatic* criteria for eligibility for treatment (early recruitment CD4<200), they become eligible for therapy. This, of course, requires that the person has knowledge of their HIV status and a CD4 count; not everyone who is eligible will enter treatment. An external input is used to specify the number actually beginning treatment in the model at this point. These people are then moved into one of the three treatment arms (public, augmented public or private).

4. When a person reaches the second *symptomatic* criteria for eligibility, i.e., they have become ill enough to seek medical treatment (late recruitment), they can be moved into the treatment group. An external input is again used to specify the number entering treatment at this stage. Once again, they are moved into one of the three possible treatment arms (public, augmented public or private).

5. Those who enter treatment are brought into the first line therapy compartment (typically non-nucleoside reverse transcriptase inhibitors (NNRTI) based therapies). Once on first line therapy, they have four options: a) continue on first line therapy from year to year; b) drop out of therapy due to side effects, difficulties in accessing a supply of drugs or other reasons; c) suffer a therapeutic failure on first line therapy and then move to second line therapy (combinations including protease inhibitors); or d) die. Those who move onto second line therapy have the options of continuing therapy, dropping out or dying. However, in general, the survival of people initiating therapy at the symptomatic stage will be lower than those who start at the asymptomatic stage. This is accounted for in the model with different rates of movement into each of these four options.

6. The model then calculates the numbers of HIV infections and deaths in each of the treatment alternative compartments, along with the numbers of people currently on therapy in each compartment with both naïve and resistant virus. The sum of these estimates provide the number of survivors, and the number of patients receiving various therapy regimen.

Figure 4: Demand and supply of ART by asymptomatic and symptomatic HIV+



3.2 Key inputs and assumptions for the ART compartment

The following represent the key inputs for the ART compartment of the 2005 AEM projections:

1. HIV to AIDS progression with no ART: average time from HIV infection to serious illness is about 10 years.
2. Time between serious illness and death: average time from being diagnosed with a serious HIV-related illness to death is set to 0.9 years in the absence of ART.
3. Infectivity reduction: a value of 0.25 is used for the factor by which infectivity is reduced due to ART (i.e., people on ART are 75% less infectious than those not on ART).
4. Symptomatic and asymptomatic criteria for entering treatment: currently specified as years before death. The average number of years before death at which a person meets the asymptomatic criteria (CD4<200) is assumed to be 2 years, and 0.9 years for meeting the symptomatic criteria.
5. Fraction of high-risk and low-risk individuals receiving voluntary counseling and testing (VCT). An external input is used to specify the fraction receiving VCT. Currently at-risk groups are much more likely to be tested than lower risk groups. This might be changed if more aggressive targeted VCT programs are undertaken in the future.
6. Proportion of individuals who meet asymptomatic or symptomatic criteria for ART seeking treatment in each possible treatment arm. An external output is used to specify the proportion of those eligible seeking treatment. This is essentially the demand for ART among those eligible, specified as proportion of eligible seeking to start ART in each arm.
7. Number of available slots for therapy in each arm at symptomatic and asymptomatic criteria. This is an externally specified supply for ART. It is assumed that the number of facilities providing ART grows 1.5% a year with the increase of the number of persons treated per facility.

8. Therapeutic inputs for first line: Inputs included estimates of the percentage by year continuing, dropping out, progressing to second line therapy or dying for those on first line therapy in each treatment arm. For those in the augmented public care sector, dropouts were lower as were death rates since adherence to ARV schedules was assumed to be better because of the extensive support available to those initiating therapy. The same is assumed for private care.
9. Therapeutic inputs for second line: Inputs included estimates of the percentage by year continuing, dropping out, developing a resistant virus or dying for those on second line therapy in each treatment arm. These inputs were obtained from clinician.
10. Behavior changes. Although behavior changes can be entered both for those on therapy in each risk population and for the population as a whole (those not on therapy), it was assumed that those on ART returned to the pre-infection levels of risk behavior, and that those who were ill did not have sex from the time of serious symptomatic illness until death.

3.3 Detailed assumptions underlying the scenario with government provision of ART

These assumptions fall into three categories: epidemiological and behavioral, biological (progressions), and number of PLHIV gaining access.

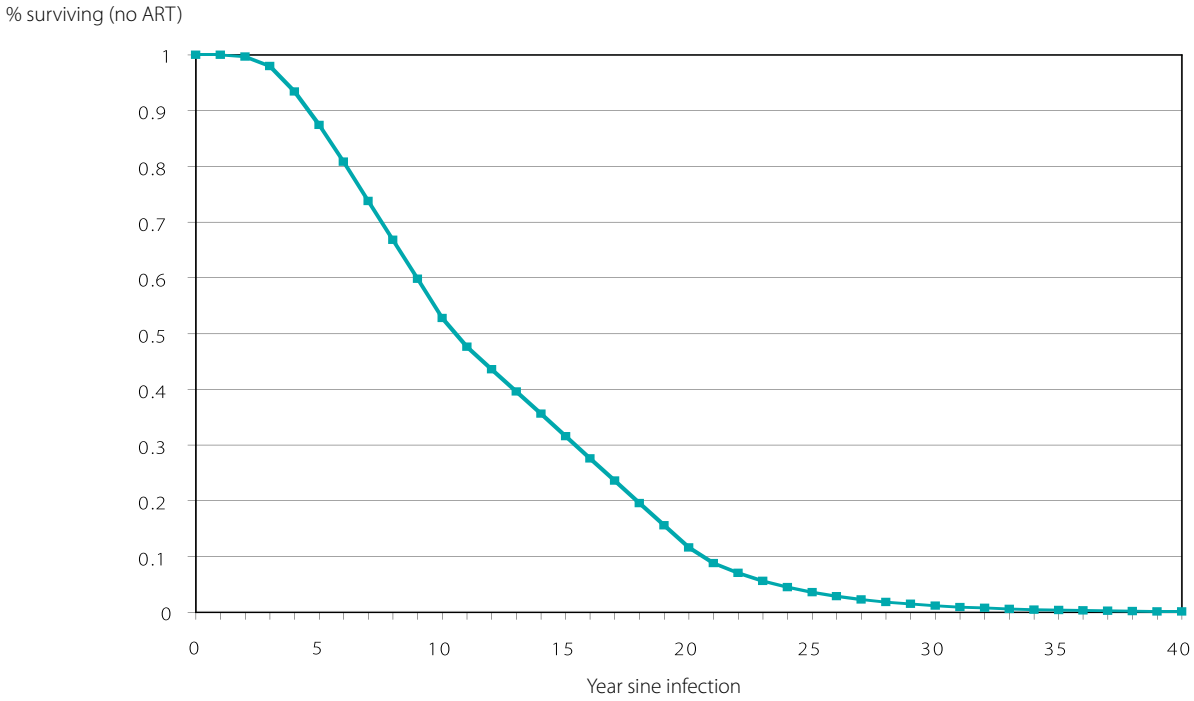
Epidemiological assumptions

In the epidemiological and behavioral sphere, the major assumption is related to the expected infectivity of those with HIV on ART compared to those who are not on therapy. After reviewing the literature, it was decided that a reduction of more than 75% in infectivity was not tenable or supported by the data. One study [Porco et al. 2004] estimated a community-level reduction in incidence of roughly 60%. Thus, a value of 0.25 was used for the ratio of infectivity of those on ART to those not on ART. It was assumed that those on ART returned to the pre-infection levels of risk behavior, and that those who were ill did not have sex from the time of serious symptomatic illness until death.

Progression assumptions

The second set of assumptions is related to the progression from HIV to death. For those adults not on ART, an HIV to death progression with a median time to death of roughly 10.4 years was used (see Figure 5). This seemed to fit well with the epidemiological trends observed in Thailand. Health care was assumed to be delivered in three sectors: a) public hospitals; b) public hospitals in which PLHIV groups and NGOs provided support for those initiating therapy to reduce dropouts and improve adherence (referred to as augmented public); and c) private hospitals. For those on ART, the inputs of clinicians regarding rates of dropout, death and treatment failure on GPOvir were sought to set the progression to death for early and late recruitment to first line ART for each of these states for those on first line therapy in each of these three major treatment sources.

Figure 5: Survival of those not on any ART by time from infection



The resulting cumulative curves over time for the public health sector in Thailand for those initiating therapy while symptomatic are shown in Figure 6. Similar data was sought for dropouts and deaths for those on the more potent second line therapies. For those in the augmented public care sector, dropouts were lower as were death rates since adherence to ARV schedules was assumed to be better because of the extensive support available to those initiating therapy. Figure 7 illustrates the difference in these dropout and cumulative death schedules for those in the public and public augmented sectors who came in for care when symptomatic. It is clear that those in the augmented public sector have lower cumulative death rates and lower cumulative dropout rates, especially during the first 3 years (roughly half the dropout rate), because they receive social support from their peers and have improved adherence to ARV regimens.

Figure 6: Fraction dropping out of therapy, dead, moving to 2nd line therapy and still on 1st line therapy in the public hospital sector for Thailand by years after initiating therapy

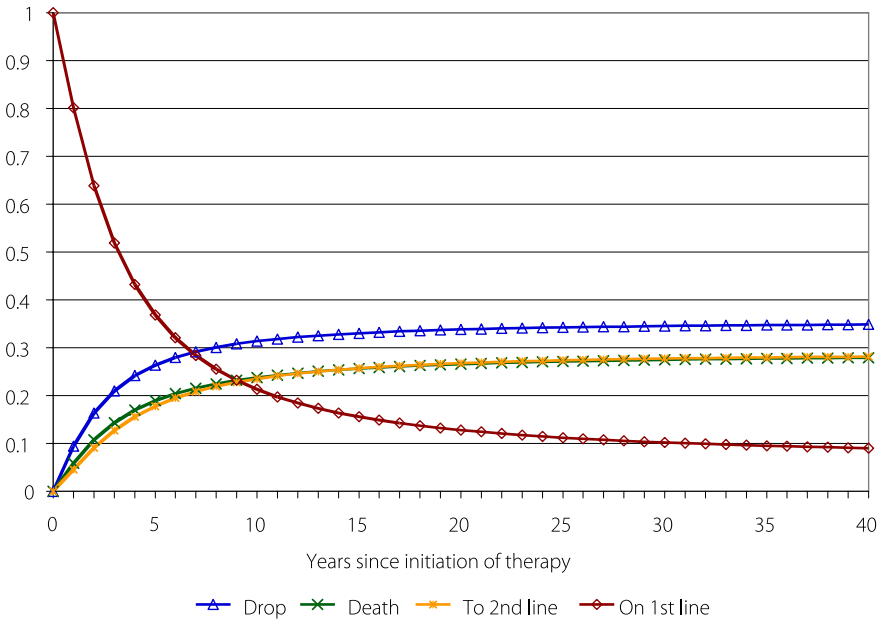
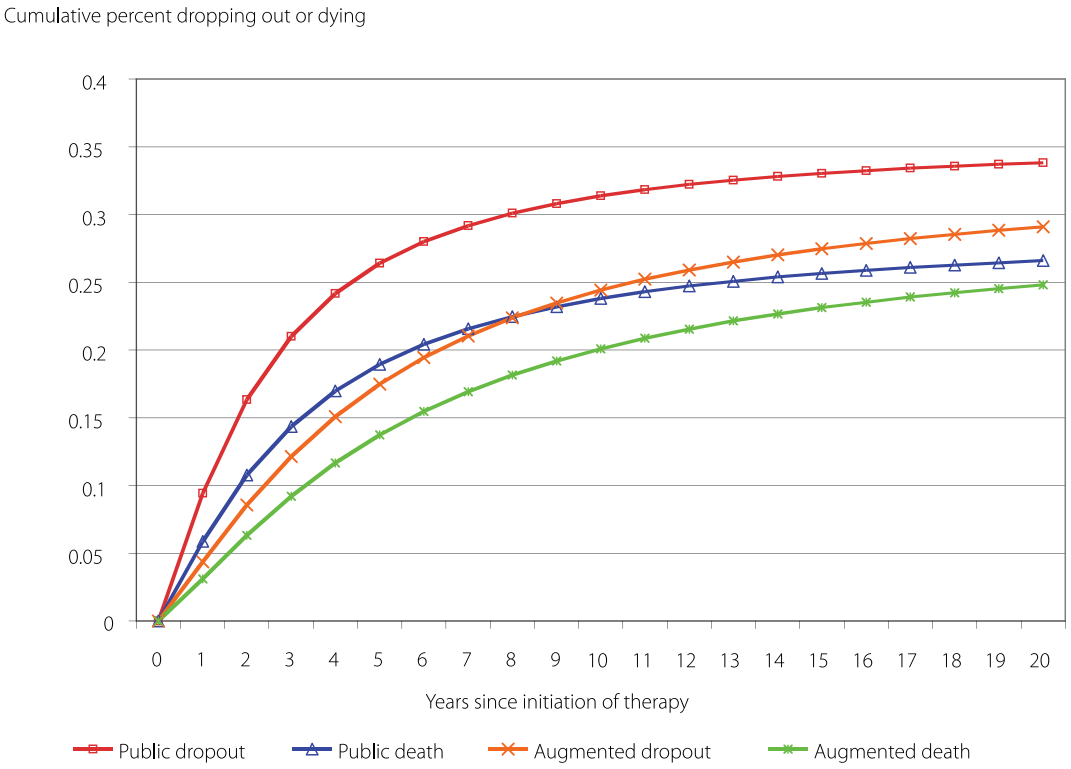


