MODEL TO ESTIMATE HEALTH INSURANCE LIABILITY FOR TREATMENT OF HIV/AIDS IN VIETNAM (2015–2020):

BACKGROUND, METHODS AND RESULTS

October 2014

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ACRONYMS

AEM	HIV/AIDS Epidemic Model
Anti – HCV	Antibodies – Hepatitis C Virus
ART	Antiretroviral Therapy
ARVs	Antiretroviral drugs
EPP	Epidemic Projection Package
GoV	Government of Vietnam
HBsAG	Hepatitis B Surface Antigen
INH	Isoniazid
IP	Inpatient
MoH	Ministry of Health
OIs	Opportunistic Infections
OPC	Outpatient Care Clinic
PMTCT	Preventing Mother to Child Transmission of HIV
PLWHA	People Living with HIV/AIDS
SHI	Social Health Insurance
TB	Tuberculosis
VAAC	Vietnam Authority of HIV/AIDS Control
VND	Vietnamese Dong
VSS	Vietnam Social Security Agency
USAID	United States Agency for International Aid

ACKNOWLEDGMENTS

EXECUTIVE SUMMARY

Rationale

The Decision No 1899/QD-TTg, dated October 16, 2013, of the Prime Minister to approve the Sustainable Financing Options Project for HIV/AIDS prevention and control for the period 2013-2020 has identified funding HIV/AIDS services through social health insurance (SHI) as one of the key strategies to ensure long term sustainability of HIV/AIDS treatment services in the context of declining, and possibly after 2018 ending, international support for HIV/AIDS treatment in Vietnam.

This report provides financial forecasts on the amounts of funding needed from SHI and other sources for HIV/AIDS treatment. It provides strong evidence to help the Vietnam Social Security (VSS) prepare the financial resources needed for SHI to reimburse HIV/AIDS treatment. It also provides estimates of the resources needed from other sources for HIV/AIDS treatment in order to help the Government plan and prepare the resources for these items.

Objectives of this report

The objectives of the analyses detailed in this report are to:

1. Establish a methodology for estimating the health insurance liability for the treatment of HIV/AIDS that can be adapted in the future as more data become available.
2. Provide estimates of the amount of payments the health insurance scheme will make to support the treatment of HIV/AIDS for 2015 through 2020 in Vietnam.

To the extent possible, the model also estimates the total costs of treatment for HIV/AIDS, and provides a breakdown of the various payers for treatment (including SHI, patients, and other sources such as direct support by the GoV, donors, etc.).

The expected results of the activity also include the development of a recommended package of services to be paid through VSS SHI and project the financial liability for SHI to include HIV/AIDS treatment.

Methodology

Liability is calculated using the following basic formula:

[People in need of services x accessing rate x insurance coverage] x [number of services x price of service] x [1 – patient copayment rate]

To calculate this formula by year, the following data are needed: (i) the

population in need of treatment, (ii) the rate at which they access any treatment, (iii) the coverage of insurance among those accessing HIV/AIDS treatment, (iv) the benefit package for those accessing treatment, (v) the rate at which people accessing treatment utilize the individual services in the benefit packages, (vi) the prices of individual services in the benefit package, and (vii) the rate of copayment for services among those accessing treatment that have insurance.

Sources for the data included existing HIV estimation and projection models used by VAAC, surveys of insurance coverage from VAAC, existing SHI payment rates for services from VSS, observed service costs for the treatment of some opportunistic infections, consultations with experts on the benefit package, and assumptions drawn in consultation with experts. When assumptions were made, we defined likely ranges of values and undertook sensitivity analyses to determine the effect of the assumptions on the results.

Results

The table below presents the estimated amount of liability for the SHI scheme to cover HIV/AIDS treatment. Liability in 2015 is expected to be about VND 267 billion, increasing to VND 813 billion by 2020.

Estimated insurance liability for treatment of HIV/AIDS, 2015-2020

Unit: million Dong

Service	2015	2016	2017	2018	2019	2020
Screening and diagnosis	1,993	1,892	1,792	1,684	1,588	1,508
Outpatient care	81,098	113,094	150,055	193,750	238,312	274,525
OPC OI treatment	9,207	12,861	16,988	21,428	26,118	29,745
ARV 1st line drugs	82,248	117,922	158,243	201,203	246,183	279,617
Inpatient OI treatment	92,238	119,401	147,416	174,862	201,574	227,378
Total	**266,785**	**365,170**	**474,494**	**592,928**	**713,774**	**812,773**

in VND millions; ARV 2nd line drugs not scheduled for SHI reimbursement before 2020, which are assumed to be paid by state budget and other sources.

The proportional breakdown of liability includes:
- Outpatient care constitutes 32 percent of projected liability.
- ARV first line drugs represent 33 percent of projected liability.
- Inpatient care represents 28 percent to 35 percent of liability across the years.

- In 2020, SHI liability represents about 52 percent of the total costs of HIV treatment for all people (whether covered by health insurance or not) estimated in the model, rising from 29 percent in 2015.

Sensitivity analyses show that uncertainty in the projection of the liability is most susceptible to different assumptions around the rate of insurance coverage among those seeking HIV/AIDS treatment:

- The base results assume, drawing from a VAAC survey done in 2014 that current insurance coverage is about 40 percent, rising to 80 percent by 2020. Under the assumption that current coverage is 80 percent and that it will rise to 95 percent by 2020, liability would be VND 238 billion higher than the figures in the above table for year 2015 and VND 147 billion higher than the figures in the table above in 2020.
- If the assumed average copayment rate were 10 percent (e.g., half of patients were classified as exempt from copayments due to poverty, minority status, etc.) instead of 20 percent, liability would increase by about VND 90 billion per year across the six years included in the model.

Conclusions

The model presents the best data available at this time and the model structure has been built to accommodate the data available. The exact amount of liability incurred under the SHI scheme will depend on (i) the final legal and policy decisions related to payment for HIV/AIDS treatment and (ii) the ability of HIV/AIDS treatment centers to enter into contracts with the SHI scheme. Additionally, the model and the data have a number of limitations, and assumptions that have a large effect on the results have been made. In particular, we recommend data be collected on:

(i)   the full costs of delivering services,
(ii)   enrollment in the VSS SHI,
(iii)   average copayment rate of patients accessing HIV/AIDS treatment,
(iv)   inpatient treatment of OIs.

1. INTRODUCTION

The HIV epidemic in Vietnam is concentrated among high risk populations, with a prevalence of 0.25% at the end of 2013, according to the *Review Report on HIV/AIDS prevention and control in 2013* for Vietnam. Vietnam's HIV/AIDS response has been mainly financed by external sources, with about 70% of spending on HIV funded by international donors for the period 2008-2010[1]. As donor funding is expected to decline over the coming years and possibly end after 2018, it is critical for the Government of Vietnam (GoV) to implement viable solutions for sustaining HIV/AIDS activities.

The Decision No 1899/QD-TTg, dated October 16, 2013, of the Prime Minister to approve the Sustainable Financing Options Project for HIV/AIDS prevention and control for the period 2013-2020 has identified funding HIV/AIDS services through social health insurance (SHI) as one of the key strategies to ensure long term sustainability of HIV/AIDS treatment.

Several costing and expenditure analyses related to HIV/AIDS treatment have been conducted over the last several years, each with different perspective, methods, and objectives. The purpose for these analyses and the types of costs included vary across the studies. Further, calculations of the amount of resources needed to provide HIV/AIDS treatment have focused on the total amount of resources needed, but have not looked specifically into the amount of insurance liability that would be incurred as the social health insurance (SHI) scheme takes over responsibility as the financing agent for HIV/AIDS treatment.

This report provides financial forecasts on the amounts of funding needed from SHI and other sources for HIV/AIDS treatment. It provides strong evidence to help the Vietnam Social Security Agency (VSS) prepare the financial resources needed for SHI to reimburse HIV/AIDS treatment. It also provides estimates of the resources needed from other sources for HIV/AIDS treatment in order to help the Government plan and prepare the resources for these items.

The objectives of the analysis detailed in this report are to:

1. Establish a methodology for estimating the health insurance liability for the treatment of HIV/AIDS that can be adapted in the future as more data become available.
2. Provide estimates of the amount of payments the health insurance scheme will make to support the treatment of HIV/AIDS for 2015 through 2020 in Vietnam.

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[1] NASA 2008-2010.

To the extent possible, the model also estimates the full costs of treatment for HIV/AIDS, and provides a breakdown of the various payers for treatment (including SHI, patients, and other sources such as direct support by the GoV, donors, etc.). In addition, the model provides breakdown of the costs or liabilities by the type of service (e.g., separating antiretroviral therapy (ART) from the treatment of opportunistic infections (OIs)).

Thus, the expected results include:

- A standardized approach, endorsed by key partners and policy making agencies, to estimate the amount of funding needed and insurance liability for a package of HIV/AIDS treatment integrated into SHI.

- A recommended package of services to be paid through VSS SHI.

- Calculation of liability and costs by type of service, and per patient receiving HIV/AIDS treatment to inform provider reimbursement.

This report is structured as follows. First, we describe the methods used to build the model, including the structure of the model employed, the sources of data used and the assumptions made, and sensitivity analyses. The methods section is followed by the results of the model, and the report concludes with lessons drawn and recommended areas for future work.

2. METHODS

The model and methods used in these analyses were developed to use existing data to estimate the future costs and liability of delivering HIV/AIDS treatment. As such, the model structure is designed with the limitations of currently available data in mind, using sensitivity analyses to assess the potential effects of the limits of existing data and assumptions made.

