A Model-Based Governance and Planning Tool for HIV/AIDS Services in Vietnam

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ABSTRACT

Planning services for HIV/AIDS is complicated by the nature of the disease and the manner in which it spreads. Reducing the HIV/AIDS burden in a country requires sophisticated tools and agreement among stakeholders about effective strategies. This paper describes a tool for governance and planning of HIV/AIDS services for use at the provincial level in Vietnam. The tool includes a System Dynamics (SD) model and an interface that enables its use by planners and multiple stakeholders. Hands on use of the model has been shown to engage stakeholders and promote conversations necessary to developing strategies that meet their multiple needs. The tool can be used to allocate constrained budgets more effectively or to develop more idealized solutions and calculate their cost. As such, it can meet the needs of countries like Vietnam that are moving toward middle income status and must make the transition toward greater responsibility for funding, management, and governance of HIV/AIDS services.

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Introduction

HIV/AIDS has been the subject of a number of System Dynamics modeling efforts. Many of these were conducted in the 1990's and early 2000's though some were more recent. They include efforts focused on the US (Lounsbury and Levine, Martin and MacDonald, Homer and St.Clair, Edwards et al, Crawford and Wenstop), the UK (Roberts and Dangerfield, Brailsford et al, Dangerfield and Fang, Gibb et al), Canada (Meagher et al), East Africa (Bernstein et al), Malawi (Qu et al, Headley et al, Greenwood et al), Southern Africa (Lauwers et al), Botswana (Viladent and van Ackere), Zimbabwe (Pedericini, India (Edgar et al), and multiple countries (Grassley et al) or on generic issues related to HIV/AIDS (Lebcir et al, Villapuram, Kim and Thompson). Many of these efforts yielded valuable insights about HIV/AIDS prevention and treatment programs and policies. Some dealt with specific modes of transmission (sexual, intravenous drug use) while others examined the impact of treatment and diagnostic modalities such as highly active anti-retroviral therapy (HAART) and ante-natal testing. This particular tool advances the state-of-the-art by putting a model into the hands of planners and stakeholders. The tool includes an interface that makes the model directly accessible by these users.

This paper describes a model-based tool and system to support provincial-level governance and planning of HIV/AIDS services in Vietnam. It is being developed in the province of Hai Phong as a prototype for potential application in other provinces. The effort to develop this tool is part of the US Agency for International Development funded Leadership, Management and Governance (LMG) Program and carried out by Management Sciences for Health which is supporting the transition of PEPFAR funded HIV/AIDS services in Vietnam. The tool is based on a System Dynamics model and also includes an interface that supports engagement with the model by non-modelers and enables a wide range of stakeholders to participate in the governance of HIV/AIDS services. In addition to public health officials and health care providers, these stakeholders include those affected by the disease and members of vulnerable populations such as intravenous drug users and sex workers within which HIV/AIDS has spread. Hands on use of the model by stakeholders promotes productive conversations about important issues and development of a shared understanding crucial to finding strategies that can be implemented with broad support.

The challenge facing Vietnam and other countries making the transition from low income to middle income countries is taking greater ownership of their HIV/AIDS programs that have been largely donor-supported until now. Planning HIV/AIDS programs must be done in a dynamic environment in which the programs will affect future prevalence of HIV/AIDS. Planning services is especially complicated because HIV/AIDS has the characteristics of both an infectious and chronic illness. People with the disease can remain contagious for long periods of time unless they are treated effectively with anti-retroviral drugs. Simple linear models cannot capture this dynamic interaction between programs and numbers of people with the disease. A governance and planning system based on an SD model has the advantage of embodying this interaction and allowing planners to see how different configurations of services might play out in terms of HIV/AIDS prevalence and future requirements for services.

Planners of these services at the provincial level in Vietnam are typically well-trained in traditional public health methodologies, but are not modelers. The planning tool based on the model therefore had to have an interface that makes it easier for non-modelers to use. The tool also needed to support two modes of planning. A normative mode allows planners and other stakeholders involved in HIV/AIDS governance to explore mixes of services directed at target populations that have the greatest effect in reducing new cases of HIV/AIDS and its prevalence and consequences over time. This allows them to find the best possible mix of services, calculate their cost, and then think about where the necessary funding might come from. The other budget-based mode comes from the opposite direction and start with assumptions about funding levels. They can then reallocate funds among services to achieve the greatest impact within given levels of funding. This latter mode is important in countries where a transition from donors to local and national funding is taking place and there may not be the same level of support available in the future. After first describing the structure of the prototype model being developed in the Vietnamese province of Hai Phong, this paper presents scenarios that illustrate how the model is used in these two different planning modes.

The planning tool has been used in two sessions so far in February and May of 2014 in Hai Phong. The first session introduced an initial version of the tool and also provided valuable feedback that helped to improve its design. The second session trained people in the use of the “improved” version that has been translated into Vietnamese. Both sessions included members of the various stakeholder groups mentioned above, working in teams that engaged in intense conversations while working with the model. The next step is for the tool to be used by planners in Hai Phong as part of their annual cycle of planning and reporting on plans to the national HIV/AIDS agency.

The Model

The HIV/AIDS model contains the factors that affect the rate of new HIV cases, prevalence of HIV and AIDS, costs of dealing with the disease, and deaths and other consequences in a province in Vietnam, specifically Hai Phong. The model simulates scenarios from 2012 to 2020 that are possible when there are changes in budgets, treatment and preventive services, staffing, and other variables that affect the spread and consequences of HIV. The purpose of the model is not to forecast specific numbers of people with HIV, but to help stakeholders understand the effects of different variables and the benefits of pursuing different strategies...

1. **Overview**

Figure 1 shows an overview of the model at a very simple level. Uninfected people may be part of groups that make them particularly vulnerable such as injecting drug users (IDUs), sex workers (SWs), or men who have sex with men (MSMs). Or they may be part of the general adult male and female populations who develop HIV through unprotected intimate contact.

The model represents each of these populations separately along with the factors that cause people to move between risky behavior that makes them more vulnerable to HIV and safer forms of behavior such as regularly using condoms in sexual encounters.

People infected with HIV and AIDS move through several stages, becoming infected, learning that they have HIV as a result of screening, entering Pre ART treatment, and entering ART treatment when qualified to do so. Some are less fortunate, do not get treatment, and suffer the effects of AIDS, though they may later enter ART treatment. Except for those receiving consistent ART treatment, people already infected with HIV can infect others. Contacts with those already infected drive the rate of New Cases

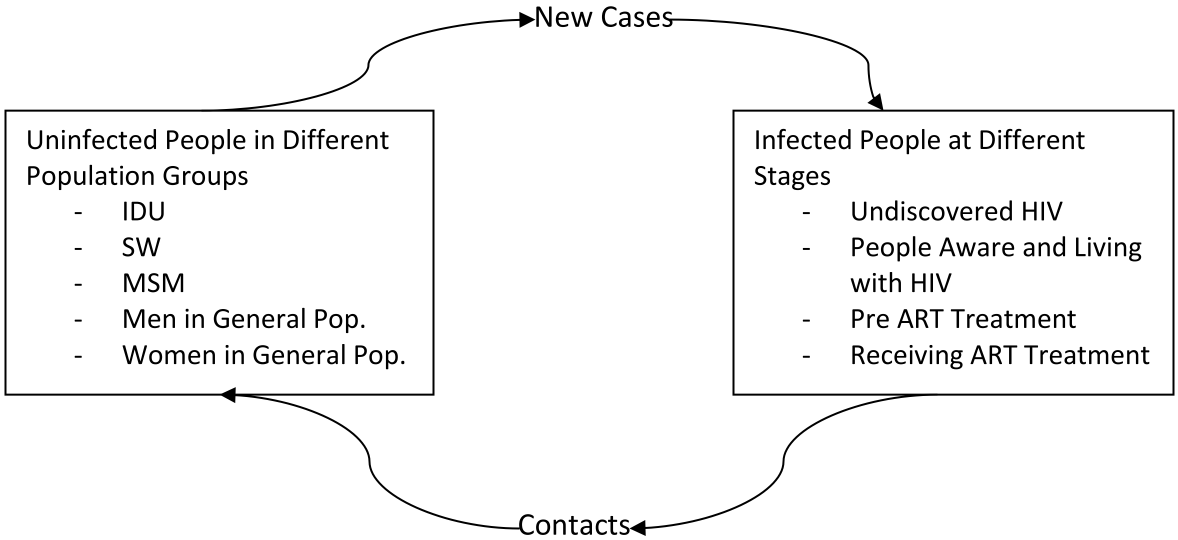

Figure 1: Overview of HIV/AIDS Model

2. Movement of People with HIV/AIDS

Figure 2 shows how the model represents how people develop and live with HIV and AIDS. The boxes represent groups of people at different stages of the disease and the arrows show movement from one stage to the next. The diagram shows that the process starts in the upper left hand corner by uninfected people becoming infected with the HIV virus. The way in which they become infected depends on who they are. Members of groups such as injecting drug users (IDU), female sex workers (FSW), and men having sex with men (MSM) develop HIV from activities such as needle-sharing and sexual contact. Others, men and women in the general population, get the virus from intimate contact with members of these groups as well as each other. Members of these groups are tracked separately in the model once they have become infected because they are also the source of infection for additional people in their groups. The model also tracks children who acquire HIV from their mothers in the absence of PMTCT treatment.