Figure 7: Comparison of cumulative dropout and death rates in the public sector and the augmented public sector



Assumptions on number of PLHIV accessing care

The model constructed balanced the expected supply of ART with the number of symptomatic and asymptomatic individuals in need of ARV care. This model assumes that people receive both first line (typically NNRTI-based therapies) and second line (combinations including protease inhibitors) treatment from the public sector. The inclusion of second line therapies significantly enhances survival of those living with HIV. Under the assumptions of this model, the number accessing care over time is shown in Figure 8. This number grew rapidly from 3,600 people in 2001 to stabilize at over 200,000 after 2010. Only a small fraction of these were assumed to access care before becoming symptomatic with HIV, increasing from 3% in 2005 to about 10% in 2020. This is because there is comparatively limited HIV testing among the asymptomatic in Thailand and an even lower number receiving regular CD4 counts, so many people do not know their current medical status and, thus, do not seek to enter treatment. Most people were assumed to seek treatment only after their infections had become seriously symptomatic. The vast majority of these, almost 90% in 2005 and decreasing slowly to about 85% by 2020, were assumed to access care in the public sector, which is by far the preferred treatment arm in Thailand for reasons of accessibility, acceptable quality of care and cost.

Figure 8: Number accessing ARV care each year in the projection

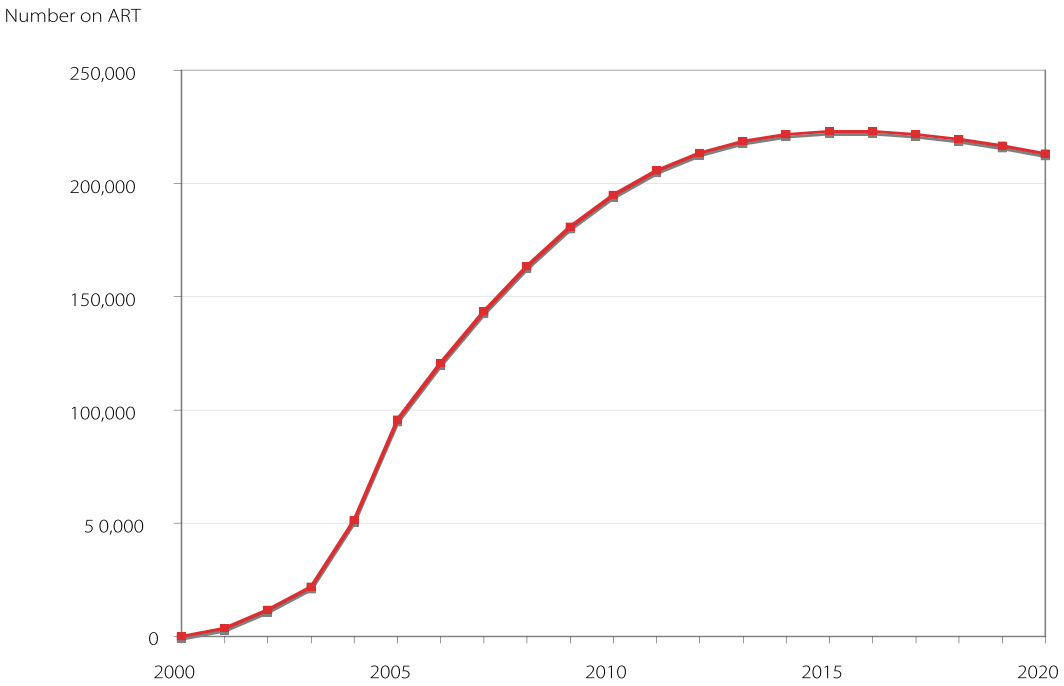
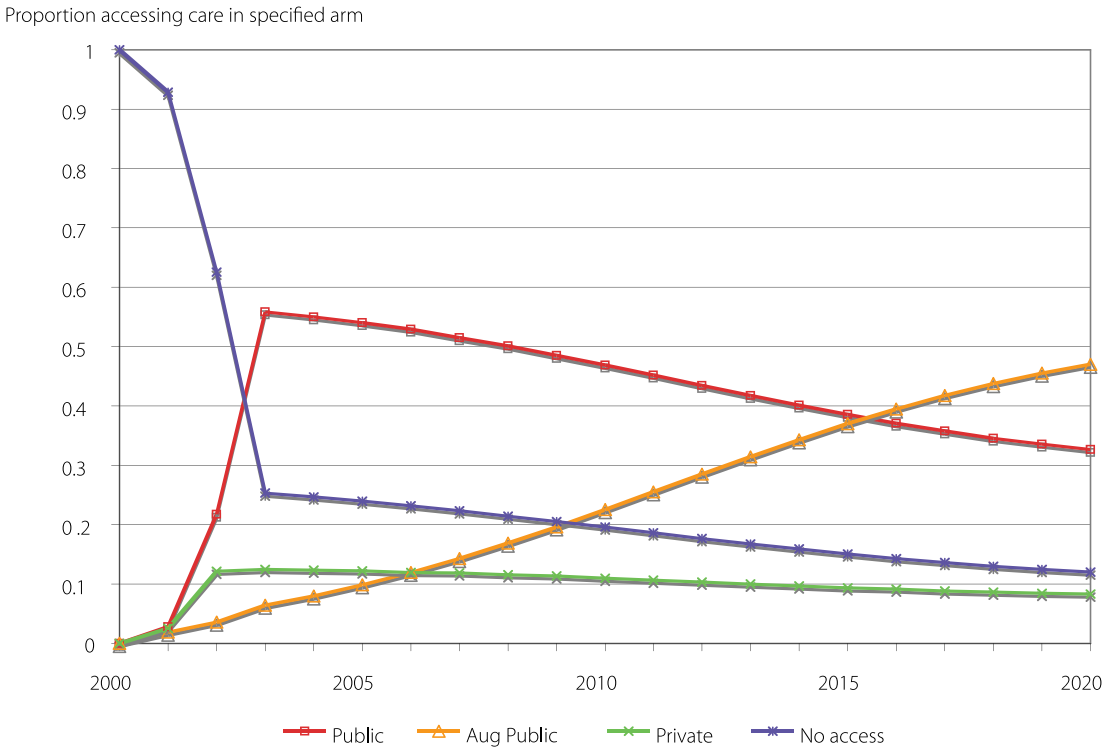


Figure 9 shows how the demand was met in the various treatment arms for those seeking care once symptomatic with HIV, with an increasing proportion obtaining care in the augmented public sector as it expanded over time. The assumption was that private demand would not increase substantially given the access to low cost and quality care through the government sector. The proportion not accessing care at all dropped steadily from 24% in 2005 to 12% in 2020, reflecting expanded accessibility of treatment and higher public knowledge of the benefits of ARV care over time.

Figure 9: How the demand for symptomatic individuals is met in various treatment arms over time



CHAPTER 4:

RESULTS OF THE 2005 HIV PROJECTION

It needs to be emphasized that the number of new infections for each year in this projection has been based on the assumption that risk behaviors and STI rates remain the same from 2005 forward. If risk behaviors or STI rates change, the number of new infections will increase or decrease accordingly.

4.1 Overview of the current state of the Thai epidemic

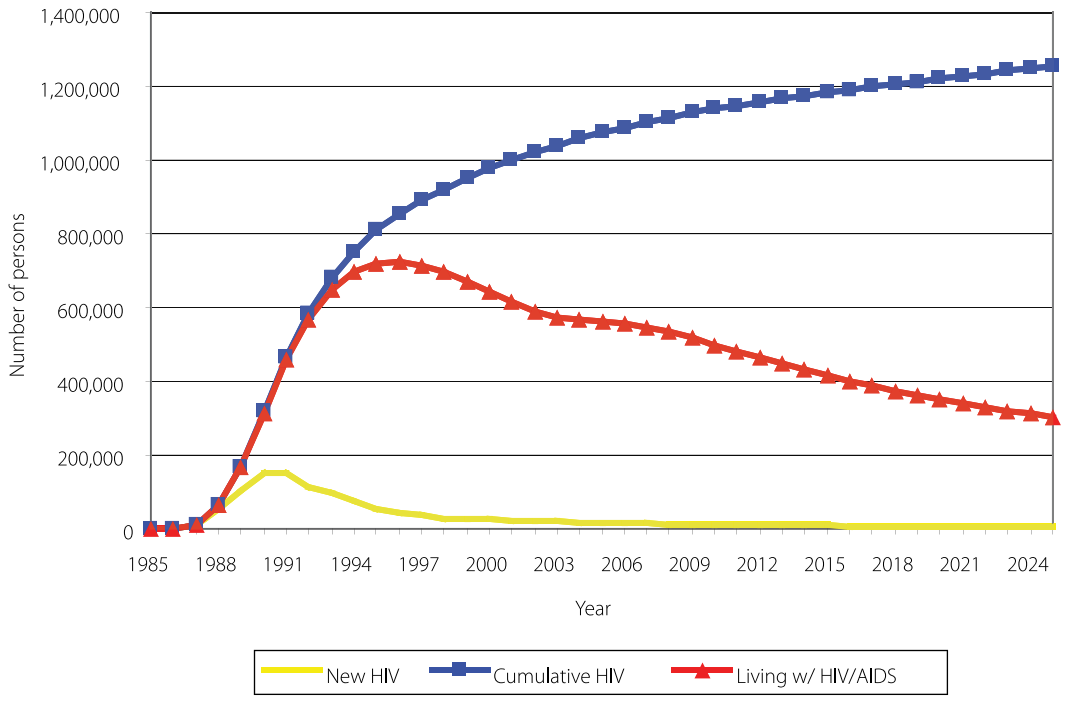
From the baseline scenario, the following was state of the Thai HIV epidemic in 2005:

- 1,074,000 adults have been infected with HIV in Thailand since the start of the epidemic.
- 514,000 of these people have subsequently died of AIDS.
- 563,000 people are currently living with HIV .
- 16,500 new infections will occur that year.
- 37,200 people have serious illness by the end of the year.

The state of the Thai HIV epidemic in 2008 is:

- 1,115,000 adults have been infected with HIV in Thailand since the start of the epidemic.
- 585,800 of these people have subsequently died of AIDS.
- 532,500 people are currently living with HIV.
- 12,800 new infections occur this year.
- 48,000 people have serious illness by the end of the year.

Figure 10: Total number of adults currently living with HIV, new HIV infections and cumulative HIV infections over time in Thailand (baseline scenario)



4.2 HIV transmission among various adult at-risk sub-populations

The Thai epidemic has significantly changed its character as the epidemic has moved among the various at-risk populations, and prevention efforts have succeeded or failed in the different groups. The following figures and tables illustrate the changing dynamics of the Thai HIV epidemic.