3.1 Model structure

In order to estimate the future liability and costs for the treatment of HIV/AIDS, a deterministic model was developed in Microsoft Excel (see Figure 1). Liability is calculated using the following formula:

[People in need of services x accessing rate x insurance coverage] x [number of services x price of service] x [1 – patient copayment rate]

Figure 1: Conceptual map of the model

Number of patients	Treatment rate	Cost / payment for treatment	Total costs
(a)	(b)	(c)	= a * b * c
Service – age_a	$s =$ 1: Pre-ART 2: ART 1st line: 1st year 3: ART 1st line: >1st year 4: ART 2nd line	Clinic visits$_s$ Laboratory$_s$ ARVs$_s$ Other drug$_s$ Maintenance$_s$	Clinic visits$_p$ Laboratory$_p$ ARVs$_p$ Other drug$_p$ Maintenance$_p$

Number of patients	Treatment rate	Cost / payment for treatment	Total costs
(a)	(b)	(c)	= a * b * c

$s =$
1: Pre-ART
2: ART 1st line: 1st year
3: ART 1st line: >1st year
4: ART 2nd line

$a =$
1: < 18 months HIV positive
2: < 18 months HIV exposed
3: 18 months to <5 years
4: 5 to <6 years
5: 6 to 15 years
6: Over 15 years
7: Pregnant women

Service – age_a

multiplied by the proportion of those in need of service$_s$ that access care for age_a

separated into patients with insurance and patients without insurance

Treatment rate:
Clinic visits$_s$
Laboratory$_s$
ARVs$_s$
Other drug$_s$
Maintenance$_s$

Inpatient admission

Cost / payment for treatment:
Clinic visits$_p$
Laboratory$_p$
ARVs$_p$
Other drug$_p$
Maintenance$_p$

Inpatient admission$_p$

Where $p =$
1. VSS SHI
2. Patient
3. Other
4. Total costs

Total costs:
Disaggregated by:
services (s), age (a), and payers (p).

>1st year: After the first year of ART.

To calculate this formula by year, the following data are needed:

- *Number of patients*, including (i) the population in need of treatment, (ii) the rate at which they access any treatment, (iii) the coverage of insurance among those accessing treatment,

- *Frequency of receipt of services*, including (iv) the benefit package for those accessing treatment, (v) the rate at which people accessing treatment utilize the individual services in the benefit packages,

- *Cost and copayment for services*, including (vi) the cost (or price when full cost data are not available) of individual services in the benefit package, and (vii) the average rate of copayment for services among those accessing treatment that have insurance.

Number of patients

There are four "service" states in this model: pre-ART, 1st line ART in the first year, 1st line ART after the first year, and 2nd line ART, as shown in column (a) of Figure 1. Thus, the first step in the model is to identify the number of patients in need of each 'service' type for each year in the period 2015 to 2020.

There are seven separate population in-need modules. Each has the same structure. The populations represented include: (i) children under 18 months of age HIV positive, (ii) children under 18 months of age HIV exposed, (iii) children aged 18 months to less than 5 years of age, (iv) children aged 5 to less than 6 years of age, (v) children aged 6 years of age to 15 years of age, (vi) people over the age of 15, and (vii) HIV positive pregnant women who are not already on anti-retroviral therapy.

We identified four different treatment packages for (i) children under 18 months of age who are HIV positive, (ii) children under 18 months of age who are HIV exposed but not positive, (iii) children aged 18 months to 5 years old, and (iv) for people 5 to15 years of age, adults, and pregnant women. Children aged 5 to 15 years of age further divided to those under the age of 6 and those 6 years and older because children under 6 years of age do not incur copayments when seeking care under the VSS SHI scheme. The final results aggregate across all the population modules.

The number of people needing care for each age group is then multiplied by the proportion of people in need of services that access services (at all) in order to determine the number of people seeking treatment of HIV/AIDS. These results are then separated into two cohorts: those that are assumed to have enrolled in the SHI scheme and those that are assumed not to have been enrolled, again by year.

Frequency of receipt of services

This model includes specific rates of treatment for each service (s) in column (b) of Figure 1. For example, patients on pre-ART in their first year may have a

different number of clinic visits than patients on ART, and so on. The type and number of treatments sought are based on national treatment guidelines, as discussed in more detail in section 2.2 below, with the exception of treatment of opportunistic infections and inpatient admissions, which are based on observed data or expert opinions. The treatments received are broken into broad categories (clinic visits, laboratory, ARVs, maintenance treatments such as cotrimoxazole, and other drugs, and OIs treated on an outpatient basis). In the model, these broad categories are further specified into line items of treatments (e.g., laboratory is further divided by the type of laboratory test needed and the numbers of each test that should be administered by treatment guidelines).

Cost of and payment for services

The model includes the unit cost (if available) or the amount of insurance liability (payment) in column (c) in Figure 1for each of the specific treatments. To the extent possible, the costs are separated into who pays for the specific treatment (VSS SHI, patients, or others) as well as considering the full unit cost of the treatment (if available). The unit costs are the same regardless of the 'service state'; for example, the cost of a clinic visit or treatment of an opportunistic infection is the same whether a patient is in pre-ART, ART, or on 2nd line ART. While it is possible, for example, that patients in the first year of ART may have a different mix of opportunistic infections than patients in the second and subsequent years, there currently are insufficient data to adjust the model for these potential differences.

Total costs and total liability

The total costs, and liabilities by agent paying, are then calculated by multiplying the number of patients in each service (column a) by the rate of accessing care/treatment for each service-year (column b) and the price of the care/treatment (column c). For example, multiplying the number of patients in Pre-ART by the specific utilization rates for patients in Pre-ART for each treatment determines the total number of treatments used by these patients. Multiplying the total number of treatments used by the price of each treatment, and then summing across the treatments gives the total cost of care for patients in Pre-ART. This is done separately for calendar year (i.e., 2015 through 2020) in the model.

Annex 1 provides a detailed description of the Microsoft Excel model, explaining the worksheets included in the model and the function of each worksheet.

While this model has been judged, in consultation with VAAC and VSS staff, to be suitable for the available data, more dynamic models would be possible with more complete data. Annex 2 provides a description of one such model.

3.2   Data collection

Table 1 lists the different types of data needed, outlined in section 2.1, to complete the model. For each type of data, Table 1 lists the sources of the data as well as brief notes explaining what type of data is needed or the assumptions made. The remainder of this section provides more details on the data needed, the source(s) of the data, and the assumptions and limitations of the data.

The last column of Table 1 lists the status of the data availability as the data of the writing of this report, and highlights what data are still needed to complete the first full iteration of the model

Table 1: Description of data needed and sources of data

Data	Source	Notes
A) Number of people needing HIV/AIDS treatment	HIV/AIDS Epidemic Model (AEM) developed by VAAC	Stratified into 7 modules (Pregnant women, Children <18mos HIV+, Children <18mos HIV exposed, Children 18mos - <5 years, Children 5- <6 years, Children 6-15 years, People >15 years). Each modules separated into number on each type of service (pre-Art (if applicable), ART 1st line first year, ART 1st line after first year, 2nd line (if applicable)).
A.1) Proportion of people accessing HIV/AIDS treatment	VAAC – AEM model and targets	Based on national targets.
A.2) Proportion of people accessing HIV/AIDS treatment who have HI card (now and future)	Assumptions / study	Assumed to currently be 40% for adults (range: 40% to 80%); 99% for children under 6 and 80% for children from 6 to 15 years old. -Targets: national HI coverage targets / high coverage (80% to 95% for adults; 99% for children).
A.3) Proportion of people accessing HIV/AIDS treatment by level of health system in selected province	VAAC (care and treatment department)	Prices, insurance liability, and costs differ by the level of the health system (as well as province to province). In order to determine average price, the level where HIV/AIDS patients seek treatment is needed, but data were not available.
B) Benefit packages	VAAC (Department of Care and Treatment) with input / review from WHO	In-depth interviews conducted. Treatment guidelines may not accurately reflect patient behavior.
B.1) OPC OI incidence rate	Not calculated	See B.2 below; every patient incurs the same cost per year.
B.2) OPC OI cost of treatment	CDC / VAAC (Department of Care and Treatment)	Used VAAC budget for OI drugs (total) and number of patients (total) to determine the cost of OI treatment per patient per year. Assumed this cost will be constant over time.

B.3) IP admission rate	VSS SHI general population	= 0.3 admissions per patient per year. This is the general admission rate for people covered under the VSS SHI scheme. While we might expect that people seeking treatment for HIV might have higher admission rates than the general population, people suffering from other illnesses are also more likely to enroll in the VSS SHI scheme. Thus, it is unclear whether 0.3 is too high or too low.
B.4) IP admission cost	VSS SHI	We use the average cost for the VSS SHI scheme to treat an inpatient admission for diagnoses most common in HIV positive people seeking inpatient care (see Annex 4). Hospital admissions for HIV exposed children under 18 months are not included in the model under the assumption that these admissions are not HIV related.
C) Prices for treatments by province / level of health system	VSS SHI	Gathered at the provincial level, and then weighted by the number of patients in each level of the health system and each province. *Note that at the time of writing this report, not all these data had been collected. The model uses average provincial level prices from Ho Chi Minh City, An Giang and HaNam provinces.*
C.1) Increase in prices / full costs for services (for liability in 2018 and after)	Consultation with VSS; not included at this time	VSS SHI is scheduled to change which items of treatment it pays for in 2018 and 2020. Specifically, in 2018 it is scheduled to start paying a management fee, the depreciation of direct medical equipment, and 20% to 30% of salaries, while in 2020 it is scheduled to pay for 100% of salaries. No data are available for these costs and, after consultation with VSS, they are not considered currently in the model.
C.2) ARV prices	VAAC, Clinton Health Access Initiative	In the future, Vietnam will simplify the regimens available. Thus, only 2 first line regimens are considered. The price of ARVs may be determined in part by who purchases the ARVs (National Government vs. reimbursed through the VSS SHI). Current procurement prices are used. Sensitivity analyses consider 30% decrease in price to 20% increase in price.
C.3) Average copayment rate among those covered by VSS SHI scheme	Consultation with VSS	Baseline is 20%; range from 10% to 20% in sensitivity analyses. Based on policy in Vietnam, we assumed that the GoV will pay for all ARV drugs for children under 16 years of age, and that either the government or other parties will pay for 2nd line ARVs for all people.

The *number of PLWHA* is needed for each of the 7 cadres of interest as well as for each service type (pre-ART, first year of ART 1st line, after the first year of ART 1st line, 2nd line ART). Table 2 provides details on the sources and assumptions used for each.