People initially don't know they are infected (group called "Infected, Undiscovered"). Screening done as part of voluntary counseling and testing (VCT) may alert them to the fact they have HIV and they move into the group marked "People Aware, Living with HIV". Once these people are aware of their HIV status, they may choose to enter Pre ART Treatment. When their CD4 counts fall below a certain level, they become eligible for ART (Anti-Retroviral) Treatment and can start their treatment if there is room in treatment programs. People who have HIV and do not get treatment can eventually develop AIDS which can lead to death unless they begin to get ART Treatment. People also flow backward along these arrows. People who are receiving ART Treatment, for example, may feel they no longer need treatment or may not like the side effects and drop out of treatment.

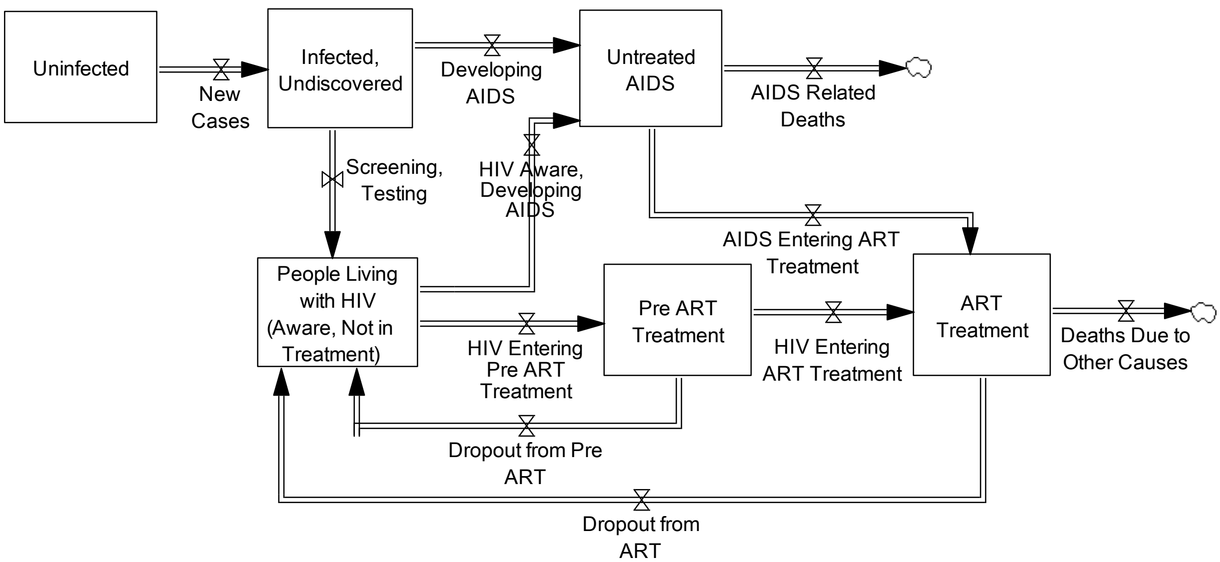

Figure 2: Flows of People in Model Once They Have Been Infected with HIV

To give the reader a sense of the scale of the problem in Hai Phong, the following are numbers of people estimated to be in each stage at the model's starting point in 2012:

Infected, Undiscovered	4,140
People Aware, Living with HIV	1,160
Receiving Pre ART Treatment	540
Receiving ART Treatment	3,915
With AIDS, Not in Treatment	1,280
Total	11,035

The following are estimated New Cases, people moving from Uninfected to Infected, Undiscovered), by population group in 2012:

Intravenous Drug Users (IDU)	153
Sex Workers (SW)	16

Men Having Sex with Men (MSM)	52
Males in General Population	59
Females in General Population	144
Children	8
Total	432

These numbers and those above were derived from an excellent study done by the FHI/360 organization (FHI/360) that brought together many pieces of data we needed for the model as well as projections of how rates of new cases would evolve in the next few years. Additional data were provided by the health department in Hai Phong. Rates of movement from one stage of illness to another were calibrated by using the model to simulate the trajectory of HIV/AIDS in Hai Phong and adjusting rates of flow so that results of a baseline simulation matched observed and projected new case incidence and overall prevalence of HIV/AIDS.

The following movements are taking place each year in 2012 at the beginning of each simulation:

Screening, Testing, and Counseling Approximately 26,000 people are screened each year, about 2% of the province's adult population, and 278 cases, a little more than one percent, are identified in people who did not previously know they had HIV. This rate of new positive findings can increase if more people are screened or if the number of peer educators increases and they encourage more people in vulnerable groups to be tested, thereby increasing the likelihood by up to 20% that those tested will have a positive finding.

Pre ART Treatment: 558 people enter Pre ART Treatment during the year, 48% of those who know they have HIV and are not yet in treatment. This number and others that affect the flow of people from one of those "boxes" in Figure 2 to another were developed by running simulations with the model and adjusting them to provide a fairly stable picture over time. More limited or expanded capacity of Pre ART programs or budgets for those programs can shut off the flow entirely or increase the number flowing in by as much as 67%. 10% of those in Pre ART are assumed to drop out each year without going on to ART.

ART Treatment: 435 or 80% of those in Pre ART enter ART Treatment from the Pre ART stage each year. An additional 128 (10%) of those with AIDS also enter ART treatment. 10% of those in ART treatment will drop out during the year for a variety of reasons, about 390 people. As a result, the number of people receiving ART treatment will grow by 193 (435+128-390). Reducing ART capacity to zero will shut off all new admissions and cause the number of people receiving ART treatment to drop to 1,672 by 2020, a reduction of 70% from the number that would have been there without any change in ART capacity. Doubling ART capacity would make it easier for people to join ART treatment programs (e.g., more locations, shorter waiting times), but only result in a 15% increase in ART program enrollment by 2020 because that is primarily dependent on the number of new people coming through Pre ART treatment.

AIDS and Deaths: 5% of those who don't get treatment will develop AIDS (252 people) and 129 will die of AIDS-related illnesses. The estimate of deaths is based on the assumption that people with AIDS will live 10 years before succumbing to AIDS-related illnesses.

As indicated above, many of the numbers used in the model were derived from an excellent document prepared by FHI360 entitled "A Snapshot of HIV in Haiphong" and dated April 11, 2013. The baseline simulation, a projection of what will happen if the HIV situation in Haiphong remains reasonably stable, projects a similar trend in new cases to the FHI360 work, declining from 432 in 2012 to 388 in 2015 and further to 363 in 2020. As a result of this stable and slowly declining rate of new cases, the number of people with HIV and AIDS is projected by our model to increase from 11,033 in 2012 to 11,778 in 2015 and 12,867 in 2020. Much of the increase in the total population with HIV and AIDS is reflected by increased numbers of people in Pre Art and ART treatment. People receiving ART treatment go from 3,914 in 2012 to 4,913 in 2020.

3. Drivers of New Cases

The model represents behavioral factors and programs affecting the fractions of people in each population group who engage in risky behavior, making them vulnerable to developing HIV. The programs represented in the model include needle and condom distribution, peer education, provision of methadone maintenance, and IEC/BCC (Information, Education and Communication / Behavior Change Communication). ART treatment also affects the number of new cases (treatment as prevention). Screening, Counseling, and Testing also affects new cases through its effect on the number of people who know they have HIV and change their behavior to some extent and or who enter ART treatment. Increases or decreases in spending in each of these areas cause shifts in the fractions engaging in risky behavior and, in turn, the number of new cases.

Table 1 shows the effects of each of these on the number of new cases for specific population groups and the population as a whole. Numbers in the table are percentage changes in new cases in 2020 compared to the 338 new cases that year in the baseline simulation. To show the maximum effects of each program, simulations were done with programs set to zero and doubled in size from their 2012 values. Given the structure of the model, setting the capacity of ART treatment and Methadone programs to zero or doubling them results in significant changes in their patient populations, but does not reduce them to zero or cause them to double in size. Setting Methadone or ART capacity to zero stops new admissions and the patient population dwindles over time as patients drop out. Doubling capacity allows for an increase, but doesn't produce a doubling in number of patients. The low methadone simulation resulted in 35% fewer patients in 2020 and the high one produced a 25% increase. The low ART simulation had 70% fewer patients in those programs in 2020 while the high one had 15% more.