Figure 11: Trends in new infections among adults by sub-population

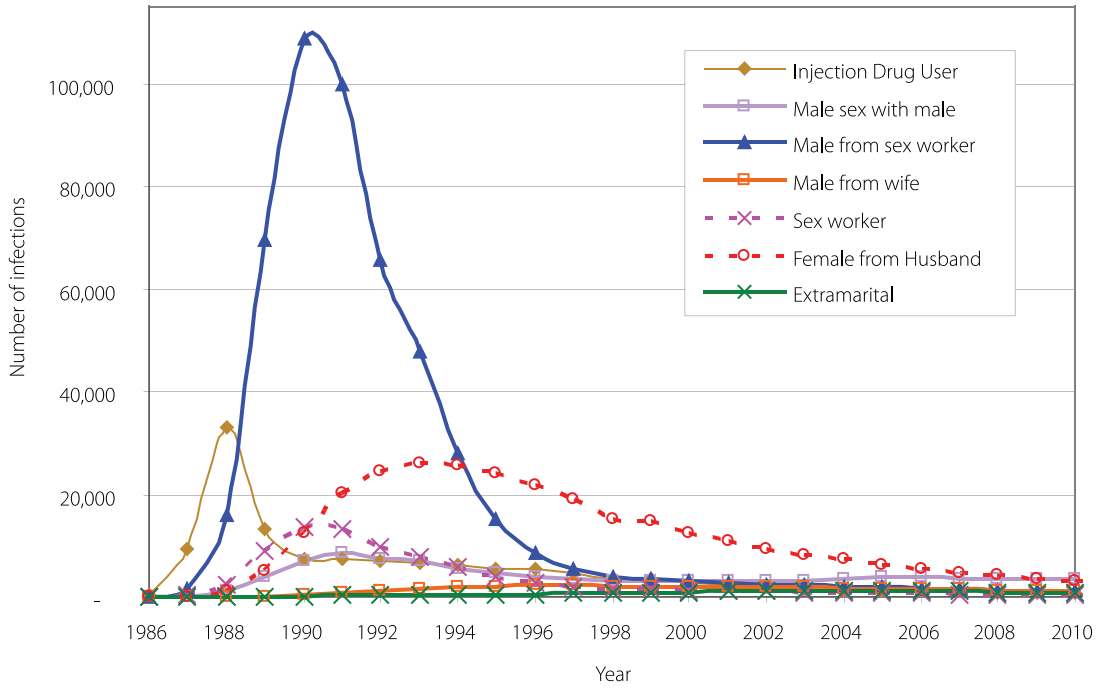


Figure 12: Changing routes of adult HIV transmission over time

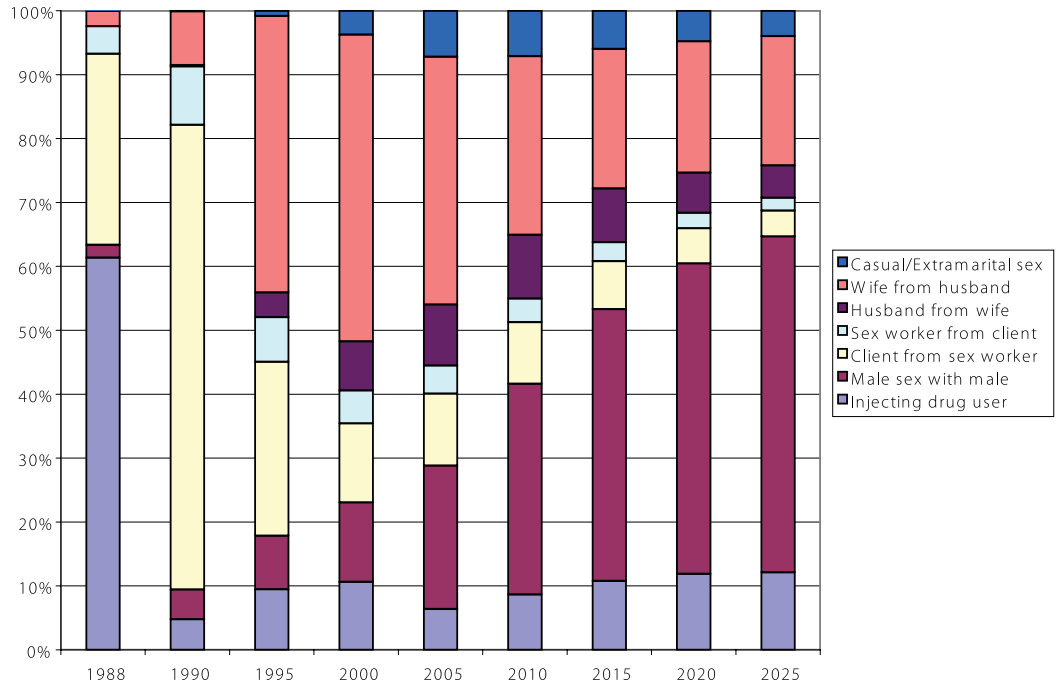


Table 4: Actual number of new adult HIV infections by modes of transmission

Transmission route	1988	1990	1995	2000	2005	2010	2015	2020	2025
Wife from Husband	1,285	12,616	23,995	12,554	6,399	3,034	1,787	1,455	1,336
Husband from wife	8	276	2,133	2,014	1,578	1,083	688	445	308
Male sex with male	1,081	7,001	4,657	3,250	3,707	3,577	3,480	3,439	3,409
Drug injection	32,945	7,209	5,260	2,785	1,056	941	884	843	813
Client from sex worker	16,030	109,029	15,082	3,238	1,861	1,048	614	391	276
Sex worker from client	2,311	13,734	3,880	1,346	723	399	243	170	131
Casual sex	9	150	445	971	1,189	769	488	339	256
Total number of new infections	**53,667**	**150,015**	**55,452**	**26,158**	**16,513**	**10,853**	**8,184**	**7,082**	**6,529**

Table 5: Percentage of new adult infections by modes of transmission

% new infections from each transmission route	1988	1990	1995	2000	2005	2010	2015	2020	2025
Wife from Husband	2	8	43	48	39	28	22	21	20
Husband from wife	0	0	4	8	10	10	8	6	5
Male sex with male	2	5	8	12	22	33	43	49	52
Drug injection	61	5	9	11	6	9	11	12	12
Client from sex worker	30	73	27	12	11	10	8	6	4
Sex worker from client	4	9	7	5	4	4	3	2	2
Casual sex	0	0	1	4	7	7	6	5	4
Total from all mode of transmissions	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**

The HIV epidemic in Thailand first started among IDUs in mid-1980s. In 1988, transmission among IDUs was driving the epidemic with 61% of new infections occurring in this group, while another 30% occurred among FSWs and their clients. However, by 1989 the transmission among FSWs and clients was dominating the epidemic; accounting for more than 80% of new infections. During the 1990s, IDUs gradually came to account for more than 10% of new infections, owing to the absence of strong prevention efforts for them. Similarly, through the 1990s, new infections among MSM accounted for an increasing proportion of total new infections, largely due to the failure to mount substantial prevention efforts in this population.

After 1991, HIV transmission between sex workers and clients slowed greatly as a result of the national 100% condom use program and transmission between husband and wife kept rising as infected men passed HIV to their regular female partners. By 1995, the majority of new infections were occurring through husband-to-wife transmission (43%), while transmission among sex workers and clients accounted for 35% of new infections. In 2000, the contribution of husband-to-wife transmission had grown to 48% of total new infections and wife-to-husband transmission contributed 8% (meaning a total of 56% of new infections occurred between husbands and wives). By this year, IDU, MSM and clients of sex worker sub-populations were each contributing slightly more than 10% of total new infections. The epidemic has become quite heterogeneous. Of the groups contributing in a major way to new infections, only clients were receiving much prevention support through programs targeted at sex work. Very limited pilot-level programs existed to address IDU, MSM or husband-to-wife transmission.

It should be noted that the actual number of new adult HIV infections declines slowly from 16,500 in 2005 to almost 11,000 in 2010 and just over 8,000 in 2015. This is still a rather high level, and indicates the need for expanded and targeted prevention efforts to address the ongoing sources of new infections.

Transmission between spouses is the major contributor to new infections

In 2005, transmission from husbands to wives contributes 38.8% of total new infections, while transmission from wives to husbands contributes 9.6%, resulting in a total 48.3% of all transmissions occurring within marriages and regular partnerships. Due to the lack of programs to address this, new infections among this group will remain high, producing 38% of total new infections in 2010. Although the actual number of new infections in 2010 will be about half of the 2005 level, this still means over 4,000 couples will transmit HIV to one another in that year.

Transmission in this group is largely a delayed consequence of infections in other at-risk populations such as FSWs and clients, IDUs and MSM. At-risk males and former sex workers who contracted HIV through their risk behaviors transmit HIV to their current or future spouses over a period of many years. Because the STI levels are low, this transmission occurs gradually at a rate of about 10% per year. This provides opportunities to intervene, both by preventing the primary infection of the at-risk partner and by encouraging expanded testing and protective measures in couples in which that one or both partners has a history of risk behavior.

Transmission among MSM is growing rapidly

MSM have been a neglected population in terms of prevention in Thailand. While there was substantial focus on them in mid-1980s, that focus was lost once the IDU and heterosexual epidemics exploded. MSM contract HIV in regular partnerships, casual partnerships and through contacts with both MSWs and FSWs; their contribution to the overall Thai epidemic is growing rapidly. In 2005, this transmission route contributed 22.6% of new infections. If effective prevention efforts for MSM are not expanded, this will increase to 43% by 2015. Although the overall new adult infections are declining over time, the lack of good HIV prevention efforts in this population means that almost 3,500 MSM will continue to be infected every year for the foreseeable future. The transmission may not stop there either. About one third of MSM also have sex with women [van Griensven et al. 2005], including FSWs, casual female partners and wives. Thus, HIV infections will not remain contained within this male sub-population.

Transmission among IDUs remains an ongoing problem

In 2005, new infections among IDUs accounted for 6.4% of total new infections. By 2010, this proportion will increase to 9%. Again, this is a legacy of weak prevention, which will continue to produce about 1,000 infections per year for the next decade unless IDU prevention efforts are strengthened substantially.

Transmission among FSWs and their clients continues

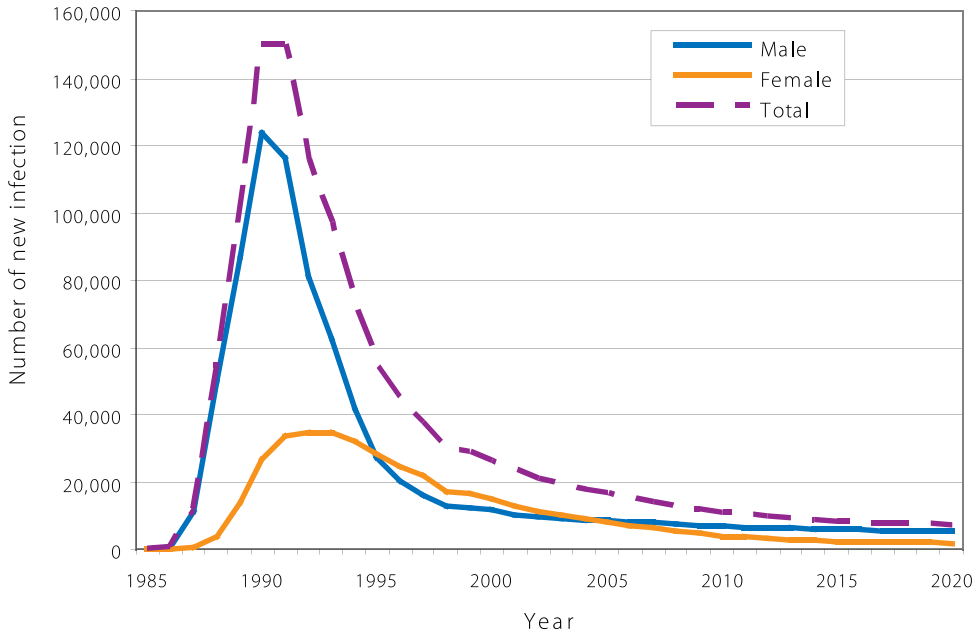
In 2005, the proportion of new infections among sex workers and clients is about 16% of new infections, decreasing very gradually to 13.5% in 2010. This will still produce almost 1,500 infections a year in 2010. As the recent national survey has shown, only about 80% of clients used a condom the last time they visited a sex worker, so there is room for substantial improvement and strengthening of sex work prevention efforts.