Table 2: Sources of data and assumptions for the number of people needing HIV/AIDS treatment

Cadre	Primary source of data	Breakdown into service needs (pre-Art, ART 1st line, ART 2nd line)	Current coverage	Coverage in the future
People over 15 years of age living with HIV/AIDS	EPP Model (VAAC)	Care and treatment division (VAAC)	Care and treatment division (VAAC)	National Strategic Plan and I-Case Model
Children under 18 months living with HIV/AIDS	EPP model (VAAC): Children under 1 years of age multiplied by 1.5	All children assumed to need 2nd line drugs	Assumed same as adults	Assumed same as adults
Children under 18 months exposed to HIV	EPP model (VAAC): Based on number of HIV positive pregnant women per 1.5 years minus number of children under 18 months living with HIV	Screening and diagnosis only	Assumed to be 95%	Assumed to be 95%
Children from 18 months – 5 years living with HIV/AIDS	EPP model (VAAC): Number of children from 18 months to 5 years living with HIV was estimated based accumulative total of children under 1 year from 2009-2013 minus number of children under 18 months living with HIV; assumes no deaths or drop-out from treatment among children.	All children assumed to need 2nd line drugs	Assumed same as adults	Assumed same as adults
Children 5 to 6 years old **and** children 6 to 15 years old living with HIV/AIDS	EPP model (VAAC): Number of children from 5 years to 15 years living with HIV was estimated based number of children living with HIV minus number of children under 5 living with HIV. Age 5-6 was calculated in the same way	All children assumed to need 2nd line drugs	Assumed same as adults	Assumed same as adults
Pregnant women living with HIV	EPP model (VAAC): Total number of pregnant women with HIV by year	Assumed 50% of patients will be detected. Pregnant women newly diagnosed with HIV will be entered into 1st year ART (first line).	80% of women detected HIV positive.	Increases 1% per year to 85% in 2020.

Note that transition rates for children and for adults (e.g., from 1ˢᵗ line to 2ⁿᵈ line and from actively on care to drop-out or dead) are based the EPP model.

A.1) The *proportion of PLWHA accessing treatment* (current coverage in Table 2) is well-estimated for patients currently enrolled in HIV/AIDS treatment services because there are reliable estimates of the HIV prevalence and the number of people enrolled in HIV/AIDS treatment. The proportion currently seeking care is less than 100 percent, and VAAC and its partners have established goals for increasing the proportion of PLWHA accessing treatment in the future. While the realization of these goals is not certain, based on our interviews with VAAC staff and partners, the goals are viewed as realistic and obtainable.

A.2) The current *proportion of people accessing treatment for HIV/AIDS that have a health insurance card* is based on a national survey performed by VAAC in November 2014, which indicated that about 40% of people accessing ART treatment had a health insurance card. These results may be biased because some patients may be reticent about saying they have an insurance card if they think it means they will have to start making copayments. Previous studies on this topic include:

- A World Bank study from 2010 (*Budget impact analysis of Scaling up Health Insurance for People Living With HIV/AIDS In Vietnam, 2011-2015*) in 3 provinces (Ha Noi, Hai Phong and Ho Chi Minh city) showed the insured proportion of patients accessing treatment for HIV/AIDS was about 30 percent.

- A USAID/HPI study conducted in March and April of 2013 in two provinces (Ninh Binh and Dong thap) reported that almost 54 percent of people accessing HIV/AIDS treatment had a health insurance card. However, coverage was over 83 percent among the poor and near poor, and 29 percent among the non-poor.[2]

Clearly, data from 5 provinces are not necessarily applicable to all of Vietnam. Also, in the last year further efforts have been made to enroll non-poor in the SHI scheme, and the current national coverage rate of the SHI is estimated at 68 percent (based on interviews with health insurance staff at VSS). Finally, the national target has been established to have 80 percent of PLWHA enrolled in SHI by 2020; note, however, that the national goal is also that 80 percent of PLWHA are access treatment by 2020. Thus, by combining these goals, the

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[2] Abt Associates - USAID/HPI Vietnam, September 2013. "Health Insurance for PLHIV in Ninh Binh and Dong Thap provinces: Assessment Results from Ninh Binh and Dong Thap." United States Agency for International Development (USAID)/Vietnam.

proportion of PLWHA accessing treatment that have a SHI cared should be close to 100 percent by 2020.

With uncertainty as to current and future enrollment in SHI among people accessing HIV/AIDS treatment, we subject these numbers to sensitivity analyses, based on the following parameters: current coverage of 30 percent, 50 percent, 60 percent or 80 percent; coverage in 2020 of 80 percent or 95 percent; the *rate of growth* between the two years is assumed to decline over time (e.g. the enrollment rate is higher in the early years). For the baseline case, we use 30 percent enrollment in 2015, reaching 80 percent coverage in 2020.

For children under 6 years of age, we assume 99 percent coverage in all years. For people aged 6 to 15, we assume current coverage is 80 percent, increasing to 95 percent in 2020 in the base case. We consider current coverage of 50 percent and 60 percent, and 80 percent coverage in 2020 in sensitivity analyses.

A.3) Estimating the *proportion of treatment accessed by level of health system* is important in establishing both the total costs and the health insurance liability since different levels of the health system (e.g., commune, district hospital, provincial hospital, national hospital) have different cost structures and insurance payment rates. Data on this proportion were not available for this analysis.

B. Benefits packages

To estimate for what type and how often patients access treatment, we use *national benefit packages* for children, adults, and women diagnosed with HIV while pregnant (see Annex 3). These benefit packages are defined item by item, with the expected utilization of services listed separately for every item.

For antiretroviral drugs (ARVs), Vietnam is expected to streamline the number of regimens available in the coming years. Thus, we consider only two regimens (3TC/ZDV/NVP and 3TC/TDF/EFV), which currently constitute the regimen of 84 percent of people on first line ART. Based on our interviews with experts at VAAC, we assume the current proportion between these two regimens will continue in the future.

Note that the benefit packages represent a normative ideal for the treatment of HIV/AIDS, and patients often do not comply with package guidelines when accessing treatment. While some data exists on actual utilization of treatment by patients,[3] these reports tend to be based on data from prior to 2010, and treatment guidelines, ART initiation criteria, procurement, and patient behavior have changed since that time. Thus, previous costing studies are not

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[3] C.f., Duong AT, Kato M, Bales S, Do NT, Nguyen TTM, Cao TTT, Nguyen LT, 2014. "Costing Analysis of National HIV Treatment and Care Program in Vietnam." *JAIDS* 65: e1-e7.

considered reliable estimates of current utilization rates, but do suggest that the assumption that patients fully follow treatment guidelines is not accurate. This noncompliance may be in either direction (e.g., patients may utilize outpatient care more than specified in guidelines, but may miss some of the laboratory testing). However, since data on actual utilization in the current situation in Vietnam is lacking, use of treatment guidelines was considered the best available option.

B1 and B2) While benefits packages specify treatment protocols for OIs, they neither specify the number of OIs patients are expected to incur nor the proportion of OIs treated in outpatient versus inpatient care. After expert consultation, we do not estimate the *incidence of OIs treated in outpatient care*; rather, we estimate the cost per patient per year based on the observed cost of drugs to treat OIs in 2013.

B3) The IP admission rate is based on the general admission rate for IP care among all VSS SHI enrollees (whether HIV positive or not). While we expect people in need of HIV/AIDS treatment to have higher IP admission rates than the population in general, there may have been adverse selection into the SHI scheme, whereby people with serious illnesses are more likely to enroll in the scheme than people who are not ill. Thus, the IP admission rate for the VSS SHI scheme is likely higher than that for the general population. The relationship between IP admission rates among all enrollees in the SHI scheme and people in need of HIV treatment is not, however, clear. Lacking further data, we assume 0.3 admissions per patient per year; note that this rate applies to all people living with HIV/AIDS, whether they are otherwise accessing HIV treatment or not.

B4) The cost of an IP admission was taken from VSS and based on the costs for common causes for IP admissions among people needing HIV treatment (see Annex 4).

Thus, the incidence rate and costs of treating OIs is not well established at the current time. Further, the rate may change in the future. Raising the CD4 threshold at which ART is initiated and raising the proportion of HIV positive people who know their status should enable them to enroll in HIV/AIDS treatment earlier, and the implementation of viral load testing should all lower the incidence rate of OIs in the future. Finally, OI treatment among PLWHA is currently already paid for by SHI on an inpatient basis if the person has a health insurance card. While this coverage does not affect total costs / liability, it complicates the calculation of additional resources needed by the SHI scheme to cover HIV/AIDS treatment. For these reasons, the models will report the costs and liability of the treatment of OIs (OPC and IP) separately from other results.

For the same reason that the incidence of OIs may change over time, the severity of OIs may also decline over time; this change is not included in the model.

C. Prices for treatments

Next, we took the *current liability payments* from three province where we data. *Note that at the time of the writing of this report, data for more provinces and for different levels within a province were not available.* We also do not adjust for inflation in this analysis (although it may be considered in future iterations of the model).

C1) While the above methods give us an estimate of the current payments incurred by SHI for different services, they do not provide the *total unit costs.* Thus, we do not estimate the total resources needed to delivery HIV/AIDS treatment; our estimates are based on current SHI payment levels. Further, the SHI liability payments are scheduled to change in 2018 and 2020, when the SHI is scheduled to assume responsibility for paying a greater proportion of the total costs of delivering medical care. In 2018, the SHI scheme is scheduled to start paying a management fee, the depreciation costs of direct medical equipment, and 20% to 30% of staff salaries. In 2020, they are scheduled to pay for 100% of staff salaries. Previous costing studies were not thought to provide sufficient quality data for use because:

(i) For some services, the full cost was not collected. For example, hospital prices were used for laboratory tests.
(ii) The costs were not broken down in ways that match future changes in insurance liability.
(iii) Some costs items, notably depreciation, were incompletely collected and the data are not viewed as reliable.
(iv) The cost studies took place more than 4 years ago, and there have been noticeable changes in the costs of medical services over the last 5 years.

Therefore, we currently are unable to include these costs in the projection model; this is a major area for further work.

C2) The current *prices of ARVs* are known, but their prices in the future is less certain. On the one hand, the VSS SHI scheme does not directly procure drugs, but reimburses provinces for drugs. If purchase of ARVs is decentralized to the provincial level, prices may rise since Vietnam may not be able to capture favorable prices associated with bulk procurement. On the other hand, the national government may take responsibility for the procurement of ARVs. Under either situation, the prices of ARVs may change in the future, as future negotiations and procurement establish different prices. Further, at this time, it does not appear that VSS SHI will be responsible for paying for 2nd line ARVs before 2020. For this reason, payments for 1st line and 2nd line ARVs are separated from other results. Further, we perform sensitivity analyses for the price of first line ARVs.