Program	Change	Specific Group Affected	% Increase or Decrease in New Cases from Baseline at 2020 for Specific Groups	Overall % Increase or Decrease in New Cases at 2020 from Baseline
Information, Education and Communication / Behavior Change Communication (IEC/BCC)	Zero	Sex Workers	20	
		Intravenous Drug Users	23	
		Men Having Sex with Men	24	25
		Men in the General Pop.	36	
		Women in the General Pop.	28	
	Double	Sex Workers	-15	
		Intravenous Drug Users	-17	
		Men Having Sex with Men	-16	-18
		Men in the General Pop.	-25	
		Women in the General Pop.	-19	
Needle Distribution	Zero	Intravenous Drug Users	22	7
	Double	Intravenous Drug Users	-17	-5
Condom Distribution	Zero	Sex Workers	20	
		Men Having Sex with Men	24	12
		Men in the General Pop.	36	
	Double	Sex Workers	-15	
		Men Having Sex with Men	-16	-8
		Men in the General Pop.	-25	
Peer Educators Focused on:				
Sex Workers	Zero	Sex Workers	192	28
	Double	Sex Workers	-46	-7
Intravenous Drug Users	Zero	Intravenous Drug Users	38	14
	Double	Intravenous Drug Users	-21	8
Men Having Sex with Men	Zero	Men Having Sex with Men	60	16
	Double	Men Having Sex with Men	-31	-8
All Peer Educators	Zero			59
	Double			-23
Methadone	Low	Intravenous Drug Users	76	21
	High	Intravenous Drug Users	-45	-13
Screening	Zero			9
	Double			-10
ART	Low			32
	High			-8

Table 1: Effects of Programs on Rates of New Cases

Effects of programs on specific populations, where relevant, are shown in the second column and effects on the population as a whole are shown in the third. As might be expected, setting programs to zero produced an increase in new cases while doubling their size decreased new cases compared to the baseline. The differences among specific populations in the effects of programs reflect how the populations relate to each other and to infected individuals. For example, changes that affect sex workers and men in the general population (including clients of sex workers) tend to show larger effects on new cases because of the multiplicative nature of contacts between them. Losing ART capacity would lead to a loss in preventive capability and significantly more new cases because there would be more people who are infected and not in treatment.

The following paragraphs describe how new case rates are calculated for each of the vulnerable groups.

a. *Intravenous Drug Users (IDUs)*

This population is a bit more complicated than the others because it includes a number of the IDUs who are receiving Methadone Maintenance Therapy (MMT) and are not likely to be using any needles. They represent a third group in addition to those engaging in risky (sharing needles) and safer behavior. Figure 3 shows how this population is represented in the model. People move between being sharers of used needles and non-sharers at a rate that depends on whether budgets for these preventive activities are above or below their level in 2012 and whether there are more or fewer peer educators working with IDUs than in 2012. Effects of the various programs on new cases among IDUs are those shown in Table 1.

The model assumes a ratio between the number of peer educators and the rate at which those engaging in the risky behavior, sharing needles, will move to the box labeled IDUs Not Sharing Needles. This ratio was developed by running simulations with the model and selecting a number that produced a trend in new cases among IDUs similar to the one in the FHI360 projections. In the case of IDUs the ratio suggests that each peer educator can help about 28 IDUs per year stop sharing needles or help keep other IDUs from reverting to sharing.

Changes in the budgets for IEC/BCC and needle distribution also affect the movement between people who are needle sharers and those who are not based on a relationship that looks like the graph in Figure 4. The bottom axis goes from zero to two and represents the ratio of spending on those preventive activities relative to a base year, 2012. The left hand axis goes from 0.8 to 1.2 and is a multiplier that increases or decreases the rate at which people move from the group that shares needles to those that don't. Small changes in the ratio of spending around 1 have little effect because the graph is fairly flat. Larger changes away from one have a greater effect as the graph becomes steeper and that, at the extremes of zero and two, produce the changes in new cases shown in Table 1.

As shown by the double-headed arrow, people can also move backwards and revert to needle-sharing. The model assumes that 10% of non-sharers will slip backwards each year and become sharers again. This requires constant pressure from preventive programs to maintain the status quo and keep the number of people sharing needles from increasing. People moving into Methadone programs also have a preventive effect since there are fewer people who are likely to share needles as a result.

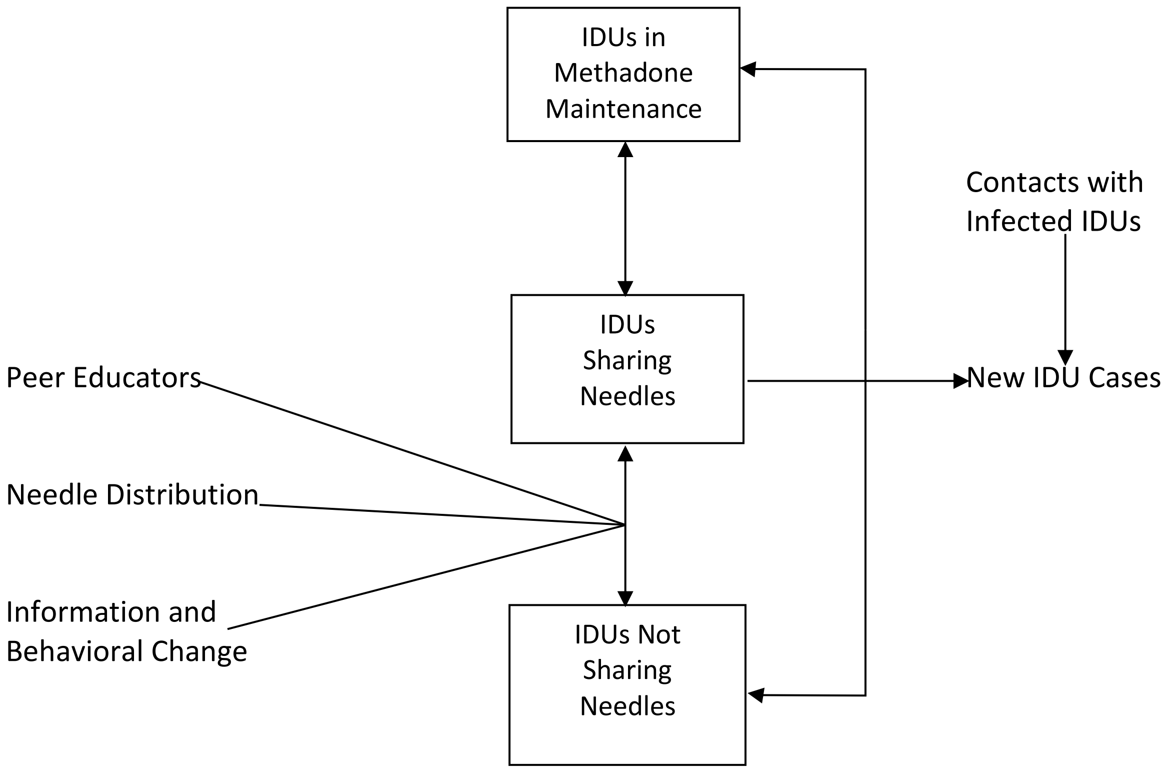

Figure 3: Drivers of Intravenous Drug User New Cases

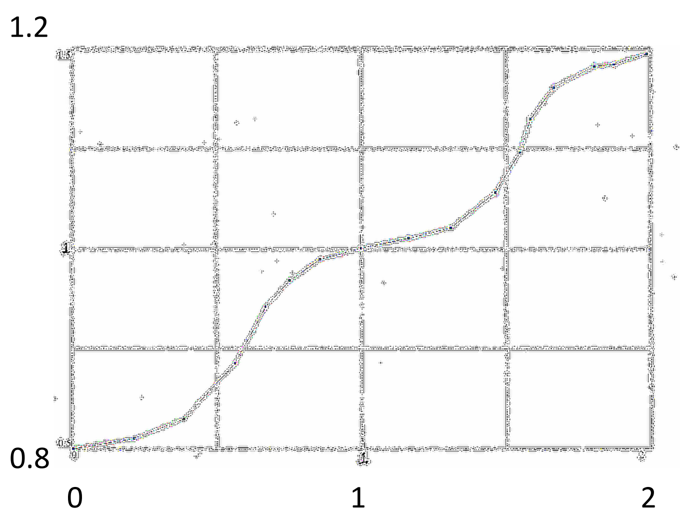

Figure 4: Relationship Between Ratio of Spending (or Other Resource) to Base Year Value and Multiplier Affecting Rate of Movement Away from Risky Behavior Such as Needle Sharing