Transmission from premarital and extramarital sex does contribute today

The number of new infections from extra-marital (casual) sex non-matital is lower than the number of new infections from most of the groups discussed previously. However, condom use is still at only 35.8% in casual sex; and, proportionately, casual sex contributes almost 7% of new infections from 2005 to 2010. While these numbers do decline slowly over time, casual sex will continue to contribute 500 to 1,000 new infections a year for the next decade.

4.3 Gender ratio in the Thai epidemic

Figure 13: New HIV infections among adult male and female populations



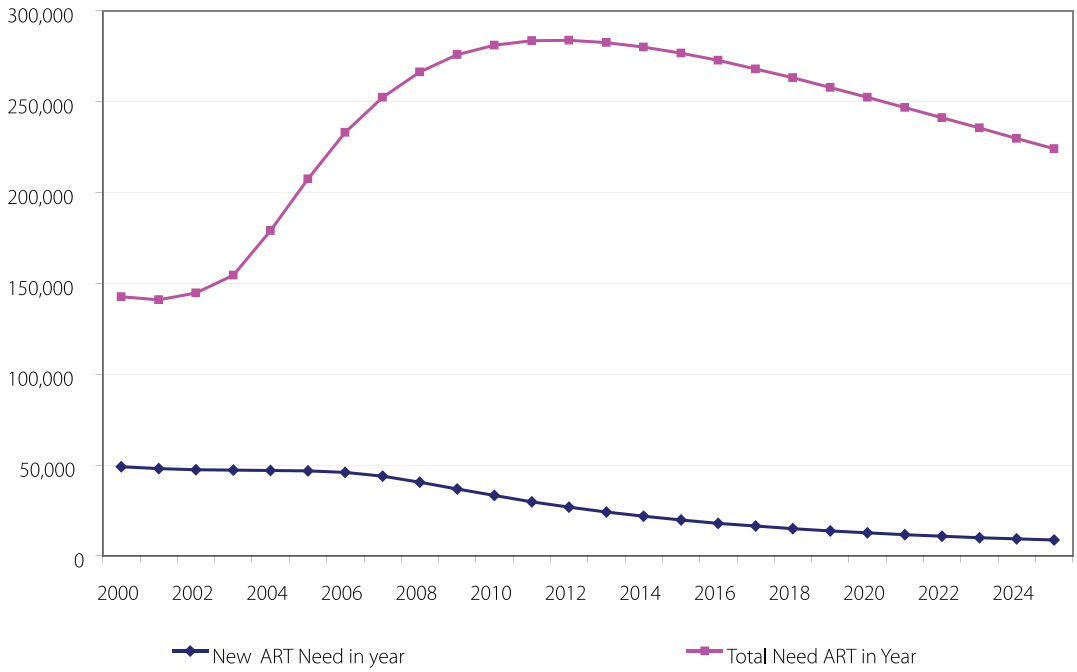
In the early days of the Thai HIV epidemic, the number of males newly infected was substantially higher than the number of females because of the high number of clients of sex workers contracting HIV and the high rates of transmission among at-risk male populations such as MSM and IDUs. In 1990, the ratio of males to females infected was 6.1. With the radical reductions in transmission between clients and sex workers that resulted from successful prevention efforts and the rise in husband-to-wife transmission in the mid-1990s, new infections among females actually exceeded those among males from 1995 to 2004. By 2005, when the number of new infections in males and females were roughly equal, the ratio of current males to females living with HIV had fallen to 1.6. However, today and for the near future, continuing transmission among MSM and IDUs has once again made new male infections more common.

4.4 ART, its impact and resource need

ART need is still growing

Figure 14 shows the numbers of new people in need of ART (the number who first meet the asymptomatic criterion in that year). This number declines gradually each year from 41,000 in 2008 to less than 10,000 in 2024 as a result of declining new infections starting in the early 1990s. The total number of people in need of ART continues to grow for several years because most of those on ART have an ongoing need, and then declines after 2012. In 2008, approximately 266,000 are in need of ART while this number increases to 284,000 in 2012. Even with the decline, the total number of people in need of ART (both currently on ART and currently not on ART) remains over 250,000 in 2020.

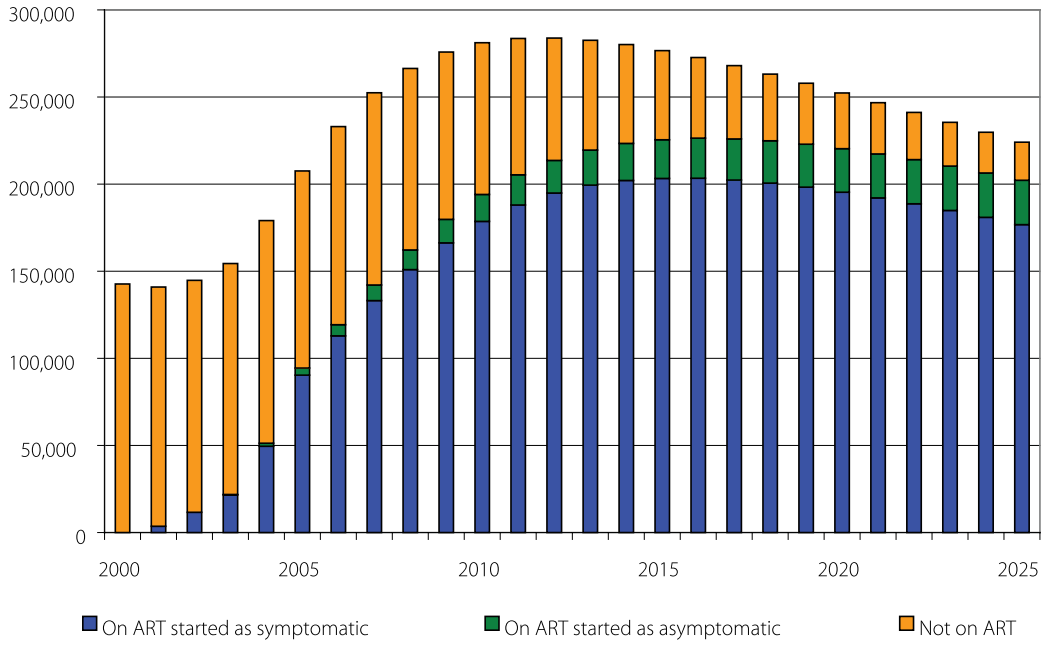
Figure 14: Number of people newly in need of ART in each year and total number of people currently in need of ART in each year



There has been great expansion of ART but further expansion is needed

Figure 15 shows the total number of people needing ART in each year, separated into three groups: 1) those who are on treatment and were recruited to treatment early (initiated ART when their CD4 fell below 200); 2) those who are on treatment but were recruited late (started ART after becoming seriously ill and seeking medical care); and 3) those who are not currently receiving treatment.

Figure 15: Total number of people in need of ART divided into those who started ART early while asymptomatic, those who started late when seriously symptomatic and those not currently on ART



Because of the large number of people currently on treatment (who continue to need ART from year to year) and the number newly needing treatment because they have reached one of the criteria for initiating ART, the total number of people needing ART continues to increase through the end of the decade and will not decline until after 2012. By that time, 284,000 people will need ART; this is approximately two times the number in need of ART in 2001 (141,000). In 2005, about 46% of the 210,000 people in need received treatment. With the continuation of the national policy supporting universal access to ART, the proportion of people in treatment is expected to increase to 75% in 2012. Then with the subsequent slow decline in the number of people needing ART, up to 80% of those in need will be on treatment in 2015 and almost 90% in 2020.

Most of the patients on treatment come from late recruitment (symptomatic illness). In 2005, less than 5% of those who received therapy accessed care before becoming seriously symptomatic. This proportion increases to about 10% in 2014 but still remains low at about 13% in 2025. The reasons for this include the fact that symptomatic patients obviously need ART urgently and many of them are already in health facilities or accessing the public care system. Other contributors include the limited number of treatment slots assumed in the projections here and the fact that many of those who are asymptomatic do not seek treatment. Many are not even aware of their HIV status because of limited uptake of VCT in Thailand. Finally, some people just have no ready access to health facilities.

In order to improve survival of those on treatment, it is important to get people into care early. Those who initiate ART at the asymptomatic stage have substantially better survival than those who initiate it only after becoming ill. This requires improvements in referrals of those in at-risk populations for testing, the marketing of VCT services to those with current or past risk behaviors and the expansion of easily available VCT services. This will allow for increased early recruitment, which will produce better survival. Interventions to improve and sustain a high level of adherence, e.g., by strengthening PLHIV support groups or other social services to help people adjust to ART, can also help to improve survival by strengthening adherence. These approaches will also help to maximize the benefits of ART and minimize drug resistance, which leads to treatment failure and drives up ART costs.

A dramatic increase in resources will be needed to support a continuum from first line to second line treatment

Second line therapy becomes a necessity when patients develop resistance to first line therapies. This has significant cost implications for the Royal Thai Government because second line drugs cost many times more than first line drugs. Because some people inevitably do fail on first line therapies, the rapid growth in the number needing second-line treatment will keep the costs rising, even though the total number needing ART decreases after 2010. Figure 16 shows the steady increase in the number of people on second line therapy, which reaches 60,000 by 2019. With the current comparatively high cost of second line therapies, this suggests that a dramatic increase in financial resources is required to sustain universal access to both first line and second line therapies.