C3) Finally, estimating *patient copayments* is necessary for establishing how much the health insurance scheme will pay (versus how much patients will pay out-of-pocket). The base copayment rate in the SHI scheme is 20 percent of charges; however, certain groups, notably the poor, children under 6 years of age, and ethnic minorities, are exempted from this copayment. For example, the USAID/HPI study found that about 46 percent of people accessing HIV/AIDS

treatment in two provinces were poor or near-poor (note that near-poor have a lower annual premium for enrolling in SHI but do not have a preferential copayment rate at this time), and that the poor and near-poor had much higher enrollment rates in the SHI scheme. This leads us to suspect a copayment rate below 20 percent, on average across patients. Contrary to this, patients that access care outside their assigned facility incur much higher copayment rates (50 percent to 70 percent, depending on where they seek care), which indicates that the average copayment rate may be above 20 percent, on average. However, SHI regulations regarding assigned facilities may change in the future. Therefore, we regard 20% copayment to represent the minimal amount of liability that the SHI scheme could face (i.e., the maximum rate of patient copayment). We include one scenario related to copayments, with and an overall average copayment rate of 10 percent, in the sensitivity analyses.

3.3 Sensitivity analyses

Table 3 lists the sensitivity analyses performed. Each is described in greater detail in Section 2.2 above. For each variable, we conduct a one-way sensitivity analysis. In these analyses, we change the values for one variable (leaving all other variables the same). We then see which values produce the lowest liability / cost, and which values produce the highest liability / cost. We then calculate the percentage increase from the lowest values to the highest values, by year, to assess the extent to which liability / costs change due to uncertainty in the variable.

Table 3: List of sensitivity analyses performed

Variable	Ranges included	Notes
Proportion of people accessing treatment for HIV/AIDS that have a health insurance card	Values in 2015: **40%**, 50%, 60%, and 80% Values in 2020: **80%** and 95%	Growth between 2015 and 2020 is assumed to be exponential. Four different scenarios are included, combining the start and end coverage proportions. Figures in **boldface** represent the baseline assumption, reported in the main results section. This sensitivity analysis does not apply to children, which have 99% coverage in all scenarios. People aged 6 to 15 years have similar sensitivity analyses as adults, but lowest coverage is considered to be 50%.
Price of 1st line ARVs	**Current prices** Prices adjusted upward by 20%, downward by 30%.	VSS SHI cannot directly procure drugs. If they reimburse for ARVs, the drugs *may* need to be purchased at the provincial level, which may result in less bulk procurement / higher prices than currently observed. However, if the national government procures drugs directly, then prices may remain at current levels or even drop.

| Rate of copayment rates | 20% (Assumption)

10% (Highest health insurance liability; assumption) | We lack good data on this parameter. Copayment rates do not change the total costs, but shifts who pays for the total costs and affects the total liability of VSS SHI scheme. Does not apply to children under 6 which are assumed to have no copayment. |

We also conduct a multi-variable sensitivity analysis, in which all possible combinations of liability / costs are assessed based on the potential values of all variables included in the sensitivity analysis. The purpose of the multi-variable sensitivity analysis is to estimate the plausible range in total liability / costs incurred by year.

3. RESULTS

3.1 Projected insurance liability

The number of people accessing HIV treatment in 2015 is projected to be about 113,400, of which, in the baseline scenario, 44 percent or about 50,200 are projected to be enrolled in the VSS SHI scheme. Figure 2 presents the number of people seeking HIV treatment covered by the VSS SHI scheme for each year by service type.

Figure 2: Projected number of people seeking HIV treatment enrolled in health insurance
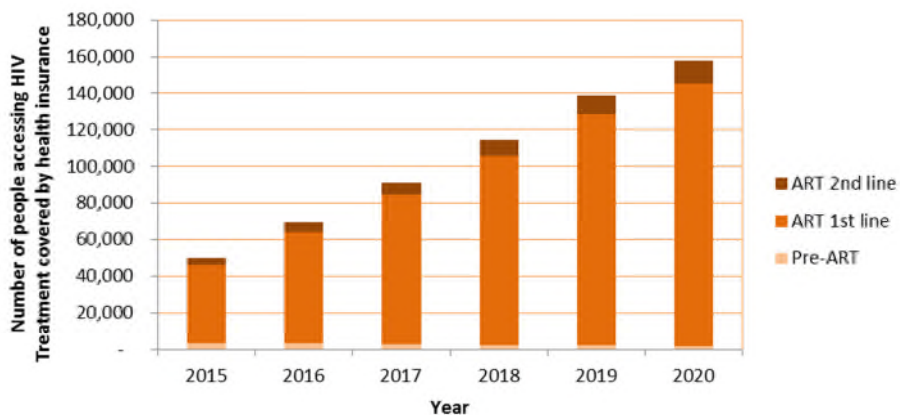
By 2020, the VSS SHI scheme is projected to cover about 158,000 people accessing HIV treatment, representing about 82 percent of people seeking HIV treatment (note that the baseline scenario assumes 80 percent coverage among adults, but the overall average is slightly higher because 99 percent of children under 6years of age are assumed to be covered). If the insurance is assumed to cover 95 percent of people over the age of 6 accessing HIV treatment in 2020, then the number of people covered in the VSS SHI scheme is projected at over 186,000 people accessing HIV treatment.

The amount the VSS SHI is expected to pay in 2015 is almost VND 267 billion (see Table 4), increasing to over VND 812 billion in 2020. In 2020, this represents about 52 percent of the total costs of HIV treatment for all people (whether covered by health insurance or not) estimated in the model (see Table 5). If we consider that VSS SHI already pays for inpatient OI treatment, the incremental liability for outpatient care is estimated at VND 175 billion in 2015 and about VND 585 billion in 2020. However, even if already covered by SHI, liability for IP treatment of OIs is estimated to be almost 2.5 times higher in 2020 than in 2015, a result predominantly due to assumed higher insurance coverage

(the model predicts only a 1.07 times increase in IP liability between 2020 and 2015 if SHI coverage remains at 30 percent).

Table 4: Estimated insurance liability for treatment of people living with HIV/AIDS, 2015-2020

Service	2015	2016	2017	2018	2019	2020
HI Liability (in VND millions)						
Screening and diagnosis	1,993	1,892	1,792	1,684	1,588	1,508
Outpatient care	81,098	113,094	150,055	193,750	238,312	274,525
OPC OI treatment	9,207	12,861	16,988	21,428	26,118	29,745
ARV 1st line drugs	82,248	117,922	158,243	201,203	246,183	279,617
ARV 2nd line drugs	-	-	-	-	-	-
Total OPC treatment	**174,547**	**245,769**	**327,078**	**418,066**	**512,200**	**585,395**
Inpatient OI treatment	92,238	119,401	147,416	174,862	201,574	227,378
Total including IP OI treatment	**266,785**	**365,170**	**474,494**	**592,928**	**713,774**	**812,773**
Service as percentage of all HI liability						
Screening and diagnosis	0.7%	0.5%	0.4%	0.3%	0.2%	0.2%
Outpatient care	30.4%	31.0%	31.6%	32.7%	33.4%	33.8%
OPC OI treatment	3.5%	3.5%	3.6%	3.6%	3.7%	3.7%
ARV 1st line drugs	30.8%	32.3%	33.3%	33.9%	34.5%	34.4%
ARV 2nd line drugs	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Inpatient OI treatment	34.6%	32.7%	31.1%	29.5%	28.2%	28.0%
Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

The largest line item estimated in the model is the liability for ART first line drugs, ranging from VND 82 billion in 2015 (or 31 percent of all health insurance liability in 2015) to over VND 279 billion in 2020 (over 34 percent of all health insurance liability in 2020). The liability for outpatient care and 1st line ARV drugs are very similar in net amount over the projections, with VND 175 billion per year on average (ranging from VND 81 to 275 billion across the years) for outpatient care and follow-up and VND 181 billion per year on average for ARV

1st line drugs. Outpatient care constitutes 33 percent of projected liability, while ARV first line drugs represent 34 percent of projected liability. Inpatient care for opportunistic infections is the third largest category, representing 30% of all estimated liability across the 6 years. Treatment of opportunistic infections on an outpatient basis constitutes 3.6 percent, and screening and diagnosis 0.3 percent, of projected liability. The current projection assumes no VSS SHI liability for 2nd line ARV drugs.

Table 5: Estimated insurance liability as a percentage of total costs of treatment of people living with HIV/AIDS, 2015-2020

Service	2015	2016	2017	2018	2019	2020
HI Liability as percentage of all costs						
Screening and diagnosis	99%	99%	99%	99%	99%	99%
Outpatient care	35%	43%	49%	55%	60%	65%
OPC OI treatment	34%	42%	49%	55%	60%	65%
ARV 1st line drugs	33%	41%	48%	54%	59%	64%
ARV 2nd line drugs	0%	0%	0%	0%	0%	0%
Inpatient OI treatment	35%	42%	49%	55%	60%	65%
Total	**29%**	**35%**	**40%**	**45%**	**49%**	**52%**

Table 6 presents the health insurance liability by service type; the bulk of the liability is for patients on first line ART care. This is partly because the majority of patients are on ART first line care (see Figure 2) but also because the health insurance liability per patient per year is higher for ART 1st line patients than for other patients. The difference is the reimbursement of first line ARVs and not 2nd line ARVs by the VSS SHI scheme. The average cost per insured patient accessing HIV treatment changes over time because the assumed scale-up of viral load testing, a different mix of patients in the 1st year vs. later years of treatment, and different mixes of patients in different age cadres. The overall health insurance liability per patient per year ranges from VND 5.14 million to VND 5.31 million.