There are initially 26 peer educators working with Haiphong's IDUs in 2012. 3.7 B VND are spent on needle distribution and 7.7 B VND are spent on IEC/BCC programs covering all of the vulnerable populations as well as the general public. (1 USD equals approximately 21,000 VND.) There are a total of 10,330 IDUs in Haiphong of which 5,366 are uninfected. 3,046 are in Methadone Maintenance programs. Changes in the capacity of Methadone programs due to budgets or other reasons will affect the number of people in those programs. Another 2,148 are using drugs, but are not sharing needles. Only 172 or about 3% are sharing needles, according to Integrated Biological and Behavioral Surveillance (IBBS) data (2009). New cases of HIV among IDUs come about as a result of contacts between these IDUs who share needles and the estimated 3,200 IDUs who are infected and not receiving the ART treatment that would keep them from infecting others. The model assumes that those who are not in treatment, but who know they are HIV positive will be somewhat more careful not to engage in needle sharing. They will therefore be only 70% as likely to infect a new IDU as those who are unaware of their positive HIV status. These contacts result in 153 new cases among IDUs per year.

b. Sex Workers (SW)

Figure 5 shows the way in which sex workers are represented. They move between those that use condoms for protection and those that do not. As with IDUs, the rate at which they move back and forth is affected by condom distribution, the presence of peer educators, and spending of IEC/BCC funds relative to what they were in the base year, 2012. The impact of changes from their base year values on new cases among SWs are shown in Table 1. The ratio calculated for peer educators focused on sex workers is that each peer educator can help about 18 SWs move to less risky behavior or keep from re-engaging in that behavior. Again, this ratio was developed by working backwards from the projected trend in new cases among SWs from the FHI 360 document.

3.2 B VND was spent on condom distribution, 7.7 B VND was spent on IEC/BCC programs for all vulnerable populations as well as the general public, and there were 13 peer educators working with sex workers. As with IDUs, changes from the base year funding or number of peer educators produce a response that follows the graph in Figure 4. Small changes in the ratios to 2012 values produce very little change in the rate at which SWs who are not using condoms adopt condom use. Larger changes as funding and peer educators increase or decrease result in bigger changes, but are limited at 20% higher or lower rates of change.

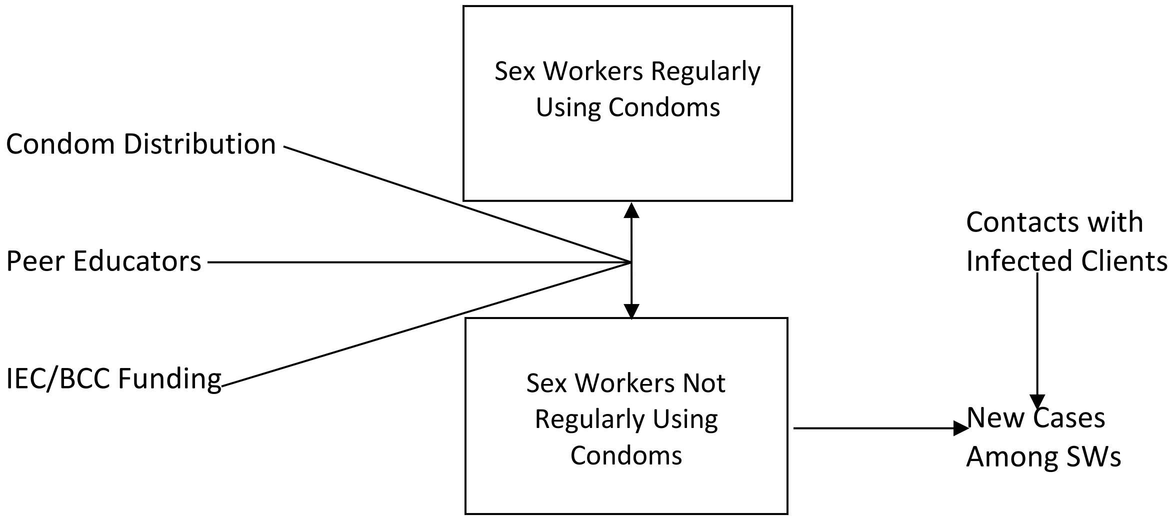

Figure 5: Drivers of New Cases in Sex Workers

In 2012, there are estimated to be 4,800 sex workers in Haiphong. 770 are estimated to be already infected with HIV. Of the remainder, about 20% or 806 are not using condoms with regular clients according to the IBBS and 3,224 are using condoms regularly. Contacts with infected clients by those SWs who don't use condoms will produce 16 new cases in sex workers per year. Men who are clients of sex workers are assumed to be 4 times more likely to be infected with HIV than men in the general population. Again, men who are aware of their positive HIV status and not in ART treatment are assumed to be only 70% as likely to engage in risky behavior (not use condoms) as those unaware of their status. Sex workers have an estimated average of 600 contacts with clients per year. Given pressures from clients not to use condoms, 10% of sex workers who use condoms are expected to drop regular condom use each year.

c. Men Having Sex with Men (MSM)

Figure 6 shows the how new cases in men having sex with men (MSM) are driven in the model.

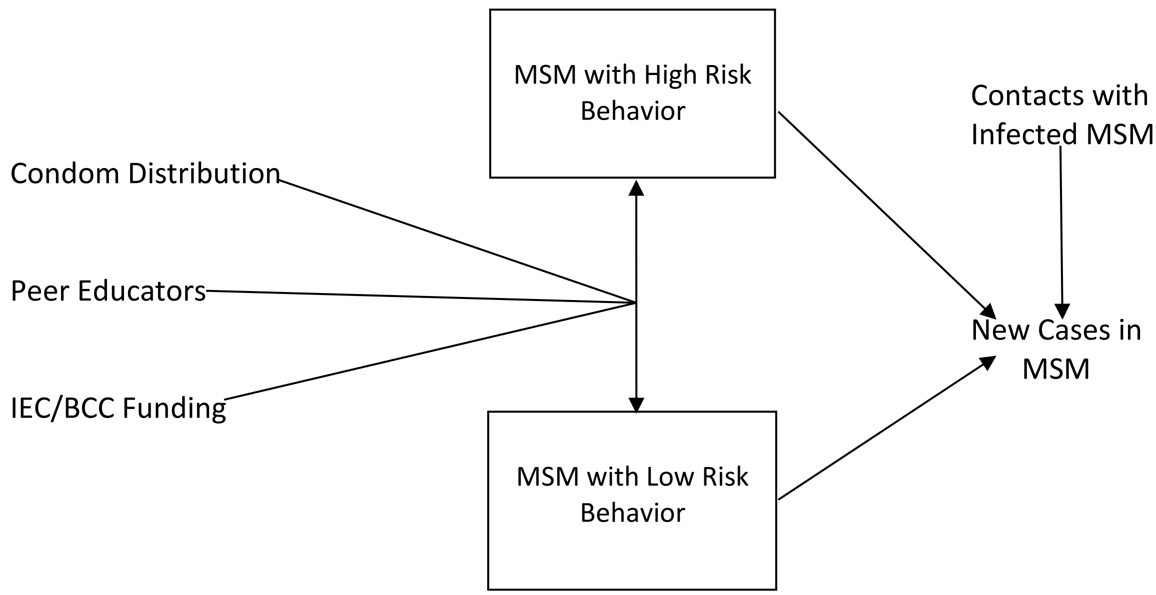

Figure 6: Drivers of New Cases in Men Having Sex with Men (MSM)

Effects of peer educators, condom distribution, and IEC/BCC funding on new cases among MSMs are shown in Table 1. The ratio of peer educators to new cases calculated from the new case projections suggest that each peer educator can help 33 MSMs per year change to less risky behavior or maintain low risk status. There were 12 peer educators allocated to the MSM population in 2012.

There are an estimated 5,200 MSM in Haiphong about 880 of whom are already infected. The FHI360 data differentiated between the rate of new cases in Low Risk vs. High Risk men having sex with men. There were 44 new cases among the ones with high risk behavior and 12 with low risk behavior in 2012. Additional data from a publication entitled HIV/AIDS Epidemiology of MSM in Vietnam, dated August, 2012 enabled us to estimate the fraction of MSM who engage in high-risk behavior, 16% (PEPFAR). These men are responsible for a large fraction of the new cases expected while the larger group of men with low risk behavior contributes a smaller fraction of cases. New cases come from contacts between these men and the 570 who are already infected and not receiving ART treatment, though those who are aware of their positive HIV status are again only 70% as likely to engage in high risk behavior and transmit HIV.

d. Men in the General Population

Men in the general population contract HIV from two sources: as clients of sex workers and through casual sex with both men and women. Separation of new cases among men from these two sources in the FHI360 data and projections allowed us to calibrate the model. There were 45 new cases in 2012 among men who were clients of sex workers. Numbers of new cases for this group are based on the number of sex workers infected and not under ART treatment (about 500), the fraction of SWs not using condoms (20%), and average number of contacts per year per sex worker (600). The fraction of SWs not using condoms came from 2009 IBBS data. The rate of new cases among men due to casual sex is calibrated to the rate of new cases among men other than clients of sex workers from the FHI360 data and projections and an assumption that 25% don't use condoms in casual sex. That fraction can change, up or down by the percentage shown in Table 1, as a result of changes in IEC/BCC funding from its 2012 value of 7.7 B VND.

e. Women in the General Population

Women in the general population acquire HIV from partners who are in vulnerable groups (IDU and MSM) or are clients of sex workers. Data on exposure of women to risks from these groups of men come from a document called "Measuring Intimate Partner Transmission of HIV in Vietnam: A Data Triangulation Exercise" by UNAIDS (UNAIDS). Fractions of women acquiring HIV from each group of men per year were then calibrated to the rate of new cases for women from the FHI360 data and projections. The fractions also reflect data on condom use by the various groups of men from the different population groups in the UNAIDS study. In 2012, there were 144 new cases among women in the general population. The fraction of women at risk of acquiring HIV is also affected by changes in funding for IEC/BCC programs, as shown in Table 1.

f. Children

The rate of new cases developing in children is based on the number of new cases expected as a fraction of women who are infected and not receiving ART treatment. In 2012, there were 8 new cases. Rates of new cases are affected by spending on PMTCT services relative to a base amount of 2.2 B VND in 2012.