Figure 16: The increasing number of people on second line therapy

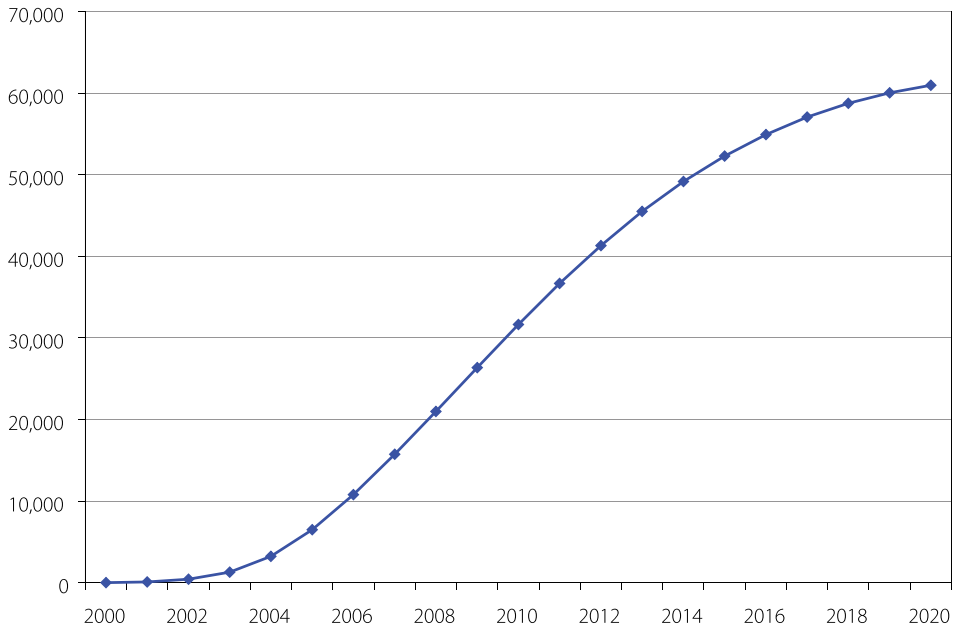
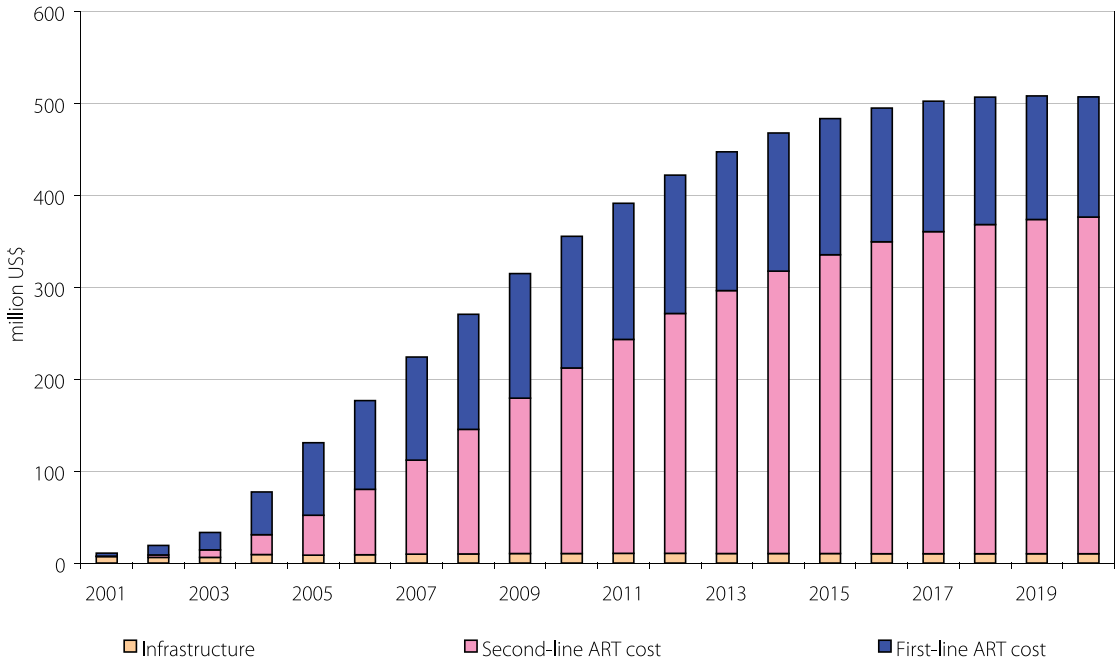


Figure 17: Projected cost of NAPHA policy for ART (values are in millions of 2004 US$)



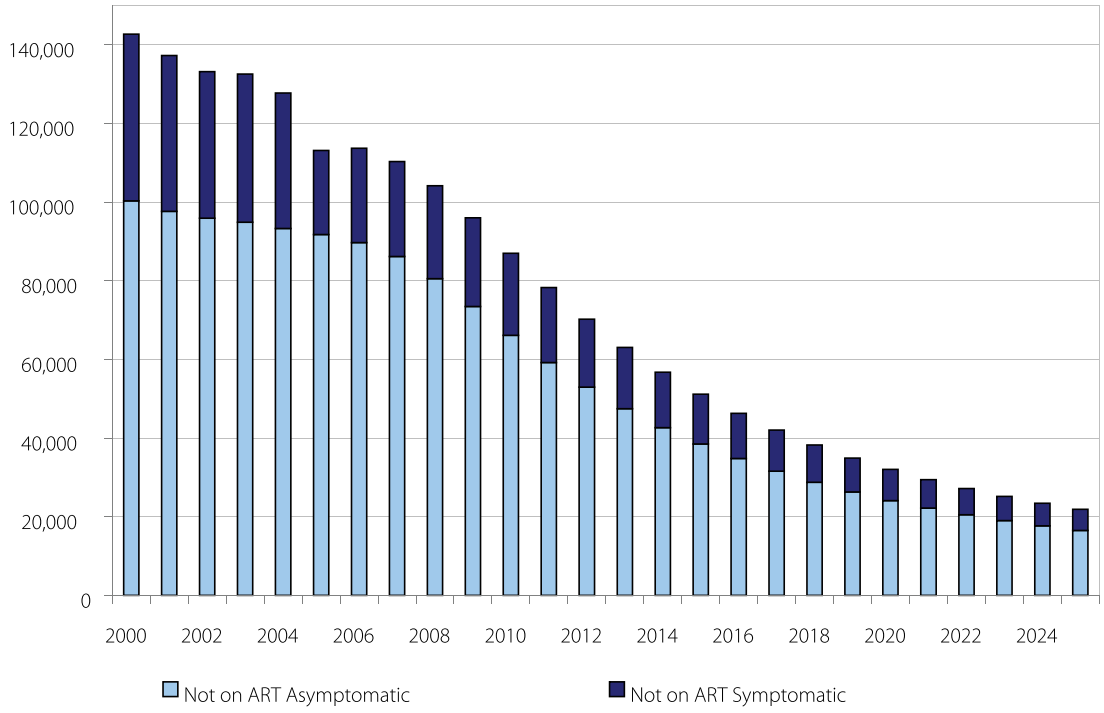
Source: Revenga et al. 2006 The Economics of Effective AIDS Treatment: Evaluating Policy Options for Thailand. The World Bank.

NOTE: These figures are based on the cost information from the year 2002-2003 and do not factor in recent price reductions associated with compulsory licensing and use of generics in Thailand.

Significant reductions in the number of those with no access to ART

In 2000, when ART was first made available, approximately 142,000 people were in need of ART but did not receive it. Under the assumptions on treatment expansion used in the projection, the number requiring but not receiving ART declines steadily each year, as access to ART increases under government support. The number needing ART but not on treatment is 104,200 (39% of total number needed ART) in 2008, 56,700 (20%) in 2014 and will fall to 23,400 (10%) by 2024.

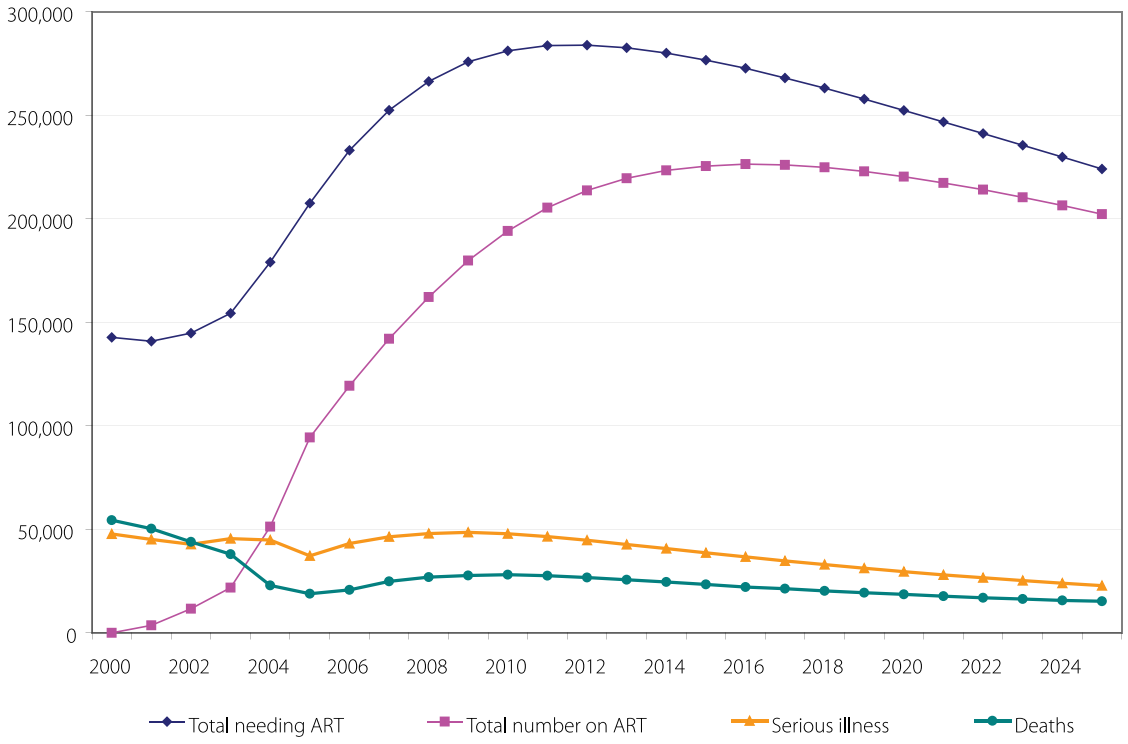
Figure 18: Number of asymptomatic and symptomatic individuals needing ART but not receiving treatment



Need for continuing care and support

In addition to ART, care and support is also needed. Each year, a number of PLHIV will develop serious illnesses as the result of HIV progression. Some will be unable to access treatment while others will drop out of treatment or will suffer a treatment failure. For some of these people, the subsequent illness will result in death. By the end of 2008, with 266,400 PLHIV in need of ART but only 162,200 receiving it, up to 48,000 will develop serious illnesses that require comprehensive care and support.

Figure 19: Number of people needing ART, on ART, number with serious illness by the end of the year and number of deaths in each year



HIV prevalence will only decline slowly as ART impacts survival of those with HIV

Had the government not commenced its provision of ART through the NAPHA program, many people would have died in the early 2000s. With NAPHA, the number of deaths dropped dramatically from 2002 to 2005 (see Figure 20). Without NAPHA, more than 40,000 people would have died each year until 2010, after which this number would have started to decline. As a result, by 2025 the total number of PLHIV with NAPHA will be about three times the number without NAPHA (see Figure 21). However, it must be noted that while ART postpones death for a limited number of years, it does not ultimately prevent death. As a result, the number of deaths with the NAPHA program in place remains lower than the number without NAPHA only until about 2017. At this point, the number of delayed deaths each year starts to exceed the deaths that would have occurred if no treatment had been offered. However, it should be noted that those dying later had many years of productive life added. They were able to continue caring for their families and children and benefited greatly from the government's provision of ART. Over these individuals' substantially extended lifetimes, ART will avert substantial medical care costs, reduce the loss of income to their families and prevent additional care burdens placed on both the family and society at large, as well as avert downstream social costs associated with HIV.