Table 6: Insurance liability for treatment of people living with HIV/AIDS, 2015-2020 by service category

Category	2015	2016	2017	2018	2019	2020
All OPC (screening and diagnosis, outpatient care, outpatient treatment of OIs, ARV drugs)						
						VND million
1 Pre-ART	7,479	6,965	6,305	5,617	4,968	4,503
2 ART 1st Line	159,006	228,797	308,262	393,743	484,208	553,101
3 ART Second Line	8,062	10,008	12,511	18,706	23,024	27,791
4 *Subtotal: Outpatient care*	*174,547*	*245,769*	*327,078*	*418,066*	*512,200*	*585,395*
Liability per patient of All OPC (VND thousands)						
1 Pre-ART	2,145	2,163	2,209	2,269	2,350	2,416
2 ART 1st Line	3,715	3,745	3,774	3,801	3,827	3,852
3 ART Second Line	2,054	1,960	1,903	2,241	2,221	2,212
4 *All patients*	*3,476*	*3,540*	*3,590*	*3,654*	*3,685*	*3,705*
Inpatient (VND millions)						
Treatment of OIs	92,238	119,401	147,416	174,862	201,574	227,378
Total: All care (VND millions)	**266,785**	**365,170**	**474,494**	**592,928**	**713,774**	**812,773**
Total liability per patient (VND thousands)	*5,312*	*5,260*	*5,208*	*5,182*	*5,135*	*5,144*

Figure 3 presents the results of the multivariate sensitivity analyses. For each year, the figure presents a box. The middle line in the box represents the baseline scenarios presented above. The top of the box represents the maximum liability based on all possible combinations of scenarios, while the bottom of the box represents the minimum liability based on all possible combinations of scenarios. The baseline scenario is on the low end of possible scenarios, based on assumed low (compared to the other scenarios considered) insurance enrollment among people access HIV/AIDS treatment. The range of liability is 2015 based on the scenarios assessed ranges from VND 242 billion to VND 601 billion, a difference of VND 359 billion. Thus, in 2015, based on the scenarios included in these analyses, the total health

insurance liability could be only about 91 percent of the base case presented above, but could also be 125 percent higher.

In 2020, the range of liability based on the scenarios assessed ranges from VND 729 billion to VND 1,151 billion, a range of VND 422 billion. Thus, in 2020, based on the scenarios included in these analyses, the total health insurance liability could be only about 90 percent of the base case presented above, but could also be 42 percent higher.

Figure 3: Range of projected liability based on sensitivity analyses
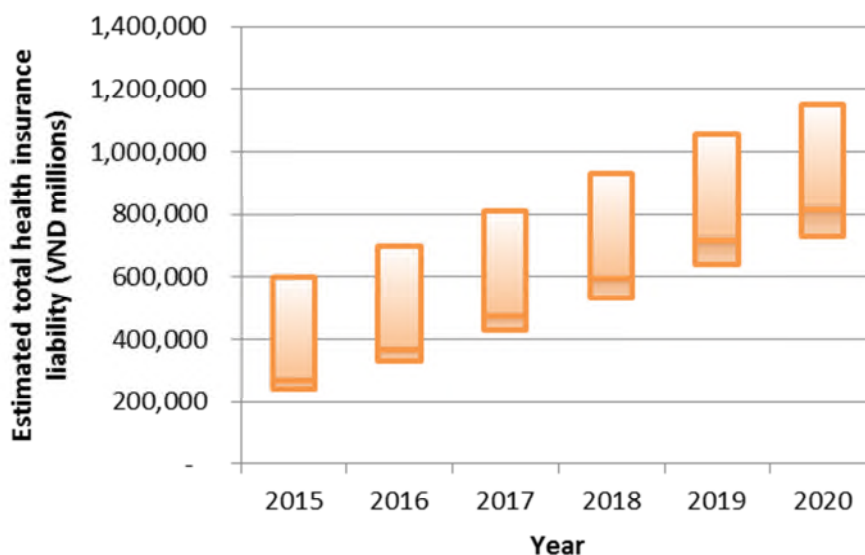
Table 7 presents the results of the one-way sensitivity analyses for health insurance liability. The figures reported in the table represent the difference (in VND millions) between the highest liability scenario (e.g., patient copayment rate of 10 percent) and the lowest liability scenario (e.g., patient copayment rate of 20 percent). Thus, a reported result of VND 30,333 million for the copayment rate in 2015 suggests that health insurance liability will be VND 30,333 million higher if the average patient copayment rate is only 10 percent than it would be if the average copayment rate is 20 percent (see Annex 6 for detailed results of the sensitivity analyses).

The results of the one-way sensitivity analysis suggest that the rate of insurance coverage of people seeking HIV treatment could have the largest impact on total health insurance liability, with a plausible gap of VND 194 billion per year across the six years between the lowest liability and the highest liability scenarios (36 percent of the average yearly liability estimated in the baseline scenario). This is followed by the price of 1st line ARV drugs, with an average of almost VND 90 billion liability gap per year across the six years between the lowest liability and the highest liability scenarios. This gap represents about 17

percent of the average yearly liability estimated in the baseline scenario. The copayment rate could make a difference in the average liability per year of about VND 64 billion (12 percent of liability estimated in the baseline scenario).

Table 7: Sensitivity analyses: amount of change in total liability based on plausible ranges for selected variables

Scenario	2015	2016	2017	2018	2019	2020	Average
Copayment rate (10-20%)	30,333	42,731	56,525	71,394	86,555	98,929	**64,411**
ARV Prices (70-120%)	41,124	58,961	79,122	100,602	123,091	139,809	**90,451**
Insurance coverage of patients	238,207	219,850	202,740	185,670	168,045	146,970	**193,580**

*In VND millions

3.2 Projected total costs

The total costs of HIV treatment (from all payers) are projected to be VND 915 billion in 2015, increasing to VND 1,563 billion in 2020 (see Figure 4). The costs for ARV drugs is the largest cost category, with 1st line and 2nd line drugs together accounting for 46 percent of costs across the six years analyzed. Inpatient treatment of OIs constitutes 25 percent of cost, while outpatient treatment of OIs accounts for 3 percent of all costs. Outpatient treatment and follow-up represents 26 percent of total costs. Annex 5 provides details on the projected total costs by source of financing separating first line and second line drugs.

Figure 4: Estimated total costs of HIV treatment by year and treatment type
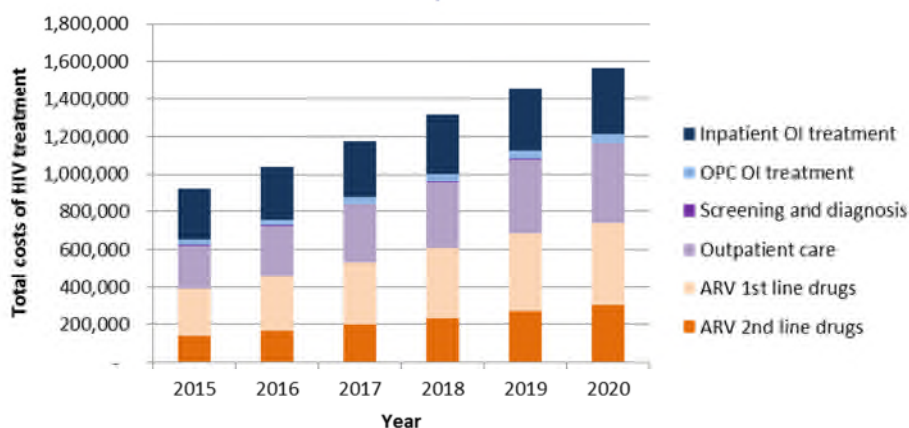
Table 8 presents the total costs broken down by who is projected to pay the costs (Annex 5 provides a more detailed breakdown of costs by treatment category and payer). The state budget and other sources (e.g., external sources) are projected to increase funding from VND 139 billion in 2015 to VND 305 billion in 2020. This funding is primarily for ARV drugs, and represents 18 percent of all costs. The VSS SHI scheme is the single largest financing agent across the six years included in the model, accounting for 43 percent of all costs. Patients not enrolled in the VSS SHI scheme constitute the third largest financing agent in this model, accounting for 29 percent of all costs, declining over time as enrollment in the SHI scheme is assumed to increase. As more patients enroll in the VSS SHI scheme, the amount patients with insurance pay increase, although across the six years it balances out to 7 percent to 13 percent of all costs.

Table 8: Estimated total costs for treatment of people living with HIV/AIDS, by project source of payment (VND millions)

	Source of payment	2015	2016	2017	2018	2019	2020
1	State budget and other sources	138,954	169,699	201,100	234,436	269,347	305,394
2	Health insurance	266,785	365,170	474,494	592,928	713,774	812,773
3	Patient with SHI	61,690	86,725	114,543	144,512	175,042	199,980
4	Patient without SHI	449,456	417,894	384,567	346,490	301,931	246,100
	Total from all sources	**916,885**	**1,039,488**	**1,174,704**	**1,318,366**	**1,460,094**	**1,564,247**
Source of payment as percentage of all costs							
1	State budget and other sources	15%	16%	17%	18%	18%	20%
2	Health insurance	29%	35%	40%	45%	49%	52%
3	Patient with SHI	7%	8%	10%	11%	12%	13%
4	Patient without SHI	49%	40%	33%	26%	21%	16%

Figure 5 presents the amount of payment for the ARV drugs only by year and source of payment. In this model, in 2015 people without health insurance are the largest payer, accounting for 38 percent of the total costs of ARVs, followed by the state budget and other sources at 36 percent of the total costs. By 2020, under the assumption of increased enrollment in insurance, patients without health insurance are projected to pay for 12 percent of the costs, while the growth in the number of people on second line drugs mean that the state budget and other sources are projected to pay for 41% of drug costs. SHI is projected to pay for 21% of the costs in 2015, increasing to 38% of all ARV costs in 2020. Patient with SHI are projected to pay 5% to 9% of drug costs through copayments.