The Interface

The interface for the provincial HIV/AIDS model has a series of input screens for specifying simulations and output screens for viewing results. The input screens are divided into two groups that support each of the planning modalities, one that starts with a budget and allocates it to various services and the other that starts with desired resources and calculates costs of services. An initial screen enables users to choose the planning modality. Figure 7 provides an example of an input screen that allocates budget among preventive and treatment services. Figure 8 shows an input screen used to allocate resources based on targets, independent of budget. The interface also has numerous screens for reviewing results, starting with a "dashboard" that provides an overview and screens that enable the model's users to drill down and get a more detailed understanding of what is going on in each simulation. The outputs include a number of reports and spreadsheets that can serve as inputs to a mandated annual planning process. Figure 9 shows the results "dashboard" with an overview of simulation results for key measures compared to a baseline simulation and indicates, with buttons at the bottom, areas in which more detailed results are available.

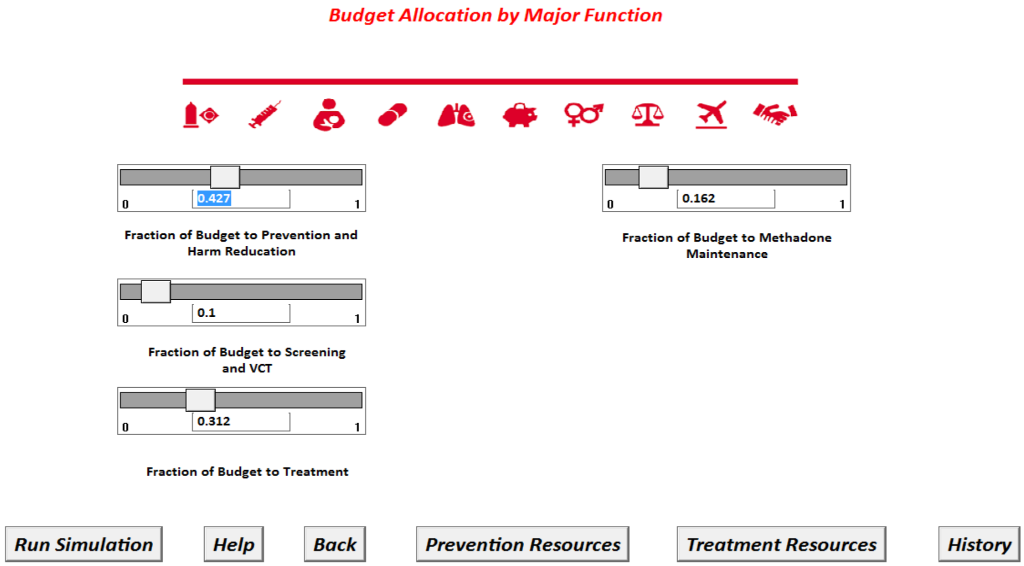

Figure 7: Example of Scenario Input Screen--Allocating Budget to Major Functions

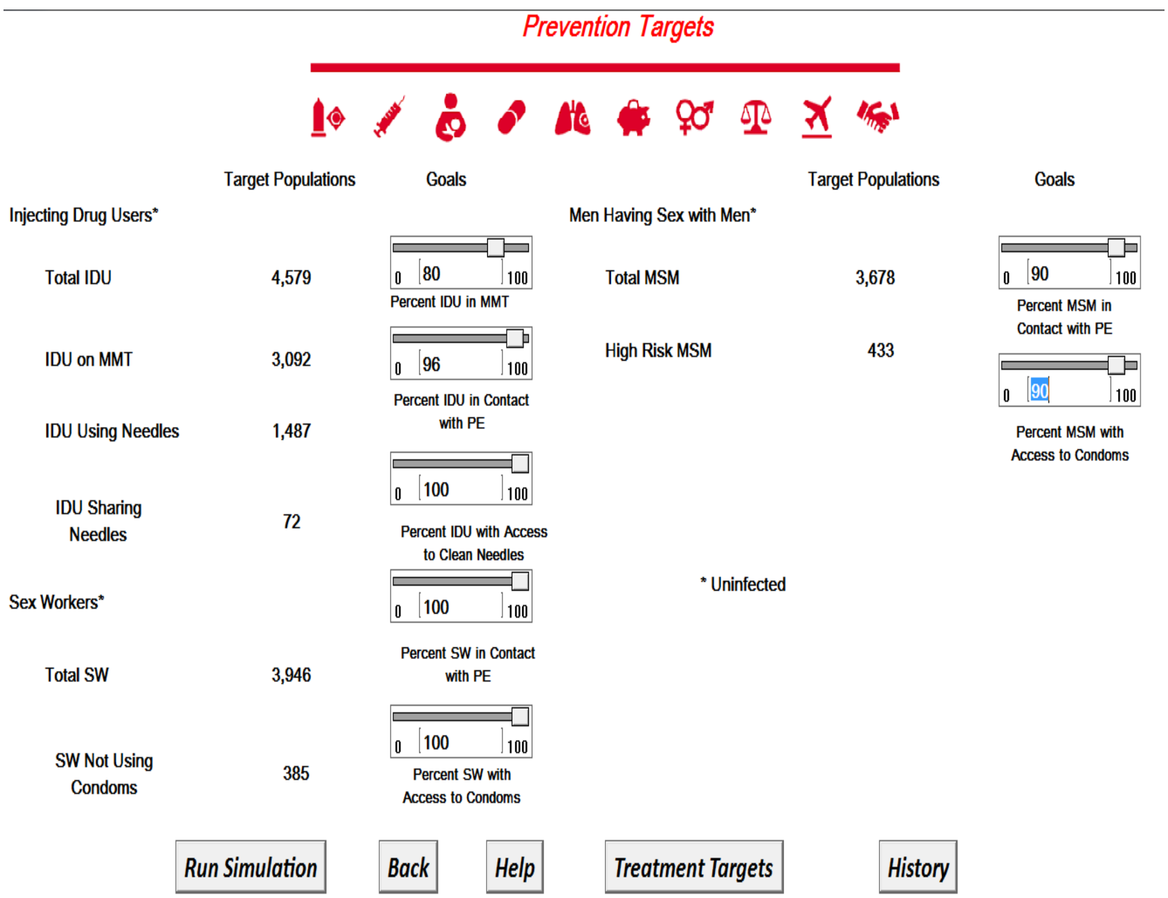

Figure 8: Another Example of Scenario Input Screen—Setting Resources Based on Targets