Figure 20: Number of deaths comparison in NAPHA and no NAPHA scenarios

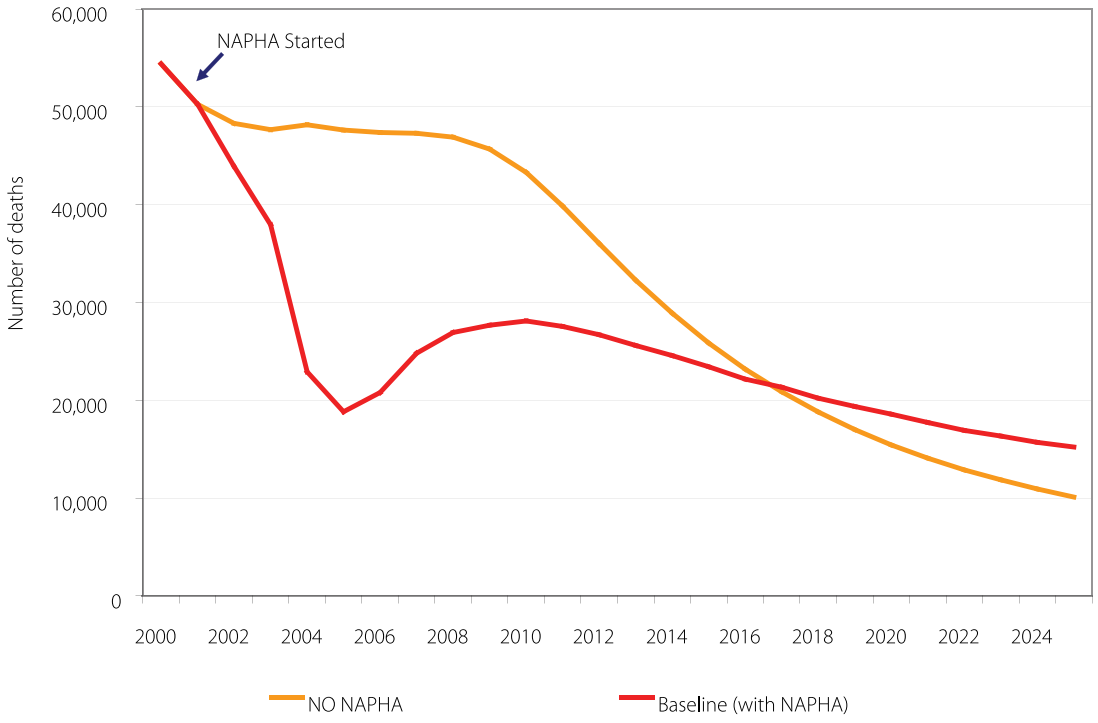
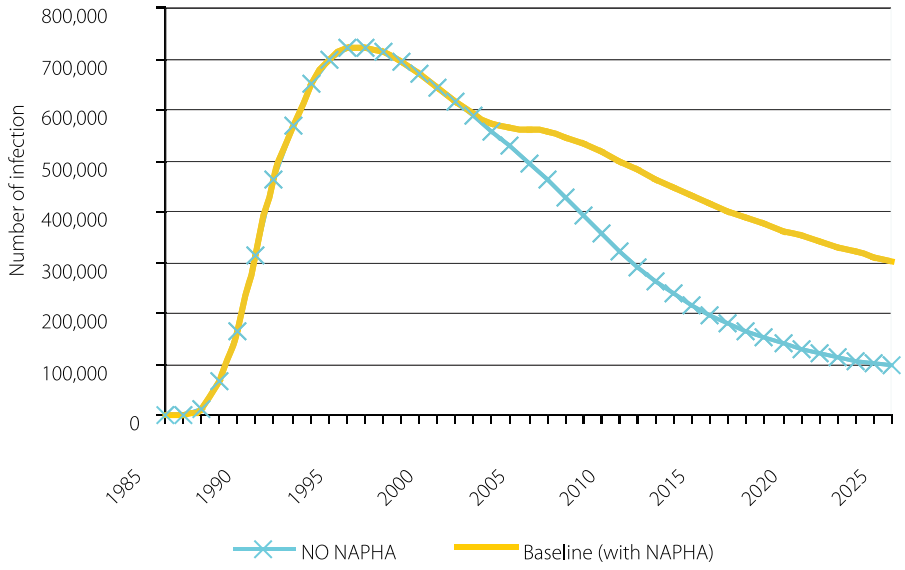


Figure 21: HIV prevalence comparison in NAPHA and no NAPHA scenarios



4.5 Recommendations for strengthening prevention and care in Thailand

With over ten thousand new infections occurring each year and a growing number of people urgently in need of treatment, increased and sustained support for both effective prevention and treatment in Thailand is critical. The current mixed nature of new infections, which are divided among all of the at-risk populations in the country, calls for a multi-faceted response that provides access to prevention services for all these populations, and ensures referrals and access to ARV care, as necessary. Some of the specific needs that arise from the projection work are described below.

Prevention interventions for sero-discordant couples (couples where one partner is infected and the other is not)

Husband-to-wife and wife-to-husband transmission now dominate new infections in the Thai epidemic, yet programs for discordant couples have been limited. Effective responses require first making couples aware of their discordance and then offering them strategies for reducing transmission. Such strategies might include:

- Development and promotion of VCT for HIV among couples and those preparing to marry.
- Campaigns to encourage those with risk behavior to learn their status and act on it to protect their partners. Couples counseling services should be offered when one partner is identified as HIV positive.
- Interventions to support condom use among discordant couples.

Prevention for MSM, MSWs and transgendered individuals

Both in Thailand and regionally, the fastest growing transmission route in Asian epidemics is male same-sex behavior, in particular anal sex. The high prevalence among MSM around the country documented in the TUC studies is a cause for serious concern. As the projection shows, by the mid-2010s more than half of new infections will occur among MSM and MSWs. Scale-up of interventions for these sub-populations is urgently needed, including:

- Mobilization of the MSM community to take a more active and aggressive role in HIV prevention in their ranks.
- Ensuring ready access to condoms and lubricants in all settings in which male same-sex behaviors occur.
- Expanded access for MSM and MSWs to subsidized or low-cost public and private sector STI services.
- Expansion of the establishment-based components of the 100% condom use program to cover MSWs and their clients.
- Development and scale-up of outreach and services for non-establishment based MSWs, MSM and transgender in cruising areas.
- Expanded efforts to promote learning one's status, improved access to testing in community-friendly venues and referrals to treatment services when needed for MSM, MSWs and transgendered individuals.

Prevention intervention for FSWs and clients

While transmission through sex work has gone down from the high levels at the earlier stages of the epidemic, it continues to be a significant contributor to the epidemic. The number of clients in the country still exceeds 2 million; this creates a large population with elevated risk. The shift to indirect forms of sex work has made traditional and structured approaches less effective, and the health care reforms of the late 1990s have weakened public sector STI treatment and outreach services nationwide. Some of the specific changes needed are:

- Revisiting the 100% condom use program to make it workable in the current contexts of more indirect sex work and the existing health infrastructure that has more limited capacity for STI/HIV outreach.
- Ensuring ready access to condoms and continued high levels of condom use in commercial sex through targeted subsidy programs.
- Development and expanded intervention for non-brothel based sex workers and other non-establishment sex workers who may not be reached by the 100% condom use program.

- Strengthening of STI treatment and outreach services for those engaging in sex work, both sex workers and clients.
- Expanded access to HIV testing and referrals for treatment when needed for sex workers.

Prevention for drug users (IDUs and non-IDUs)

Despite their important role since the early days of the Thai epidemic, programs for IDUs have been weak and limited. As a result, the prevalence among IDUs remains high at over 40% nationwide. The growing use of non-injecting drugs by youth, such as methamphetamines, also contributes substantially to potential sexual risk for HIV. In light of this, programs needed include:

- Expanded efforts to reduce drug use among the young, both injecting and non-injecting. This will involve both primary prevention to keep people from starting drugs and expanded treatment programs to help them stop using.
- Campaigns to raise awareness and knowledge about HIV transmission through needle sharing and sexual activity and their prevention among drug users.
- Policy changes to create a more enabling environment for HIV prevention among drug users and reduce barriers to accessing clean equipment.
- Efforts to reduce needle sharing among IDUs through outreach and peer education among IDUs in communities and expanded clinic-based programs to reduce needle sharing.

Prevention for youth

Half of the sex work clients in Thailand are aged 15-24, as are most of the sex workers. Many drug users are also young. Furthermore, casual sex is a small but important source of new infections, many of which will occur among young people. Youth behaviors in Thailand are in flux, creating further risk for acquiring HIV among the large generation of young Thai people. In light of these changes, a number of programs are needed, including:

- Targeted outreach and peer education for young clients, sex workers, MSM and drug users. The needs of young members of these populations are unique, and they have the highest risk in each of these groups. This means they should receive special attention in prevention efforts.
- A program that promotes HIV/AIDS awareness and knowledge among general youth and provides them with the necessary knowledge and skills sets for HIV prevention before they engage in risk behaviors. Where possible, such programs should be specially targeted at youth with higher risk, e.g., street children, out-of-school youth and vocational school students.
- Expansion of access to friendly and non-judgmental STI and other reproductive health services for youth to reduce the contribution of STIs to HIV transmission and address other urgent issues such as youth pregnancy and STIs.

Prevention for marginalized people and people in closed settings

A number of specific populations, including migrant laborers, fishermen, prisoners and illegal immigrants have elevated risk for HIV, and need access to prevention and health services. Such programs need to be designed with appropriate attention to language, culture, beliefs and barriers to accessing health and social services. Appropriate interventions to reduce sexual transmission risk and needle sharing should also be made available in closed/supervised settings such as prisons and youth detainment facilities.

Control of STIs remains an urgent priority

Despite past successes in controlling STIs, the health care reforms started in 1997 have resulted in fewer STI clinics and less outreach to promote prevention and STI care among sex workers [MOPH Thailand and WHO Regional Office 2005]. Most clinics under the new hospital-based STI service system are not fully functional; frequently lacking outreach, partner notification, condom promotion and counseling services. Sex workers were also reported less likely to use the new services because of the unfriendly attitudes of other patients and hospital staff, and inadequate attention to their specific needs and concerns.

STI control is critically important for HIV prevention as the risk of HIV transmission is higher with a concurrent STI. Changes in the level of STIs often indicate changes in levels of condom use and can serve as an early warning system for rising HIV transmission. Therefore, it is critical to strengthen these services and guarantee that quality STI services are readily available again. Quality and friendly STI services are needed not only for FSWs and their clients as in the past, but also for MSM, MSWs and young people who engage in higher-risk sexual behaviors. Specific attention should be paid to their needs as services are expanded.

Availability of VCT services

While VCT services should be widely available both for prevention and treatment purposes, their availability has been limited and the services are not well attended. There are few targeted services meeting the specific needs of populations such as MSM, sex workers, drug users and higher risk youth; some of the groups most in need of VCT. In addition to HIV testing, the package of services available should include couples counseling, disclosure counseling, premarital counseling, and referrals to CD4 testing and treatment when needed. Positive prevention to protect the partners of the PLHIV should also be a part of VCT and treatment service. Making testing more widely available and promoting it among those at risk are essential if people are to start treatment before they become seriously ill. Initiating treatment earlier will improve survival and reduce other medical care costs for those with HIV.

Expansion of treatment access and support for adherence

The public system to provide quality ART has been scaled up rapidly. However, better links need to be made between sex workers, IDUs, MSM and MSWs, and available treatment services. Targeted prevention efforts in these populations should include a 'referral to treatment' component for anyone showing signs of HIV-related illness or testing HIV positive. VCT services should be used to get people into therapy in a timely fashion. An effort to expand access to CD4 testing is also needed if people are to receive ARVs before falling ill, which will improve survival and quality of life.

As the costs associated with second line therapies are likely to make up a large part of the total costs of ART, the Royal Thai Government needs to continue its efforts to ensure affordable access to these drugs. Effective prevention, coupled with efforts to keep these costs down will ensure the sustainability of publicly-financed ART.

Finally, expansion of programs to support those on ART is needed, e.g., the community support groups which have worked with hospitals to assist those starting ART. This type of social and emotional support is critical to promote understanding of adherence, provide a supportive environment that improves adherence and support the continued well-being of PLHIV. With improved adherence, survival will improve, the need for second line therapies will be reduced and the development of ARV drug resistance will be reduced.

CHAPTER 5:

USING THE 2005-2025 PROJECTION TO GUIDE HIV PREVENTION AND CARE STRATEGIES

Thailand first prepared a national HIV projection using the AEM in the period of 1999 to 2000. This first projection was widely used as a source of strategic information and provided frequently quoted estimates. However, its full potential for helping to guide HIV prevention and care strategic planning was not realized. Although recommendations were made based on the projection, no actual implementation plan was produced to turn those recommendations into specific actions to improve the effectiveness of the national response.

The updated 2005 projection was prepared using an updated version of the AEM and incorporated changes in the national situation occurring since the previous projection was prepared. However, learning from experience with the 2000 projection, additional steps were taken to encourage use of the results of the 2005 projection to influence strategic planning for HIV prevention and care.

5.1 Setting a national prevention goal

While the 2005 projection shows a declining trend of new HIV infections in the country, the number of new infections in each year remains substantial (see Table 7). After the initial presentation of the projection and its results, a policy dialogue began on how to reduce new infections at a faster rate than the projected trend. Specific cost estimates were prepared for the additional ARV burden associated with these infections to show that the benefits of prevention outweighed its costs [Martin and Sangrujee 2006, Revenga et al. 2006].