Figure 5: Estimated costs of ARV drugs by financing agent and year
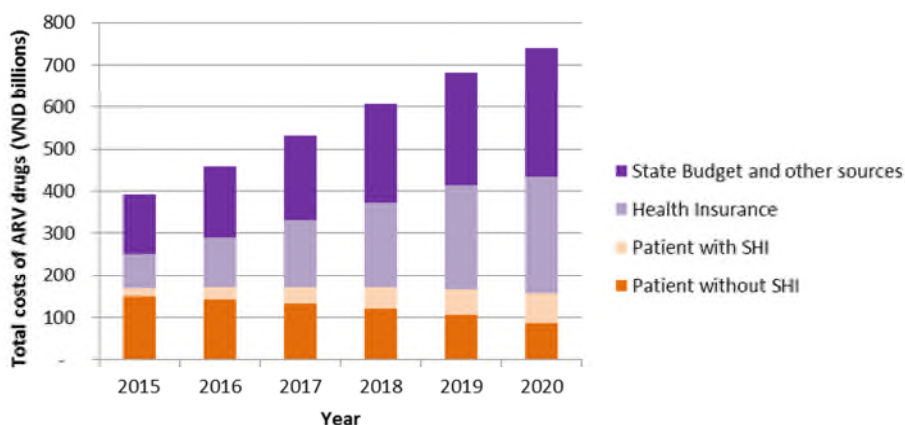
Table 9 presents the range of total costs based on the sensitivity analyses. Note that only one of the scenarios included in the sensitivity analyses affects total costs; issues regarding enrollment in the health insurance scheme or the rate of patients' copayment affect who will pay for HIV treatment, but do not affect the total costs. The difference in the total costs of HIV treatment between the scenario including the lowest price of first line ARVs and the scenario where the highest price is used is about VND 175 billion, on average across the six years assessed. This difference represents about 14 percent of the costs in the mid-level ARV price scenario.

Table 9: Sensitivity analyses: percentage change in total costs in 2018 and in 2020 based on plausible ranges for selected variables

Scenario	2015	2016	2017	2018	2019	2020	Average
ARV Prices (70-120%)	126,513	144,937	165,482	186,157	206,993	217,775	**174,643**

*In VND millions

4. DISCUSSION

This projection model indicates that the total costs of HIV treatment will be VND 917 billion in 2015, and increase to VND 1,564 billion in 2020 (range in 2020: VND 1,434 to 1,651 billion). Based on projections of VSS SHI coverage and copayment rates, we estimate that the SHI scheme will be liable for 29 percent of those costs in 2015 and 52 percent in 2020; under various scenarios the VSS SHI could be liable for up to 70% of the total costs in 2020, but at a minimum would be liable for 51 percent of the total costs.

The construction of the model and the collection of the data to populate the model involved consultations with multiple partners. While the model has limitations, we feel confident that it presents the best data available at this time and the model structure has been built to accommodate the data available. However, the model and the data have a number of limitations, and some large assumptions have been made. Some of the major assumptions include:

> 1. HIV/AIDS treatment facilities are eligible to provide HIV examination and treatment services through SHI.

> 2. Legal framework for the payment of HIV/AIDS treatment through SHI is available and effective.

> 3. Procurement of antiretroviral drugs with SHI funds has been developed and is in place.

We have identified the following set of variables as most likely to provide the greatest improvements to the model:

1. Perhaps the most important limitation is the lack of **data on the full costs of delivering services**. The costs and liabilities presented in this report only represent the amount of insurance payments made for services under current conditions. As the VSS SHI scheme becomes the agent for more aspects of health services, including overhead costs, depreciation of equipment, and staff salaries in 2018 and onwards, the amount of liability will increase over what has been estimated in the current model. (In terms of the total costs of delivering HIV treatment, this model also excludes these costs; thus we do not present a truly global picture of the total costs of HIV treatment).

2. Tracking the **enrollment in the VSS SHI** scheme of people accessing treatment for HIV, as well as assessing the overall treatment rate for all people living with HIV/AIDS, is important to establish future health insurance liability. In sensitivity analyses, this proved to be more influential than the **average copayment rate of patients** accessing HIV treatment, although this latter indicator is also an important missing data point.

3. It should be noted that not all of the costs included in the model are incremental; specifically **inpatient treatment of OIs**. The VSS SHI

insurance scheme now pays for any person living with HIV/AIDS who is enrolled in its scheme and who seeks care at a hospital. Since the HIV diagnosis would not normally be noted in the hospital billing form, VSS SHI has no means of estimating what this current liability might be. Further we have no recent data on how often people living with HIV/AIDS seek inpatient care. Considering that inpatient care for OIs constitutes about 25 percent of all costs and 31 percent of health insurance liability, establishing better parameters for estimating these costs should be considered a priority.

4. We have used normative benefits packages as the basis for the costing of outpatient treatment. It is not clear that patients will follow benefits packages in reality. Further, it is not clear in which way using normative benefit packages biases the cost and liability estimates, since patients may over- or under-utilize services. However, using a benefits package approach ensures that the VSS SHI scheme has enough money to reimburse health care providers at adequate levels for the services they should provide.

We recommend that at least two of the first three points be addressed as an urgent priority over the next year; likely the first point should be addressed most urgently. Note that this is not an exhaustive list of all the data and model shortcomings, but a list of areas we view as most strategic for intervention. However, further consultations on the model, the data, and what activities are possible are needed in order to define a concrete list of next steps.

In order to more fully develop the (i) assumptions made in this model and (ii) produce more accurate estimates of the resources needed for HIV treatment, we recommend, to the extent possible, tracking data on important variables. Ideally, tracking the total expenditures and people in HIV treatment enrolled in the VSS SHI scheme would be undertaken on a routine basis. Short of that, building capacity to track costs over time will better enable VSS/SHI to understand its liability vis-à-vis HIV/AIDS treatment. Understanding this liability will help ensure proper resource mobilization for HIV/AIDS treatment. Overestimating the liability could result in over-payment of moneys from the government; underestimation of the liability will result either in financial distress to the VSS SHI scheme or a rise in general premium payments to enroll in the SHI scheme. Building the capacity for the SHI scheme and the GoV more widely to undertake regular and detailed actuarial analyses of these risks will enable them to provide accurate data to inform these discussions.

ANNEX 1: DETAILED DESCRIPTION OF THE MODEL FOR ESTIMATING HEALTH INSURANCE LIABILITY
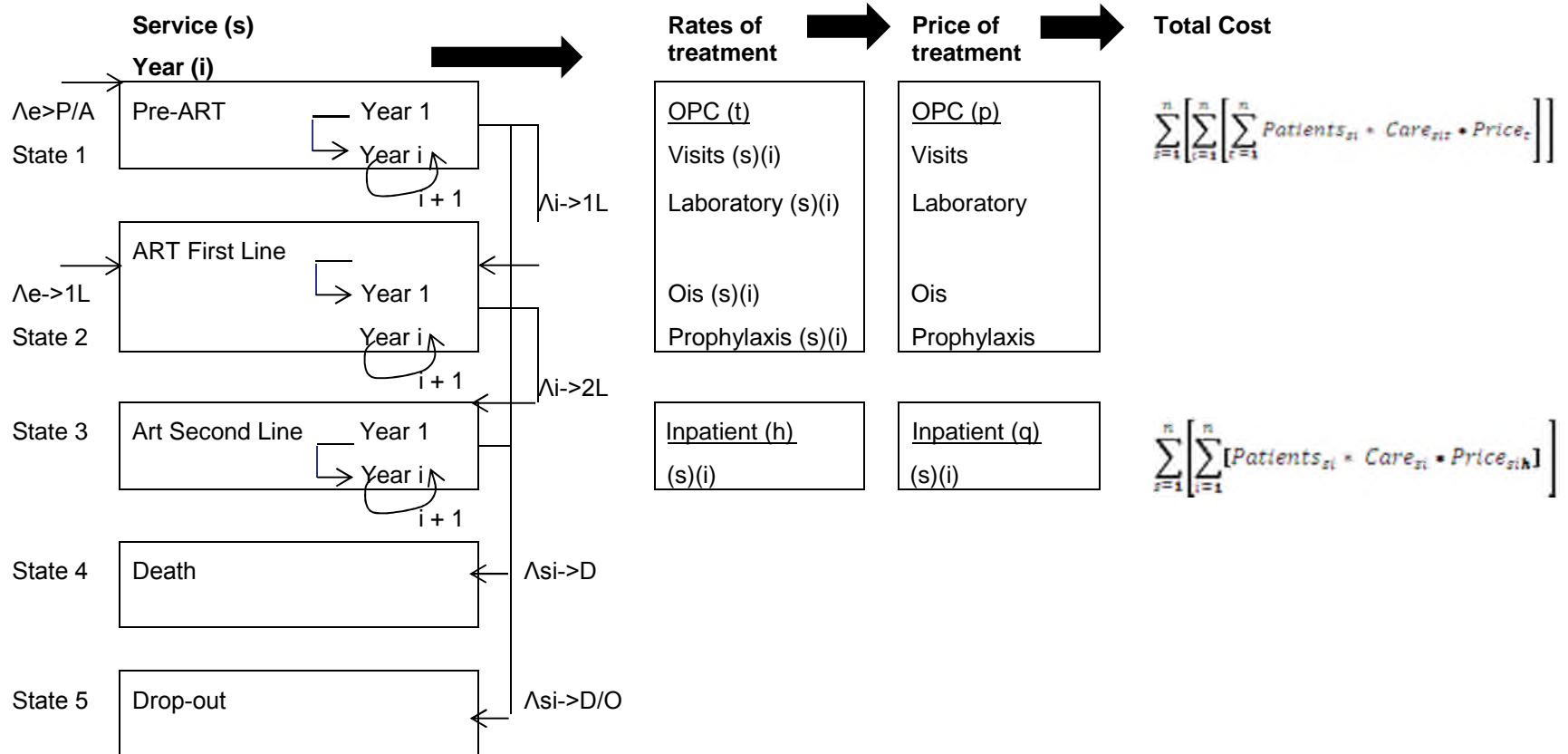
There are eight separate workbooks (Excel files) in the model: seven representing the different age / benefit packages, and one workbook which pulls the data from the other seven workbooks together to tabulate the totals. The seven age-specific workbooks all have the same structure, with 15 worksheets (tabs) in each workbook. The following table provides details on the 15 worksheets within each workbook.