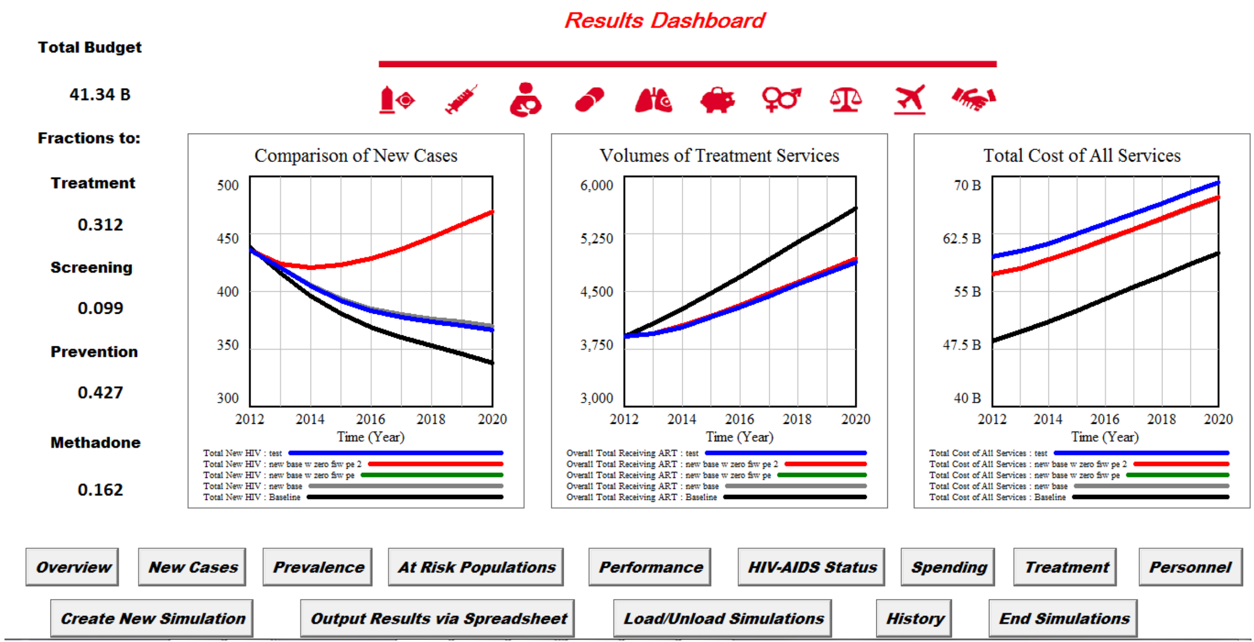

Figure 9: Results Dashboard. First Row of Buttons at the Bottom Indicate Areas in Which Detailed Graphs and Reports Are Available

Using the Model: Two Scenarios

1. Planning Based on Budget

In the first scenario, we'll examine the effect of a transition in funding from international donors that reduces available budget and then experiment with a strategy to make better use of the reduced budget. In a baseline simulation, HIV/AIDS appears to be a fairly stable and slowly improving problem in Hai Phong. Donors at the various international agencies that have been supporting many of the HIV/AIDS programs anticipate transitioning down to lower levels of funding in the future and to a more focused technical assistance role. In this scenario, we'll first examine the effect of a reduction of about 40% in funds available from donors. These funds support various prevention and treatment programs. For the purposes of this scenario, assume that the reductions in donor funding are applied equally across the board to all programs. Figure 10 shows the results with a reduced budget alone.

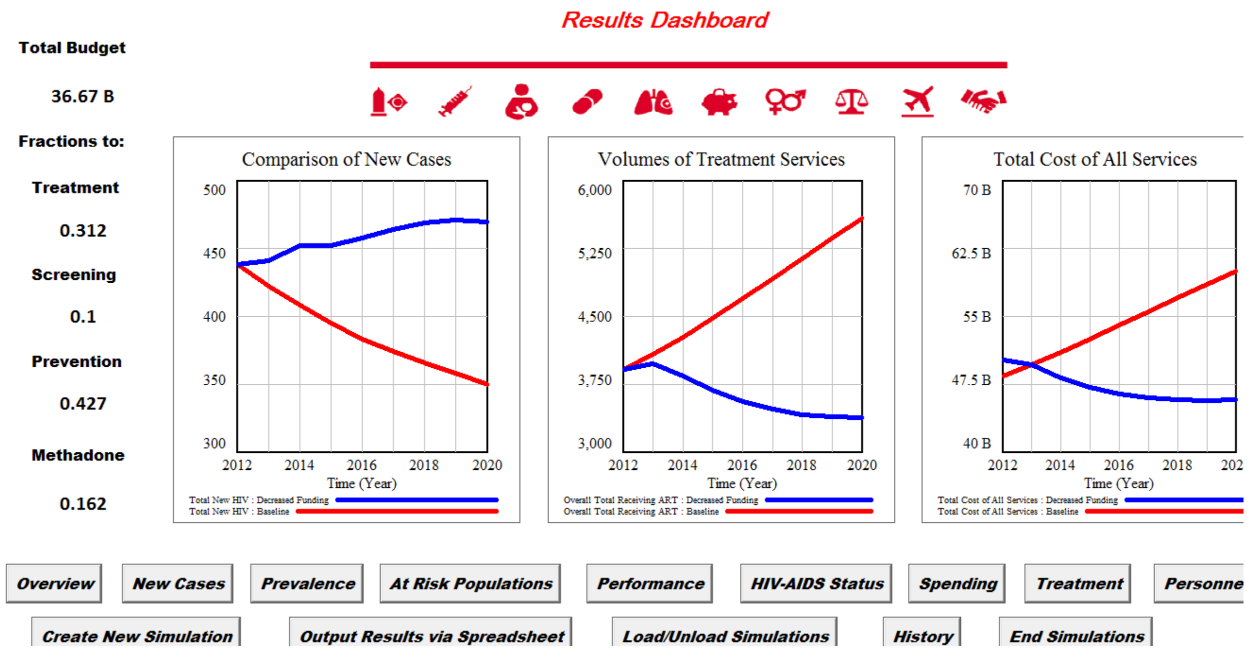

Figure 10: Results Dashboard with Decreased Funding Simulation Compared to Baseline

The left-hand graph, with a vertical scale of 300 to 500 shows that the New Cases per year in the decreased funding simulation has grown to about 475 over time to 2020 compared to the Baseline simulation where New Cases have declined to 350 by 2020. The middle graph with a scale of 3,000 to 6,000 shows that the number of people receiving ART is lower, which is to be expected given decreased funding. Having fewer people receiving ART also adds to new cases. The right hand graph shows that the total cost of services, on a scale of 40 B to 70 B VND, is also lower as a result of the decreased funding. Numbers on the left-hand side of the screen show the total funding available for this simulation, 36.67 B VND, and the fractions allocated to different types of services.

Clearly, the increasing rate of new cases is not desirable when we would have expected it to decline given the Baseline projection. What can be done to reduce the number of new cases? Further review of more detailed output screens would suggest that much of the growth in new cases seen in Figure 10 is concentrated among IDUs and MSMs. A strategy to try might be:

- shifting a larger fraction of the reduced resources to prevention and methadone maintenance,
- further concentrate the prevention budget on peer educators working with IDUs and MSMs, and
- increased needle distribution.

The results with this strategy are shown in Figure 11.

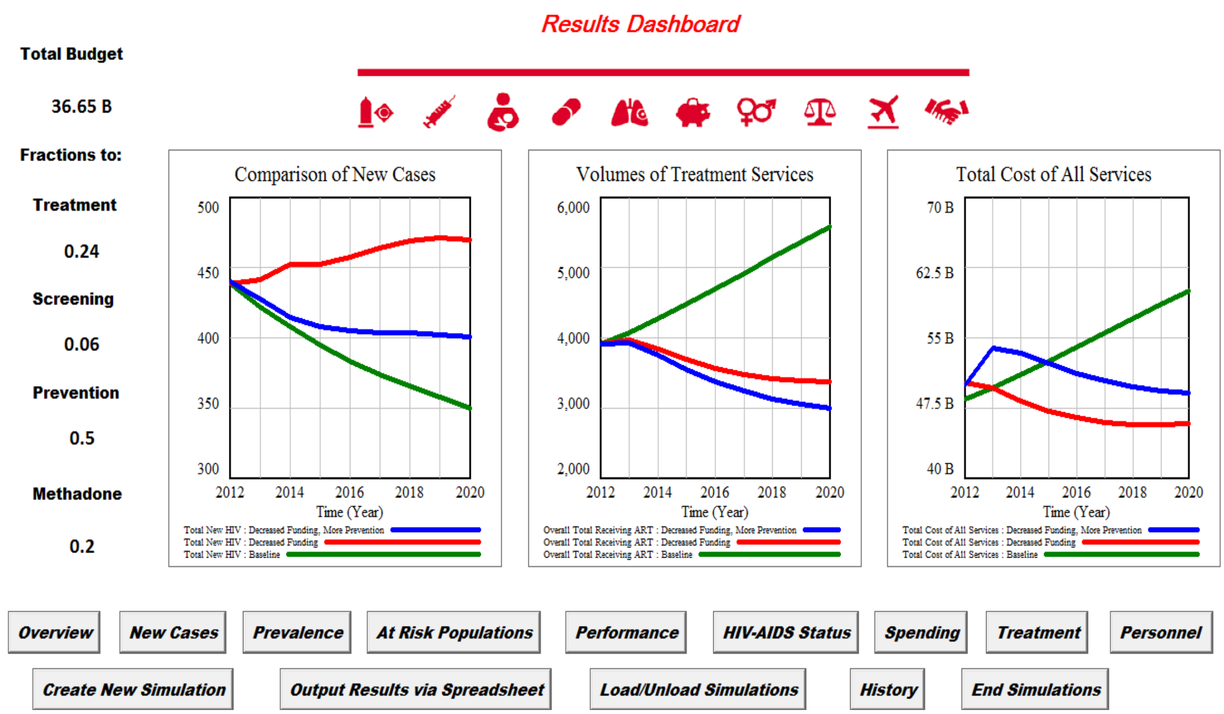

Figure 11: Results Dashboard with "Decreased Funding More Prevention" Scenario Displayed

As shown in the left-hand graph, this strategy definitely helped move the trajectory of new cases (now it's the blue line) closer to where it had been in the Baseline simulation (now the green line) and much lower than the simulation in which we only had a reduction in budget (red line) without any change in strategy. The middle graph shows that we sacrificed a bit in terms of people receiving ART which probably kept new cases from improving even more since we know that ART contributes to prevention. We were able to live within the lower budget and achieve this reduction in new cases at a lower cost than in the Baseline as shown in the right-hand graph. Further experimentation with other strategies might yield additional improvements.