Table 7: Number of new infections at baseline (no additional prevention support)

Route of transmission	2005	2006	2007	2008	2009	2010
IDU	1,056	1,015	989	971	955	941
Male sex with male	3,707	3,693	3,672	3,643	3,609	3,577
Client from sex worker	1,861	1,652	1,473	1,314	1,173	1,048
Husband from wife	1,578	1,483	1,382	1,280	1,180	1,083
Sex worker	723	640	570	506	449	399
Wife from Husband	6,399	5,583	4,828	4,139	3,538	3,034
Extramarital	1,189	1,108	1,022	934	849	769
Total number of new infections	**16,513**	**15,174**	**13,936**	**12,787**	**11,753**	**10,853**

The goal was set to reduce the number of new infections by half in three years. This was the first time in Thailand that a goal for HIV prevention was quantified and specified. In order to match this national goal with the UNAIDS/WHO goal of universal access by 2010, the goal was later modified to achieving this result by 2010 [MOPH Thailand 2006].

5.2 Providing convincing evidence of feasibility

Having set the national prevention goal, the AEM was used to demonstrate the feasibility of reducing new infections within the planned period. As the number of new infections is directly determined by changes in risk behaviors, the AEM was used to assess the levels of behavior change needed to achieve the 50% reduction goal. Table 8 shows a set of achievable and realistic behavior changes that will achieve the desired reduction in new infections. Table 9 shows the numbers of new infections expected in each population if these levels of behavior change are achieved. This shows that if these behavior changes can be realized, the effect would be sufficient to cut the new infections by half in 2010 compared to the current baseline situation.

Based on the analysis of the importance of various groups presented earlier in this report, targeted prevention strategies for each key population were developed to achieve the necessary level of behavior change.

Table 8: Target population, behavior to be changed and behavior change targets

Target group and Behavior	2005	2006	2007	2008	2009	2010
Direct FSWs - Condom use	82%	82%	85%	90%	95%	95%
Indirect FSWs - Condom use	70%	70%	75%	83%	90%	90%
Discordant couple - Condom use	2%	2%	10%	20%	30%	30%
Casual sex - Condom use	36%	36%	40%	50%	60%	60%
MSW - Condom use	82%	82%	85%	88%	90%	90%
MSM - Condom use	70%	70%	75%	85%	90%	90%
IDU - Needle sharing	36%	36%	27%	18%	18%	18%

Table 9: New infections by year and cumulative case averted number in a strengthened prevention scenario

Route of transmission	New infections						Cases averted
	2005	2006	2007	2008	2009	2010	2007-2010
IDU	1,056	1,015	681	533	483	467	1,692
Male sex with male	3,707	3,693	3,012	1,832	1,201	1,106	7,350
Client from sex worker	1,861	1,652	1,207	699	305	248	2,549
Husband from wife	1,578	1,483	1,266	1,043	841	768	1,007
Sex worker	723	640	471	282	133	115	923
Wife from Husband	6,399	5,583	4,421	3,351	2,483	2,087	3,197
Extramarital	1,189	1,108	952	722	523	469	908
Total number of new infections	**16,513**	**15,174**	**12,010**	**8,462**	**5,970**	**5,261**	**17,626**

5.3 The benefits of minimizing new infections

The Royal Thai Government has made first line ART drugs available at low prices through local production. However, the cost of second line drugs remains high. The current number of PLHIV already implies that considerable resources are required to support ART for those needing first line and second line therapies. Any additional new infections will contribute significantly to these resource needs. With the Royal Thai Government's policy to provide ART to PLHIV, the country will pay a very high price if no additional action is taken to reduce new infections [Revenga et al. 2006].

This suggests that in order for access to treatment to be sustained, access to prevention must also be provided. The greater the reduction in new infections, the fewer people will need ART. This will mean fewer people on first line and second line therapies; producing substantial reductions in drug costs, which more than offset the costs of prevention. By strengthening prevention efforts, both the sustainability and quality of ART can be improved.

5.4 Some challenges in achieving the prevention goal and targets

Having developed and agreed on the prevention goal and the behavior change targets to be achieved among key populations, more specific prevention strategies are needed for each target population. This requires cooperative design of a prevention program for each population that can work effectively in the current socioeconomic and cultural context. It also requires that existing and future prevention activities be closely monitored and adapted as necessary to ensure their effectiveness in reducing behaviors that transmit HIV.

With the country's newly decentralized administration and budget system, the national HIV prevention strategies cannot be implemented as vertical programs as they were in the past. Instead, the decisions and the resources for the implementation of HIV prevention will be made or generated at the provincial and local levels, rather than at the central level. Therefore, the national HIV prevention strategies and policy need to be translated and integrated into provincial strategies, policies and planning before being implemented by the stakeholders at the provincial level.

The AEM projection can support such a strategic management process by illustrating the dynamics of the HIV epidemic and demonstrating the impacts of prevention alternatives to policy actors and stakeholders at the provincial level. Understanding the situation, seeing the trends for the future and learning the impact of their programs can help draw stakeholders together to establish joint goals, strategies and plans, and build ownership and partnerships.

5.5 Using the model to track progress in achieving the goal set

Assuming that collaboration among the local, regional and central government, civil society, experts and implementers is built; that adequate resources and human capacity can be mobilized; and that targeted and effective prevention programs are developed and implemented, it will be necessary to periodically verify whether and to what extent the desired changes in behavior have been achieved.

Appropriate monitoring of behavior changes of the target populations will provide evidence of how well the prevention program works. Data will need to be collected from various sources (including program implementers, health care providers, the communities and the target populations), synthesized and triangulated in order to estimate the overall behavior changes occurring at the population level. If the program doesn't work very well, it will be necessary to ascertain why, and make appropriate adaptations to the program accordingly.

Models, such as the AEM, provide an essential tool for estimating the impact of these behavior changes, as measuring the number of new infections over a period is both costly and difficult. By using information gathered on the level of behavior change in different target populations, the AEM can determine the associated number of new infections that have been averted. This makes it possible to monitor progress towards achieving the prevention goal of reducing new infections by half by 2010.

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APPENDIX A:

RESULTS OF BASELINE PROJECTIONS

Table 1: Summary table of overall epidemic

Year	New HIV in year	Living w/ HIV end year	Cumulative HIV end year	New deaths in year	Cumulative deaths end year
1985	41	41	41	0	0
1990	150,015	315,391	316,630	1,183	1,440
1995	55,452	719,772	808,245	34,787	92,320
2000	26,158	642,121	976,107	54,414	339,361
2005	16,513	562,243	1,073,518	18,843	513,268
2010	10,853	499,324	1,138,020	28,123	641,633
2015	8,184	416,099	1,183,268	23,432	769,516
2020	7,082	351,132	1,220,546	18,594	871,227
2025	6,529	302,462	1,254,171	15,231	953,164

Table 2: Summary table of number of adult living with HIV in year by gender in the baseline scenario

Year	Male	Female	Total	M/F ratio
1985	40	2	41	26.0
1990	270,956	44,435	315,391	6.1
1995	526,092	193,681	719,772	2.7
2000	414,813	227,308	642,121	1.8
2005	342,318	219,925	562,243	1.6
2010	298,278	201,045	499,324	1.5
2015	251,472	164,627	416,099	1.5
2020	218,469	132,663	351,132	1.6
2025	194,242	108,220	302,462	1.8

Table 3: Summary table of annual adult death by gender

Year	Male	Female	Total
1985	0	0	0
1990	1,108	74	1,183
1995	28,298	6,489	34,787
2000	38,533	15,882	54,414
2005	12,197	6,647	18,843
2010	17,691	10,433	28,123
2015	13,856	9,576	23,432
2020	10,962	7,632	18,594
2025	9,244	5,987	15,231

Table 4: Summary table of new adult infections by mode of transmission

Year	Injection Drug User	Male sex with male	Male from sex worker	Male from wife	Sex worker	Female from Husband	Extra-marital	Total
1985	23	4	6	0	1	0	0	35
1990	7,209	7,001	109,029	276	13,734	12,616	150	150,015
1995	5,260	4,657	15,082	2,133	3,880	23,995	445	55,452
2000	2,785	3,250	3,238	2,014	1,346	12,554	971	26,158
2005	1,054	3,707	1,863	1,578	723	6,399	1,189	16,513
2010	940	3,577	1,049	1,083	399	3,034	769	10,853
2015	884	3,480	614	688	243	1,787	488	8,184
2020	843	3,439	391	445	170	1,455	339	7,082
2025	813	3,409	276	308	131	1,336	256	6,529

Table 5: HIV and deaths for all adults

Year	New HIV in year	Cumulative HIV in year	Living with HIV end year	New deaths in year	Cumulative deaths end year
1985	41	41	41	0	0
1986	681	722	722	0	0
1987	11,506	12,228	12,227	1	1
1988	53,667	65,895	65,875	24	26
1989	100,720	166,615	166,404	232	258
1990	150,015	316,630	315,391	1,183	1,440
1991	150,064	466,695	461,935	3,901	5,341
1992	115,734	582,429	569,177	9,146	14,487
1993	97,055	679,483	650,128	16,974	31,461
1994	73,310	752,793	698,281	26,072	57,534
1995	55,452	808,245	719,772	34,787	92,320
1996	45,175	853,420	723,248	42,398	134,719
1997	37,861	891,282	713,126	48,512	183,231
1998	29,662	920,943	695,845	47,235	230,466
1999	29,006	949,949	670,478	54,481	284,947
2000	26,158	976,107	642,121	54,414	339,361
2001	23,268	999,375	614,710	50,264	389,625
2002	20,955	1,020,330	590,630	43,916	433,541
2003	19,002	1,039,332	572,474	37,963	471,504
2004	17,673	1,057,005	565,067	22,921	494,425
2005	16,513	1,073,518	562,243	18,843	513,268
2006	15,174	1,088,692	556,848	20,797	534,065
2007	13,936	1,102,628	546,578	24,830	558,895
2008	12,787	1,115,415	532,522	26,935	585,830
2009	11,753	1,127,168	516,632	27,680	613,510
2010	10,853	1,138,020	499,324	28,123	641,633
2011	10,097	1,148,117	481,770	27,557	669,191
2012	9,473	1,157,589	464,414	26,715	695,905
2013	8,959	1,166,549	447,640	25,606	721,511
2014	8,535	1,175,084	431,475	24,573	746,083
2015	8,184	1,183,268	416,099	23,432	769,516
2016	7,890	1,191,157	401,700	22,169	791,684
2017	7,640	1,198,797	387,877	21,350	813,035
2018	7,426	1,206,223	374,966	20,227	833,262
2019	7,241	1,213,464	362,737	19,371	852,633
2020	7,082	1,220,546	351,132	18,594	871,227
2021	6,944	1,227,490	340,256	17,730	888,957
2022	6,822	1,234,312	330,073	16,923	905,881
2023	6,714	1,241,026	320,371	16,343	922,224
2024	6,616	1,247,642	311,212	15,708	937,933
2025	6,529	1,254,171	302,462	15,231	953,164

Table 6: HIV and deaths for adult males

Year	New HIV in year	Cumulative HIV in year	Living with HIV end year	New deaths in year	Cumulative deaths end year
1985	40	40	40	0	0
1986	657	696	696	0	0
1987	11,114	11,810	11,809	1	1
1988	50,063	61,873	61,854	24	25
1989	86,730	148,603	148,401	221	247
1990	123,521	272,124	270,956	1,108	1,355
1991	116,428	388,551	384,160	3,561	4,916
1992	81,024	469,576	457,648	8,090	13,006
1993	62,517	532,093	506,298	14,577	27,583
1994	41,397	573,490	526,613	21,790	49,373
1995	27,179	600,669	526,092	28,298	77,671
1996	20,408	621,077	513,380	33,586	111,257
1997	16,203	637,280	492,460	37,433	148,690
1998	12,543	649,823	469,627	35,493	184,183
1999	12,289	662,112	442,071	39,802	223,986
2000	11,470	673,582	414,813	38,533	262,518
2001	10,399	683,981	390,332	34,487	297,005
2002	9,556	693,537	369,712	29,361	326,366
2003	8,822	702,359	354,105	24,921	351,287
2004	8,582	710,941	346,362	14,907	366,193
2005	8,479	719,420	342,318	12,197	378,390
2006	8,110	727,531	337,157	13,416	391,806
2007	7,772	735,302	329,364	15,959	407,765
2008	7,450	742,753	319,613	17,251	425,016
2009	7,145	749,897	309,155	17,609	442,625
2010	6,863	756,760	298,278	17,691	460,316
2011	6,608	763,367	287,722	17,077	477,393
2012	6,376	769,743	277,701	16,301	493,694
2013	6,166	775,909	268,353	15,418	509,112
2014	5,977	781,886	259,601	14,639	523,751
2015	5,810	787,696	251,472	13,856	537,607
2016	5,664	793,360	244,006	13,055	550,662
2017	5,532	798,892	236,932	12,539	563,200
2018	5,415	804,307	230,403	11,881	575,081
2019	5,309	809,616	224,265	11,391	586,472
2020	5,217	814,832	218,469	10,962	597,434
2021	5,136	819,968	213,062	10,495	607,929
2022	5,062	825,030	208,012	10,068	617,997
2023	4,995	830,025	203,193	9,778	627,775
2024	4,934	834,959	198,630	9,463	637,238
2025	4,877	839,836	194,242	9,244	646,483