Worksheet name	Description	Links to worksheet:
Population in need		
1. Epidemic data	Lists the total population for all 7 age categories considered, eligibility for services, and access rate to services.	*2. Input data*
2. Input data	Lists the population by service for the age group that is the focus of the particular workbook. Each service (e.g., pre-ART, ART first year, etc.) lists the total number of eligible patients, the access rate, and the total number of patients seeking care. The average number of inpatient admittances applies to all patients seeking care (adults) and to all eligible (children).	*Calculations* sheets 6 through 10, columns I through N (where number of patients is multiplied by the cost per treatment per patient)
Frequency of receipt of services		
3. Package	Lists the number of times each patient will receive each treatment in one year (per treatment guidelines). *Note that because viral load testing is scheduled to be scaled-up to replace CD4 testing for patients established on antiretroviral therapy, the number of times per year per patient for these two tests are listed in the calculation sheets.	*Calculations* sheets 6 through 10, columns C through H (where number of times per year is multiplied by the unit cost per treatment to determine the cost per patient per year for each treatment).
Unit costs		
4. Unit price	Lists the unit cost for each treatment category. For each year in the model, it then breaks down the unit costs by the payer (HI = Health Insurance, patient, and other).	*Calculations* sheets 6 through 10, columns C through H (where number of times per year is multiplied by the unit cost per treatment to determine the cost per patient per year for each treatment).
Assumptions		
5. Assumption	Lists assumption areas that are used for sensitivity analyses (not all assumptions listed on this sheet are used in the model). Four areas are listed: the amount	-*Co-payments by patients*: 4. Unit price columns E through V.

	of co-payment by patients, the price of first line ARVs, health insurance coverage, and whether to include payment components that the VSS SHI scheme is scheduled to assume responsibility for in 2018 and 2020 [currently this last scenario is disabled; full costs were not available].	*-Price of 1st line ARVs*: Unit prices cells C34 and C54. *-Health insurance coverage*: Calculations sheets 6 through 10, columns I through N

Calculations		
6. calculation for HI	Provides the cost per person per year paid for by the VSS SHI scheme in columns C through H (for the years 2015 to 2020) and the total costs per year in columns I through N for the VSS SHI scheme for each category of treatment.	
7. calculation for Patient	Provides the cost per person per year paid for by the patients enrolled in VSS SHI in columns C through H (for the years 2015 to 2020) and the total costs per year in columns I through N for the patients enrolled in VSS SHI for each category of treatment.	*10. Calculation for Total* *13. Results Summary*
8. calculation for Patient no HI	Provides the cost per person per year paid for by the patients NOT in VSS SHI in columns C through H (for the years 2015 to 2020) and the total costs per year in columns I through N for the patients NOT in VSS SHI for each category of treatment.	
9. Calculation for Other	Provides the cost per person per year paid for by other actors (e.g., GoV or external sources) in columns C through H (for the years 2015 to 2020) and the total costs per year in columns I through N for other actors (e.g., GoV or external sources) for each category of treatment.	
10. Calculation for Total	Provides the total cost per person per year paid for by all payers in columns C through H (for the years 2015 to 2020) and the total costs per year in columns I through N for all payers for each category of treatment.	*13. Results Summary*
11. One way	Holding sheet for the results of one-way sensitivity analyses; this sheet is used with the macro called "one-way sensitivity".	*15. one way result*
12. scenario	Holding sheet for the results of all possible scenario analyses; this sheet is used with the macro called "scenario_calculation".	*None* (but links to external workbook summarizing results)

Results		
13. Result Summary	Pulls data from the calculation worksheets to tabulate 3 tables that summarize the results: -Table 1: Total Costs by source of payment for care (rows 1 through 45). -Table 2: Total by type of patient (all payers) (rows 47 through 56). - Table 3: Total by type of patient (Health Insurance) (rows 58 through 78).	*None*
14. Results detailed	Currently empty; placeholder for more detailed reporting of results.	*None*
15. one-way result	Lists the percentage and VND change in health insurance liability and total costs based on the scenarios established on the *Assumptions* worksheet.	*None*

ANNEX 2: BRIEF OUTLINE OF AN ACTUARIAL MODEL FOR ESTIMATING HIV/AIDS TREATMENT LIABILITY

Figure A1.1: Conceptual map of a fuller actuarial model

$$\sum_{s=1}^{n}\left[\sum_{i=1}^{n}\left[\sum_{t=1}^{n} Patients_{si} \bullet Care_{sit} \bullet Price_t\right]\right]$$

$$\sum_{s=1}^{n}\left[\sum_{i=1}^{n}[Patients_{si} \bullet Care_{si} \bullet Price_{sih}]\right]$$

<u>Description:</u>

Service States/ Services for state of disease

There are five "service" states in this model: Pre-ART, First line ART, Second line ART, death, and drop-out. Death and drop-out are terminal services, in that patients that enter these states never leave (although in reality some patients that drop-out will return to ART services, in this model the number eligible for ART is determined outside the model, so drop-outs cannot enter this population).

New patients enter the model either on Pre-ART or immediately eligible for ART (determined by the rates $\Lambda e\text{->}P/A$ and $\Lambda e\text{->}1L$, respectively, where the first rate is the proportion of eligible patients that enter on Pre-ART and the second rate is the proportion of eligible that enters directly to ART. Both rates should add up to the assumed overall uptake of ART among those eligible.)

Patients on Pre-ART (s = 1) start in the first year (i = 1) of Pre-ART. After the first year, they may either stay on Pre-ART (i + 1), start ART 1st line ($\Lambda i\text{->}1L$), die, or drop-out of care. The same possibilities exist for patients in year 2 of Pre-ART; however, the rates which patients in Pre-ART year 2 start ART 1st line, die, or drop-out of care can be different than the rates used in year 1 (indicating, for example, that patients on pre-ART for longer periods of time will be more likely to be eligible for ART).

Similar patterns exist for ART 1st line patients (s = 2), except instead of starting 1st line ART, they could start 2nd line ART ($\Lambda i\text{->}2L$). For patients on second line ART (s = 3), the only options in this model are to remain on 2nd line ART, die, or drop-out.

Note that this basic model requires separate rates for each year. That is, it requires the rate of death for patients in their first year of ART, their second year of ART, their third year of ART, and so-on. The same is needed for rates of starting 2nd line ART, and for all possible state changes. This is data intensive and the rates could be estimated for groups of years, e.g., the first year on 1st line ART, years 2 through 5 on 1st line ART, and patients on 1st line ART for more than 5 years. The basic model proposed in the main text of this overview has only two year categories for 1st line ART patients (the first year of treatment, and all subsequent years), while Pre-ART and 2nd line ART have only one group (all years of treatment). At this time, the data available cannot support more categories.

Rates of treatment

This model proposed specific rates of treatment for each service (s) and year (i) combination. For example, patients on pre-ART in their first year may have a different number of clinic visits than patients in their second year of pre-ART and so on. This model proposes, however, only one price for outpatient care. For example, the cost of a clinic visit is the same regardless if a patient has been on ART for one year or three years or five years. This assumption may be

revisited for the price of the ARV drugs. For inpatients admissions, it is possible to envision that the cost of an admission may be variable depending on how long a patient has been on ART (etc. for other services). Patients in the first year of ART may have a different mix of opportunistic infections than patients in the second and subsequent years. However, there currently are scant data to accept or reject this hypothesis.

Cost function:

Total cost/liability = number of patients x rates of treatment x price of treatment

The total costs or liabilities (as the case may be) are then calculated by multiplying the number of patients in each service-year by the rate of care seeking for each service-year and the price of the service, and then summing across years and services. For example, multiplying the number of patients in their first year of Pre-ART by the specific utilization rates for patients in their first year of Pre-ART determines the number of services used by these patients. Multiplying the total number of services used by the price of each service, and then summing gives the total cost of care for patients in their first year of Pre-ART. Summing these results across all years of Pre-ART gives the total costs for Pre-ART, and then adding the costs for the other services (ART first line and ART second line) gives the total costs. This process is done for each calendar year (e.g., 2015 through 2020; as opposed to the number of years a patient has been attending a particular service) to estimate the costs of care and treatment.

ANNEX 3: BENIEFIT PACKAGES FOR TREATMENT OF PEOPLE LIVING WITH HIV/AIDS

Number of times people over the age of 5 receive the following services**:

No	Cost component	Service			
		Pre-Art	ART 1st line (first year)	ART 1st line (after first year)	ART 2nd line
1.2.1	Examination	12	12	12	12
1.2.2	Laboratory work				
1.2.2a	Blood cell count		2	2	2
1.2.2b	HbsAg	1	1	1	
1.2.2c	Anti-HCV	1	1		
1.2.2d	Hemoglobin		1.3	0.3	
1.2.2e	Creatinine in blood		1	1.4	1.4
1.2.2g	ALT		1.6	0.6	0.6
1.2.2i	CD4*	2	1.9	1.9	1.9
1.2.2k	Viral Load*		0.1	0.1	0.1
1.2.3	TB INH Maintenance	0.7	0.7		
1.2.4	Cotrimoxazole Therapy	365	365	365	365
1.2.5	ARV		12	12	12
	3TC/ZDV/NVP		3.6	3.6	
	3TC/TDF/EFV		8.4	8.4	
	3TC/TDF/LPV/r*				12
1.2.6	OI OPC treatment	1	1	1	1

*Subject to change over time
**Children aged 5 to 15 are all assumed to need ART 2nd line.

Number of times people under 5 years of age and HIV positive receive the following services:

No	Cost component	ART 2nd line
1.2.1	Examination	12
1.2.2	Laboratory work	
1.2.2a	Blood cell count	2
1.2.2b	HbsAg	1
1.2.2c	Anti-HCV	
1.2.2d	Hemoglobin	
1.2.2e	Creatinine in blood	
1.2.2g	ALT	1
1.2.2i	CD4	1
1.2.2k	Viral Load	1

1.2.3	TB INH Maintenance	
1.2.4	Cotrimoxazole Therapy	365
1.2.5	ARV	12
	3TC/ZDV/NVP	
	3TC/TDF/EFV	
	3TC/TDF/LPV/r*	12
1.2.6	OI OPC treatment	1

Number of times newly diagnosed pregnant women receive the following services:

No	Cost component	ART 1st line (first year)
1.2.1	Examination	6
1.2.2	Laboratory work	
1.2.2a	Blood cell count	2
1.2.2b	HbsAg	1
1.2.2c	Anti-HCV	1
1.2.2d	Hemoglobin	
1.2.2e	Creatinine in blood	1
1.2.2g	ALT	1
1.2.2i	CD4	1
1.2.2k	Viral Load	1
1.2.3	TB INH Maintenance	0.47
1.2.4	Cotrimoxazole Therapy	180
1.2.5	ARV	6
	3TC/ZDV/NVP	1.8
	3TC/TDF/EFV	4.2
	3TC/TDF/LPV/r*	
1.2.6	OI OPC treatment	0.5

Number of times children under 18 months exposed to HIV receives the following services:

No	Cost component	Exposed treatment*
1.2.1	Examination	18
1.2.2	Laboratory work	
1.2.2l	DNA-PCR	1
1.2.2m	Elisa	1
1.2.4	Cotrimoxazole Therapy	540

*Number present need over an 18 month period; for the model the yearly number needed is computed.