2. Achieving Goals to Reduce HIV/AIDS Incidence in Hai Phong

In this scenario, we are going to take a very different approach. We will assume that funding is not an issue and examine the effect that higher levels of resources can have on new cases to see how we can reach a goal of reducing the incidence of new cases and what that would cost if the funding can be made available. We might craft an aggressive program of prevention and treatment to get a meaningful reduction in the number of new cases. This will include:

- Increasing coverage by preventive programs (needle and condom distribution, IEC and BCC programs) to cover larger percentages of vulnerable populations, either doubling the percentage covered or increasing it to 100%.
- Increasing the percentage of people in vulnerable populations reached by peer educators, either doubling the percentage or increasing it to 100%.

- Doubling the capacity of Methadone Maintenance programs by increasing the percentage of IDUs that can be covered from 40% to 80%.
- Expanding ART treatment program capacity from 4,000 to 6,000 and Pre ART capacity from 550 to 1,000.
- Doubling Screening, Testing, and Counseling capacity from 26,000 to 52,000 per year.

Resource assumptions for this scenario would be entered via the input screen shown in Figure 8 for targeting prevention programs and a companion screen for setting the capacities of treatment and screening, testing, and counseling programs. Results with this scenario are shown in Figure 12.

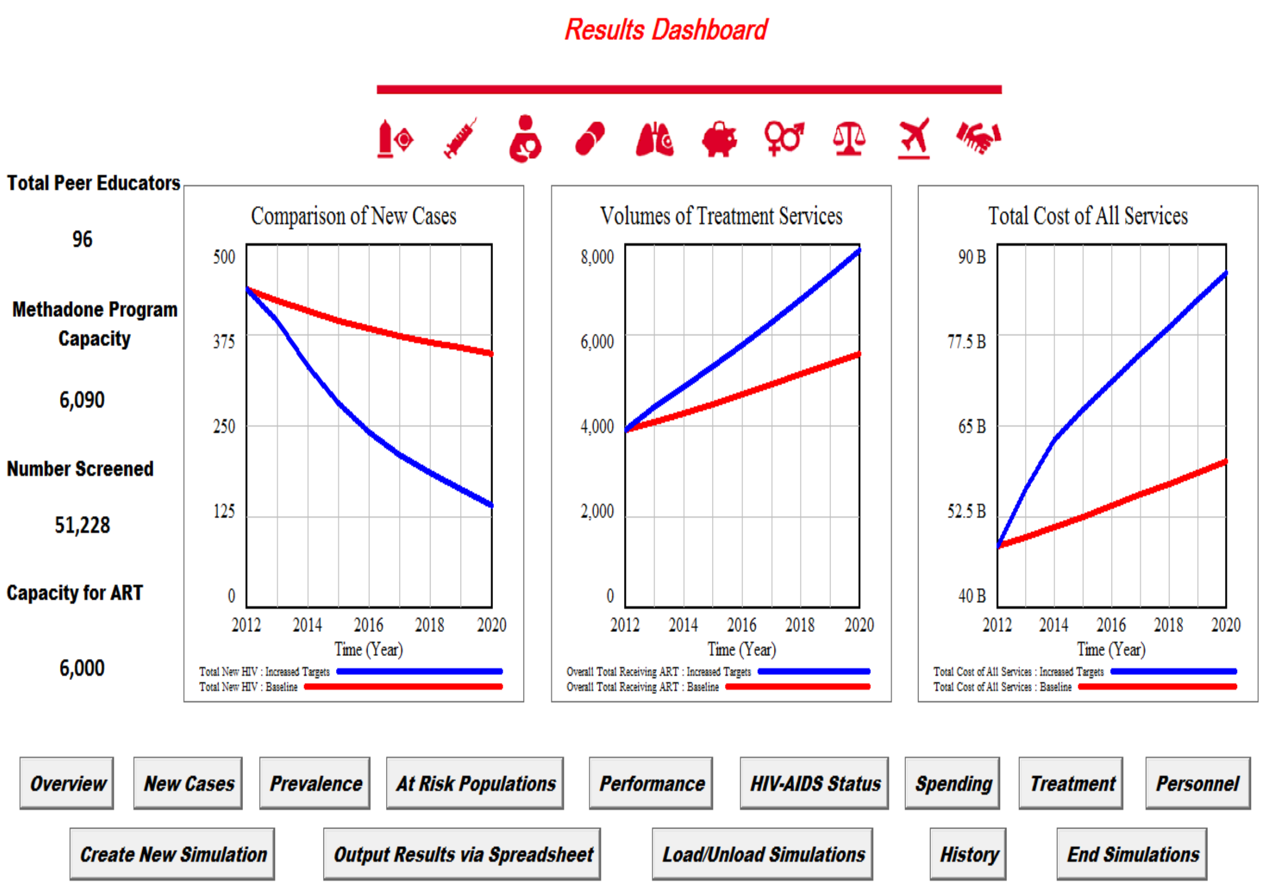

Figure 12: Dashboard with Results for Increased Targets

On the left-hand side of the Dashboard, the values of key resources used in the simulation are shown based on the settings on the input screens. In the center, there are three graphs that, as in the previous example, display the rates of New Cases (with a vertical scale of zero to 500 new cases per year), number of people in ART Treatment (0 to 8,000), and the total cost of HIV-AIDS services in the province (40 B to 90 B VND per year). All three graphs run from 2012 to 2020, as shown on the horizontal axis. The red line in each graph reflects the Baseline simulation while the blue one represents the one we have named "Increased Targets". There has been a significant effect over time on new cases, achieving an important goal. New cases decline from about 430 per year to 125 where they had previously declined to 350 in the Baseline simulation where there were no changes in programs. Part of this decline results from there being more people receiving ART Treatment (treatment as prevention), as shown in the middle graph where the number increases to over 8,000 vs. 5,500 in the Baseline. The final graphs shows the challenge that this simulation poses, costs that are significantly higher than in the Baseline, starting off about 10 B VND higher and reaching about 85 B VND by 2020 compared to about 60 B in the Baseline.

The first row of buttons at the bottom of the screen allow a user to dig more deeply into the results and get a better idea of what is going on. For example, if a user wants to see the components of cost, they would click on the button labeled "Spending" and see the screen shown in Figure 13. It displays a graph of the components of spending in this (Increased Targets) simulation on the right side of the screen. The blue line represents spending on treatment, the green on prevention programs, and the red on screening and VCT. Much of the growth in cost over time appears to be coming from treatment as more people are able to receive ART treatment. If a user wanted a more specific account of spending, they could click on the button at the bottom that says "Spending Report" which would produce the report shown in Figure 14.

If they wanted to see how this simulation compared to the Baseline on a cumulative basis, for the entire period 2012 to 2020, the user would click on the "Performance" button at the bottom of the Results Dashboard screen and go to the screen shown in Figure 15. The blue bars represent the current, "Increased Targets" simulation. The graphs show about 950 fewer new cases over the entire time period, 198 fewer deaths, and more spending. The final graph on the right shows the additional cost for each new case that is avoided. The cost of 135 M VND shown on the graph seems reasonable when the lifetime costs of health care for someone with HIV-AIDS are considered as well as the costs of lost productivity and premature death.

Figure 16 shows the composition of the population with HIV-AIDS and the "cascade" from all with the disease to those who are aware of their status, those getting any care, and those receiving ART. The left-hand graph shows that the total population that is infected (blue line) remains almost constant over time (better prevention) while the number aware of their condition increases (red line) due to more screening as do the numbers receiving any care and ART (green and gray lines respectively) as a result of greater capacity in Pre ART and ART programs. The right-hand graph confirms this picture showing that, by 2020, there are fewer people infected in the Increased Targets simulation (blue column) than in the baseline (red), but more are aware and receiving care.