Table 7: HIV and deaths for adult females

Year	New HIV in year	Cumulative HIV in year	Living with HIV end year	New deaths in year	Cumulative deaths end year
1985	2	2	2	0	0
1986	24	26	26	0	0
1987	392	418	418	0	0
1988	3,604	4,022	4,021	1	1
1989	13,990	18,012	18,003	10	11
1990	26,495	44,506	44,435	74	86
1991	33,637	78,143	77,775	339	425
1992	34,710	112,853	111,528	1,056	1,481
1993	34,537	147,390	143,830	2,397	3,878
1994	31,913	179,303	171,668	4,282	8,160
1995	28,273	207,576	193,681	6,489	14,649
1996	24,767	232,343	209,867	8,813	23,461
1997	21,658	254,001	220,666	11,079	34,541
1998	17,119	271,120	226,218	11,742	46,283
1999	16,717	287,837	228,407	14,679	60,961
2000	14,688	302,525	227,308	15,882	76,843
2001	12,869	315,394	224,378	15,777	92,620
2002	11,399	326,793	220,918	14,555	107,175
2003	10,180	336,973	218,368	13,042	120,217
2004	9,091	346,064	218,705	8,014	128,231
2005	8,034	354,098	219,925	6,647	134,878
2006	7,063	361,161	219,692	7,381	142,259
2007	6,164	367,326	217,215	8,871	151,130
2008	5,337	372,662	212,909	9,685	160,814
2009	4,608	377,271	207,477	10,071	170,885
2010	3,990	381,260	201,045	10,433	181,317
2011	3,489	384,749	194,048	10,480	191,798
2012	3,097	387,846	186,712	10,413	202,211
2013	2,793	390,640	179,287	10,187	212,399
2014	2,558	393,198	171,874	9,934	222,332
2015	2,373	395,571	164,627	9,576	231,909
2016	2,226	397,797	157,694	9,114	241,023
2017	2,107	399,905	150,945	8,812	249,834
2018	2,011	401,916	144,563	8,346	258,181
2019	1,932	403,848	138,472	7,980	266,160
2020	1,865	405,714	132,663	7,632	273,793
2021	1,808	407,522	127,195	7,235	281,028
2022	1,760	409,282	122,060	6,855	287,884
2023	1,719	411,001	117,179	6,565	294,449
2024	1,683	412,684	112,582	6,246	300,695
2025	1,651	414,335	108,220	5,987	306,681

Table 8: Number of new adult infections by mode of transmission

Year	Injection Drug User	Male sex with male	Male from sex worker	Male from wife	Sex worker	Female from Husband	Extramarital	Total
1985	23	4	6	0	1	0	0	35
1986	522	29	106	0	17	8	0	681
1987	9,338	188	1,587	1	256	136	1	11,506
1988	32,945	1,081	16,030	8	2,311	1,285	9	53,667
1989	13,055	3,886	69,741	47	8,778	5,162	51	100,720
1990	7,209	7,001	109,029	276	13,734	12,616	150	150,015
1991	6,831	8,584	100,277	722	13,219	20,166	264	150,064
1992	6,554	7,420	65,873	1,155	9,816	24,566	349	115,734
1993	6,186	6,808	47,924	1,568	7,955	26,209	405	97,055
1994	5,908	5,471	28,087	1,891	5,748	25,770	435	73,310
1995	5,260	4,657	15,082	2,133	3,880	23,995	445	55,452
1996	5,269	4,076	8,770	2,237	2,706	21,660	457	45,175
1997	4,598	3,665	5,612	2,240	1,984	19,148	614	37,861
1998	3,497	3,110	3,877	1,952	1,432	15,125	670	29,662
1999	3,298	3,268	3,496	2,075	1,388	14,615	866	29,006
2000	2,785	3,250	3,238	2,014	1,346	12,554	971	26,158
2001	2,309	3,197	2,732	1,948	1,173	10,845	1,063	23,268
2002	1,810	3,186	2,472	1,848	1,036	9,459	1,143	20,955
2003	1,369	3,186	2,256	1,749	923	8,309	1,212	19,002
2004	1,142	3,444	2,048	1,663	815	7,296	1,265	17,673
2005	1,054	3,707	1,863	1,578	723	6,399	1,189	16,513
2006	1,013	3,693	1,653	1,483	640	5,583	1,108	15,174
2007	988	3,672	1,475	1,382	570	4,828	1,022	13,936
2008	970	3,643	1,315	1,280	506	4,139	934	12,787
2009	954	3,609	1,174	1,180	449	3,538	849	11,753
2010	940	3,577	1,049	1,083	399	3,034	769	10,853
2011	927	3,552	939	991	357	2,633	697	10,097
2012	915	3,530	842	906	321	2,325	634	9,473
2013	904	3,510	756	827	290	2,094	579	8,959
2014	894	3,493	680	754	265	1,920	530	8,535
2015	884	3,480	614	688	243	1,787	488	8,184
2016	875	3,471	557	628	224	1,685	450	7,890
2017	866	3,462	507	574	207	1,606	417	7,640
2018	858	3,453	463	527	193	1,544	388	7,426
2019	850	3,445	424	484	181	1,495	362	7,241
2020	843	3,439	391	445	170	1,455	339	7,082
2021	837	3,435	362	411	160	1,421	319	6,944
2022	830	3,430	336	380	151	1,394	300	6,822
2023	824	3,424	314	353	144	1,371	284	6,714
2024	818	3,417	294	329	137	1,352	269	6,616
2025	813	3,409	276	308	131	1,336	256	6,529

Table 9: Number of people needing ART, on ART and not on ART, and number with serious illness needing care

Year	Living w HIV	Serious illness needing care	Needing ART			
			Total	Total eligible asymptomatic need ART end year	Total symptomatic need ART end year	Newly needing ART in year
1990	315,391	2,984	24,144	21,361	2,783	-
1991	461,935	7,326	44,863	38,118	6,744	-
1992	569,177	14,079	69,057	56,213	12,844	-
1993	650,128	22,215	93,350	73,241	20,109	-
1994	698,281	30,185	114,920	87,756	27,163	-
1995	719,772	37,212	132,237	98,872	33,365	-
1996	723,248	42,948	144,297	105,895	38,402	-
1997	713,126	46,943	150,362	108,494	41,867	-
1998	695,845	48,899	150,904	107,373	43,531	-
1999	670,478	49,125	147,575	103,925	43,649	-
2000	642,121	47,734	142,708	100,349	42,359	49,069
2001	614,710	45,089	140,892	97,663	43,229	48,005
2002	590,630	42,777	144,795	95,924	48,871	47,391
2003	572,474	45,503	154,380	95,044	59,336	47,144
2004	565,067	44,790	179,041	95,068	83,973	47,078
2005	562,243	37,178	207,544	95,779	111,765	46,830
2006	556,849	43,116	233,035	96,137	136,897	45,914
2007	546,579	46,423	252,387	95,045	157,343	43,866
2008	532,522	48,009	266,369	91,829	174,540	40,640
2009	516,632	48,506	275,821	86,975	188,846	36,884
2010	499,324	47,840	281,138	81,626	199,512	33,215
2011	481,770	46,456	283,612	76,488	207,125	29,817
2012	464,414	44,693	283,883	71,782	212,101	26,771
2013	447,640	42,722	282,612	67,607	215,005	24,108
2014	431,475	40,676	280,062	63,944	216,118	21,776
2015	416,099	38,639	276,629	60,707	215,920	19,724
2016	401,700	36,677	272,688	57,833	214,856	17,920
2017	387,877	34,760	268,013	55,270	212,743	16,331
2018	374,966	32,938	263,100	52,973	210,127	14,930
2019	362,737	31,209	257,850	50,907	206,943	13,695
2020	351,132	29,567	252,333	49,046	203,287	12,607
2021	340,257	28,021	246,766	47,360	199,406	11,646
2022	330,073	26,577	241,199	45,821	195,378	10,792
2023	320,371	25,232	235,502	44,405	191,097	10,032
2024	311,212	23,970	229,815	43,100	186,714	9,358
2025	302,462	22,807	224,057	41,899	182,158	8,762

Table 9 (cont.): Number of people needing ART, on ART and not on ART, and number with serious illness needing care

Year	On ART				No ART		
	Number entering ART in year	Total on ART end year	Started ART from early recruit (as eligible asympto-matic)	Started ART from late recruit (as sympto- matic)	Total	Eligible asymptomatic	Symptomatic
1990	-	-	-	-	24,144	21,361	2,783
1991	-	-	-	-	44,862	38,118	6,744
1992	-	-	-	-	69,057	56,213	12,844
1993	-	-	-	-	93,350	73,241	20,109
1994	-	-	-	-	114,919	87,756	27,163
1995	-	-	-	-	132,237	98,872	33,365
1996	-	-	-	-	144,297	105,895	38,402
1997	-	-	-	-	150,361	108,494	41,867
1998	-	-	-	-	150,904	107,373	43,531
1999	-	-	-	-	147,574	103,925	43,649
2000	-	-	-	-	142,708	100,349	42,359
2001	3,844	3,590	-	3,590	137,302	97,663	39,639
2002	9,124	11,623	-	11,623	133,172	95,924	37,248
2003	12,888	21,816	165	21,651	132,564	94,879	37,685
2004	35,855	51,290	1,751	49,539	127,751	93,317	34,434
2005	53,726	94,393	4,016	90,377	113,151	91,763	21,388
2006	38,983	119,324	6,429	112,895	113,710	89,708	24,002
2007	39,317	142,067	8,879	133,188	110,321	86,166	24,155
2008	38,650	162,175	11,274	150,901	104,194	80,555	23,639
2009	37,717	179,797	13,504	166,293	96,024	73,471	22,553
2010	35,527	194,127	15,514	178,613	87,011	66,112	20,899
2011	33,078	205,351	17,286	188,065	78,262	59,202	19,060
2012	30,413	213,656	18,823	194,833	70,227	52,959	17,268
2013	27,956	219,567	20,145	199,422	63,045	47,462	15,583
2014	25,500	223,330	21,274	202,056	56,732	42,670	14,062
2015	23,376	225,444	22,228	203,216	51,183	38,479	12,704
2016	21,611	226,373	23,026	203,347	46,316	34,807	11,509
2017	19,628	225,986	23,683	202,303	42,027	31,587	10,440
2018	18,167	224,848	24,214	200,634	38,252	28,759	9,493
2019	16,633	222,915	24,631	198,284	34,935	26,276	8,659
2020	15,206	220,315	24,949	195,366	32,018	24,097	7,921
2021	14,053	217,319	25,178	192,141	29,447	22,182	7,265
2022	13,010	214,022	25,329	188,693	27,177	20,492	6,685
2023	11,872	210,320	25,410	184,910	25,182	18,995	6,187
2024	10,935	206,400	25,432	180,968	23,414	17,668	5,746
2025	9,941	202,186	25,403	176,783	21,871	16,496	5,375

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