ANNEX 4: UNIT COSTS USED IN THE MODEL

No.	Line Item	Unit cost (VND)
1	Examination (Outpatient per visit)	30,000
1.1	Basic diagnosis (lab test and X-ray, per test)	
1.1a	Blood cell count	57,000
1.1b	HbsAg	80000
1.1c	Anti-HCV	100,000
1.1d	Hemoglobin	25,000
1.1e	Creatinine in blood	25,000
1.1g	ALT	25,000
1.1i	CD4	300,000
1.1k	Viral Load	600,000
1.1l	DNA-PCR	300,000
1.1m	Elisa	600,000
1.2	TB INH Maintenance (per year)	80,000
1.3	Cotrimoxazole Therapy (per day)	2,000
1.4	OI treatment for OPC (per patient per year)	237,797.7
1.5	Labor cost (per visit)	Not available
1.6	Overhead cost (per visit)	Not available
1.7	Depreciation cost (per visit)	Not available
2	ARVs	
2.1	First line ARVs (per month)	203,612
2.1a	3TC/TDF/NVP	171,348
2.1b	3TC/TDF/EFV	217,440
2.2	Second line ARVs	1,655,000
2.2a	3TC/TDF/LPV/r*	1,655,000
3	Inpatient care (per admission)	5,748,531.3

Calculation of the cost of treating opportunistic infections (VND)

Name of opportunistic infection (OI)	Inpatient care		Outpatient care	
	Percentage of all OIs	Cost per admission	Percentage of all OIs	Cost per treatment
Other congenital infectious and parasitic diseases	4%	935,339	5%	37,151
Neonatal candidiasis	2%	6,842,902	3%	127,905
Respiratory tuberculosis, bacteriologically and histologically confirmed	14%	6,108,449	19%	856,325
Acute respiratory failure	18%	14,546,555	24%	2,549,046
Toxoplasma meningoencephalitis	4%	8,459,108		
Personal history of allergy to other drugs, medicaments and biological substances	3%	2,777,033		
Functional diarrhea	6%	632,395	8%	35,461
Toxoplasmosis	1%	5,880,281		
Acute hepatitis B	2%	4,111,871	3%	96,072
Other septicemia	0%	19,813,502		
Nonspecific lymphadenitis	0%	2,758,917	1%	12,892
HIV disease resulting in mycobacterial infection	2%	3,110,452		
Congenital cytomegalovirus infection	12%	222,812		
HIV disease resulting in Pneumocystis carinii pneumonia	3%	13,313,775		
Myelodysplastic syndromes	1%	16,857,334	1%	118,159
Human immunodeficiency virus [HIV] disease resulting in infectious and parasitic diseases	3%	12,035,954	4%	393,699
Postzoster neuralgia	1%	1,590,371	1%	11,147
Unspecified viral infection characterized by skin and mucous membrane lesions	1%	512,752	2%	5,990
Fever of unknown origin	4%	3,669,227	5%	128,594
Cachexia	7%	2,664,679	9%	186,777
Anogenital herpesviral [herpes simplex] infection	12%	899,456	16%	105,077

ANNEX 5: DETAILS OF THE TOTAL COSTS BY SERVICE AND PAYER

#	Payer	2015	2016	2017	2018	2019	2020
	Screening and diagnosis						
1	State budget and other sources		-	-	-	-	-
2	Health Insurance	1,993	1,892	1,792	1,684	1,588	1,508
3	Patient with SHI	-	-	-	-	-	-
4	Patient without SHI	20	19	18	17	16	15
	Total from all sources	*2,014*	*1,911*	*1,810*	*1,701*	*1,604*	*1,523*
	Outpatient care						
1	State budget and other sources		-	-	-	-	-
2	Health Insurance	81,098	113,094	150,055	193,750	238,312	274,525
3	Patient with SHI	18,082	26,255	35,699	46,724	57,980	67,072
4	Patient without SHI	131,214	125,916	119,275	111,497	99,554	82,154
	Total from all sources	*230,395*	*265,265*	*305,028*	*351,971*	*395,845*	*423,752*
	OPC OI treatment						
1	State budget and other sources		-	-	-	-	-
2	Health Insurance	9,207	12,861	16,988	21,428	26,118	29,745
3	Patient with SHI	2,159	3,088	4,139	5,263	6,443	7,351
4	Patient without SHI	15,664	14,807	13,824	12,555	11,060	9,000
	Total from all sources	*27,030*	*30,757*	*34,951*	*39,245*	*43,620*	*46,097*
	Subtotal: All OPC treatment						
1	State budget and other sources		-	-	-	-	-
2	Health Insurance	92,299	127,847	168,835	216,863	266,017	305,778
3	Patient with SHI	20,241	29,343	39,837	51,986	64,423	74,423
4	Patient without SHI	146,899	140,743	133,117	124,068	110,630	91,170
	Total from all sources	*259,439*	*297,933*	*341,790*	*392,918*	*441,070*	*471,371*
	ARV 1st line drugs						

1	State budget and other sources	1,287	1,278	1,113	875	656	481
2	Health Insurance	82,248	117,922	158,243	201,203	246,183	279,617
3	Patient with SHI	20,562	29,481	39,561	50,301	61,546	69,904
4	Patient without SHI	148,929	141,194	132,048	119,934	105,601	85,546
	Total from all sources	*253,026*	*289,874*	*330,964*	*372,313*	*413,985*	*435,549*
	ARV 2nd line drugs						
1	State budget and other sources	137,667	168,421	199,987	233,560	268,691	304,913
2	Health Insurance	-	-	-	-	-	-
3	Patient with SHI	-	-	-	-	-	-
4	Patient without SHI	-	-	-	-	-	-
	Total from all sources	*137,667*	*168,421*	*199,987*	*233,560*	*268,691*	*304,913*
	Subtotal: ARV drug costs						
1	State budget and other sources	138,954	169,699	201,100	234,436	269,347	305,394
2	Health Insurance	82,248	117,922	158,243	201,203	246,183	279,617
3	Patient with SHI	20,562	29,481	39,561	50,301	61,546	69,904
4	Patient without SHI	148,929	141,194	132,048	119,934	105,601	85,546
	Total from all sources	*390,693*	*458,296*	*530,951*	*605,873*	*682,676*	*740,462*
	Inpatient OI treatment						
1	State budget and other sources	-	-	-	-	-	
2	Health Insurance	92,238	119,401	147,416	174,862	201,574	227,378
3	Patient with SHI	20,887	27,901	35,145	42,225	49,074	55,652
4	Patient without SHI	153,628	135,957	119,402	102,488	85,700	69,384
	Total from all sources	*266,753*	*283,259*	*301,963*	*319,575*	*336,348*	*352,414*
	Total (Inpatient + all OPC + ARVs)						
1	State budget &other sources	138,954	169,699	201,100	234,436	269,347	305,394
2	Health Insurance	266,785	365,170	474,494	592,928	713,774	812,773
3	Patient with SHI	61,690	86,725	114,543	144,512	175,042	199,980
4	Patient without SHI	449,456	417,894	384,567	346,490	301,931	246,100
	Total from all sources	*916,885*	*1,039,488*	*1,174,704*	*1,318,366*	*1,460,094*	*1,564,247*

* in VND millions

ANNEX 6: DETAILED RESULTS OF THE SENSITIVITY ANALYSES

Total health insurance liability under various scenarios (VND millions)

Scenario	2015	2016	2017	2018	2019	2020
Baseline scenario (results presented in report)*						
Total	**266,785**	**365,170**	**474,494**	**592,928**	**713,774**	**812,773**
Coverage of health insurance**						
60% coverage in 2015; 95% coverage in 2020	383,750	483,754	597,907	723,741	853,774	959,744
80% coverage in 2015; 95% coverage in 2020	504,992	585,020	677,234	778,598	881,819	959,744
50% coverage in 2015; 80% coverage in 2020	326,336	410,818	507,153	613,426	723,217	812,773
Copayment rate						
Patients pay 10% copayment rate on average	297,117	407,901	531,019	664,322	800,329	911,703
Price of first line ARVs						
20% increase in price	283,234	388,755	506,143	633,168	763,010	868,697
30% decrease in price	242,110	329,794	427,021	532,567	639,919	728,888

*Insurance coverage of 40 percent in 2015 increasing to 80 percent in 2020; patient incur 20 percent copayment rate on average, price of ARVs as currently procured

**For children aged 6 to 15, insurance rates are 80 percent to 95 percent (baseline), with other scenarios the same as presented here.

Total cost of HIV/AIDS treatment under various scenarios (VND millions)

Scenario	2015	2016	2017	2018	2019	2020
Baseline scenario (results presented in report)*						
Total	**916,885**	**1,039,488**	**1,174,704**	**1,318,366**	**1,460,094**	**1,564,247**
Price of first line ARVs						
20% increase in price	967,490	1,097,463	1,240,897	1,392,828	1,542,891	1,651,357
30% decrease in price	840,977	952,526	1,075,415	1,206,672	1,335,899	1,433,582

*Insurance coverage of 40 percent in 2015 increasing to 80 percent in 2020; patient incur 20 percent copayment rate on average, price of ARVs as currently procured; insurance coverage and copayment rate do not change total costs.

This report provides financial forecasts on the amounts of funding needed from SHI and other sources for HIV/AIDS treatment. It provides strong evidence to help the Vietnam Social Security Agency (VSS) prepare the financial resources needed for SHI to reimburse HIV/AIDS treatment. It also provides estimates of the resources needed from other sources for HIV/AIDS treatment in order to help the Government plan and prepare the resources for these items.

To the extent possible, the model also estimates the full costs of treatment for HIV/AIDS, and provides a breakdown of the various payers for treatment (including SHI, patients, and other sources such as direct support by the GoV, donors, etc.). In addition, the model provides breakdown of the costs or liabilities by the type of service (e.g., separating antiretroviral therapy (ART) from the treatment of opportunistic infections (OIs)).