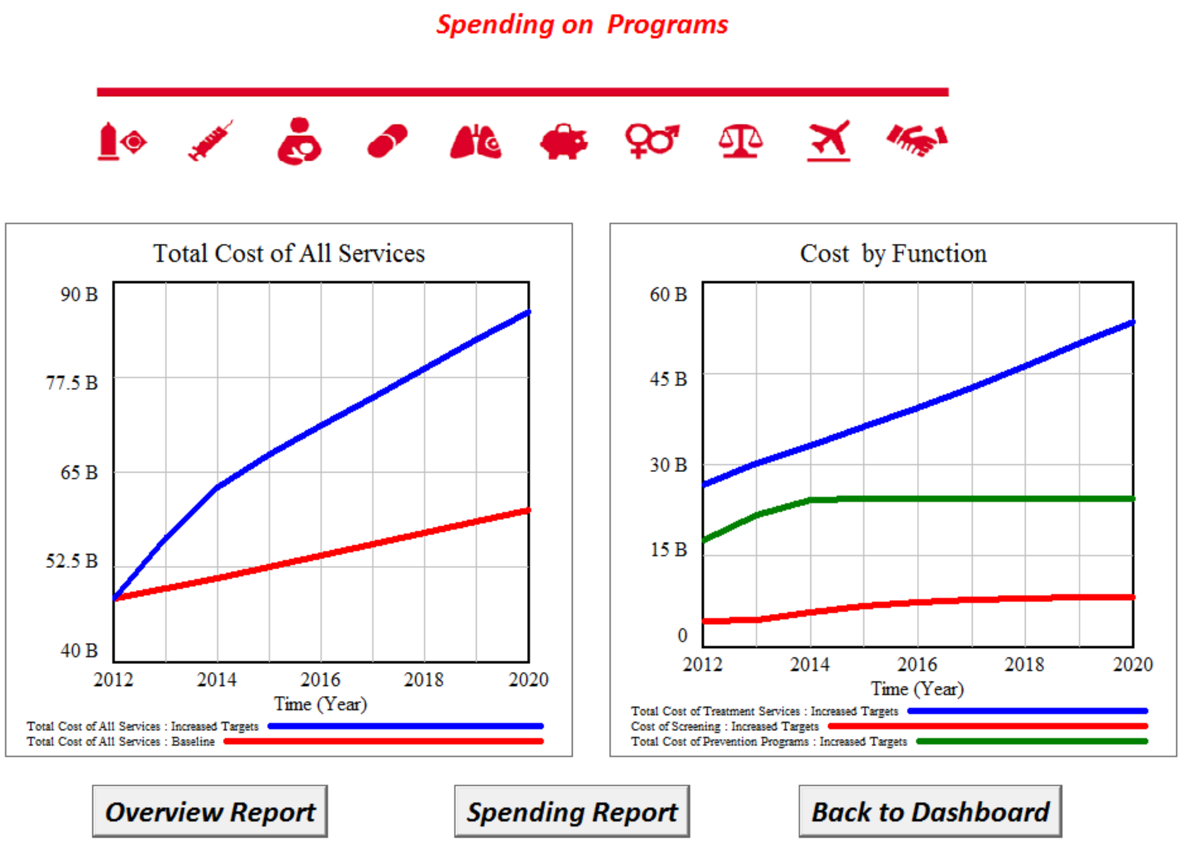

Figure 13: Spending on Services: Total Compared to Other Simulations, Cost by Function for Current Simulation

Time (Year) The following were annual expenses in each category:	2012	2013	2014	2015	2016	2017	2018	2019	2020
Prevention and Harm Reduction									
Total Prevention and Harm Reduction	17.61 B	21.69 B	24.09 B	24.37 B	24.39 B	24.39 B	24.39 B	24.39 B	24.38 B
Peer Educators	2.902 B	4.439 B	5.346 B	5.454 B	5.462 B	5.462 B	5.462 B	5.462 B	5.462 B
Methadone Maintenance									
Methadone Maintenance Programs	17.93 B	19.33 B	20.27 B	20.89 B	21.28 B	21.52 B	21.64 B	21.70 B	21.71 B
Screening and VCT									
Screening and VCT Programs	4.16 B	4.539 B	5.767 B	6.757 B	7.378 B	7.753 B	7.979 B	8.115 B	8.196 B
Treatment									
Pre ART Monitoring and Support	1.409 B	1.687 B	1.704 B	1.83 B	2.02 B	2.219 B	2.404 B	2.569 B	2.718 B
ART Programs	25.27 B	28.44 B	31.47 B	34.33 B	37.31 B	40.51 B	43.87 B	47.32 B	50.80 B
PMTCT Services	609,600	609,600	609,600	609,600	609,600	609,600	609,600	609,600	609,600

Overview Report | Spending Graphs | Back to Dashboard | Print

Figure 14: Detailed Report on Spending

Figure 15: Graphs of Cumulative Performance for the Years 2012 to 2020 Compared to Baseline

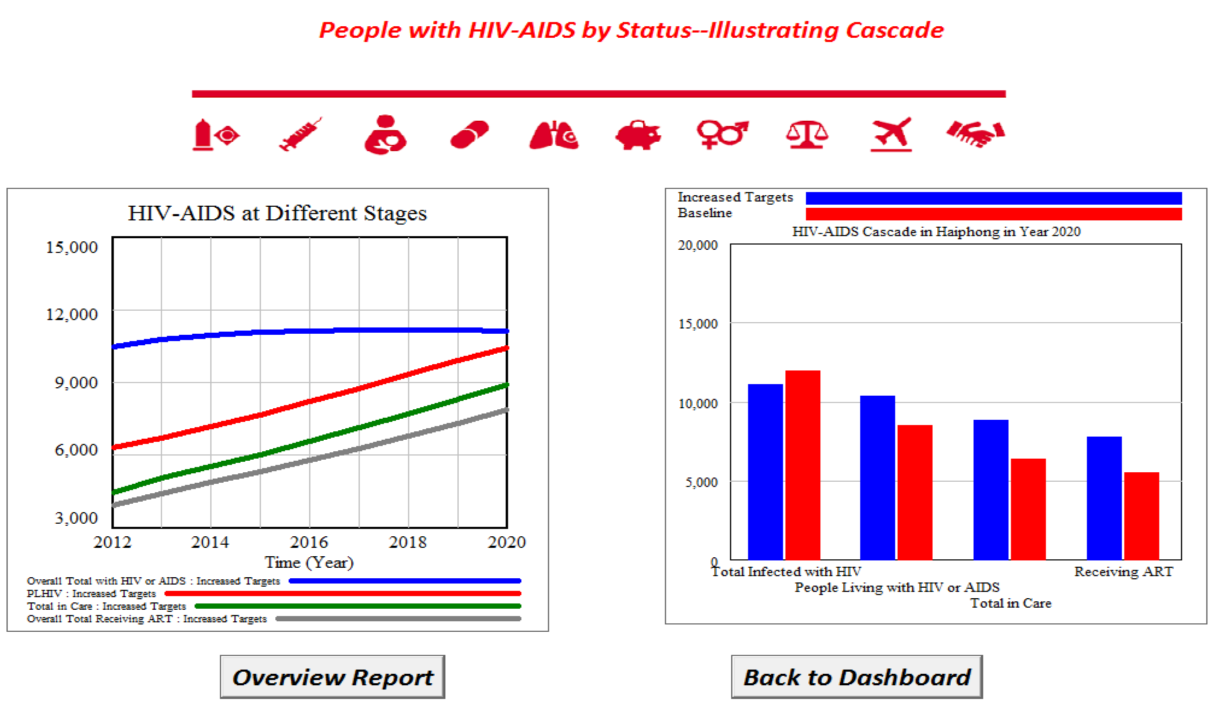

Figure 16: Graphs of HIV-AIDS by Status

Other buttons in the first row at the bottom of the Results Dashboard in Figure 12 would take the user to more detailed data on various population groups and on other resources such as numbers of different personnel required under different scenarios. Reports such as those shown in Figure 14 can provide planners with the numbers they need for submitting annual plans to the national HIV/AIDS agency. Another button at the bottom of the dashboard in Figure 12 also allows simulation results for various scenarios to be output as spreadsheets to make it easier to incorporate them in plans. Users are also able to change certain assumptions in the model, for example the unit costs of various services, before doing simulations.

Conclusion

This paper has described a governance and planning tool being developed for provincial level HIV/AIDS services in Vietnam. The tool is based on a model of HIV/AIDS and the mechanisms by which it spreads in various populations. An elaborate interface enables it to be used for planning and governance by stakeholders who must be able to support strategies that meet their multiple needs. A workshop in February, 2014 in Hai Phong with a broad group of stakeholders demonstrated widespread interest in the model as well as revealing several improvements that could lead to a more useful tool. (See Figure 17.) Training in May, 2014 with the improved model readied planners and other stakeholders to use the improved model as part of a required annual planning cycle. The true test will be the tool's value in helping to produce better plans in the latter part of 2014 and, hopefully, better services for HIV/AIDS in Vietnam.

Figure 17: Stakeholders Using HIV/AIDS Model in February, 2014 Workshop

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