Development and Preliminary Specifications for an AIDS Drug Assistance Program Economic Model:

FINAL REPORT

PREPARED FOR

HIV/AIDS BUREAU, HEALTH RESOURCES AND SERVICES ADMINISTRATION

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I. INTRODUCTION

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II. BACKGROUND

AIDS Drug Assistance Programs (ADAPs) are authorized under Title II of the Ryan White Comprehensive AIDS Resources Emergency (CARE) Act. Formula-based grants are awarded to States and eligible territories to support ADAPs. Changes in the CARE Act made during reauthorization in 1996 and 2000 have expanded the scope and funding mechanisms for ADAP. Currently, formula funds earmarked specifically for ADAPs are available to Title II grantees; in addition to general Title II funds that may be allocated in part to ADAPs or direct care services. Between FY 1996 and FY 2000, earmarked ADAP funds represented the primary source of ADAP funding.

The reauthorized CARE Act specifies that ADAP funds may be used to purchase medications to treat HIV disease or prevent the serious deterioration of health associated with opportunistic infections (OIs) and other HIV-related conditions. ADAP funds also may be used to purchase ancillary devices that are essential to administer those drugs, provide outreach to HIV-infected individuals (and their families as appropriate), facilitate access to treatment, and encourage, support and enhance adherence to and compliance with treatment regimens, including medical monitoring. A 5% ceiling on ADAP funds is set for medical monitoring.

To maximize ADAP funds, reauthorized CARE Act language now allows ADAPs to be used to purchase insurance premiums to cover the cost of medications. This strategy has been successful at levering access to medical care and other essential healthcare services, as well as often offering much broader access to HIV medications.

Since its inception, ADAP funds have grown from $52 million in Fiscal Year (FY) 1996 to $639 million in FY 2002. Although there has been substantial growth in Federal funds to support State ADAPs, several states have periodically experienced budgetary shortfalls in meeting program demand. As a consequence, States have intermittently imposed restrictions to ADAP enrollment, leading external advocates for State ADAPs to lobby for supplemental appropriations to offset projected budget shortfalls. The ADAP Working Group (AWG), one of the lead advocacy organizations calling for increased ADAP funding, developed a budget projection model that estimated shortfalls in total ADAP funds of $82 million in FY 2002 and $202 million in FY 2003. The Office of Management and Budget (OMB) has questioned the accuracy of these projections.

The HIV/AIDS Bureau (HAB) of the Health Resources and Services Administration (HRSA) currently has limited information on which to base its assessment of projected need. HAB receives monthly reports from states on program enrollment, utilization, and the cost of

medications purchased. However, these data alone do not provide HAB with the detailed information necessarily to easily project program spending.

This report describes a framework that can be used to construct an ADAP projection model for use by HAB. The framework makes use of each State's specific ADAP reporting data, as well as a number of other data sources. The resulting model would allow both for budget projections based on current statue and for projections under alternative policy scenarios.

III. MODELING OBJECTIVES

In discussions with the project team, HAB staff identified the objectives of the model as:

- Estimate the funds necessary to serve all potential ADAP clients currently (e.g., in FY 2003), without waiting lists, under current program requirements. Estimates would be produced at the state level and aggregated to produce a national total. The model will estimate service expenditures for clients, but not for administrative costs (although these may be estimated *ex post*).

- Project estimates of expenditures into the near future (one to four years). Because of rapidly changing treatment, projections beyond the near term are subject to extreme uncertainty.

- Allow for a limited number of "policy levers" that allow model users to estimate the effect on expenditures of across-the-board changes in State or national program policies. Potential policy levers include ADAP eligibility criteria (financial and/or clinical), Medicaid eligibility criteria, enrollment caps, formulary policy, and pricing concessions.

- Allow for sensitivity analyses that test assumptions that are not based on strong, direct empirical evidence.

IV. OVERVIEW OF PROPOSED APPROACH

The proposed model would enable HAB staff to produce its own national ADAP budget projections as a point of comparison to and validation of the existing AWG model. While the AWG model uses what appears to be reasonable approach to predict program spending, some of the assumptions and data elements on which the model relies may bias its findings. For example, the AWG model:

- Does not necessarily reflect the discounts and rebates State ADAPs receive;

- Relies on data prior to the advent of highly active antiretroviral therapy (HAART) and does not take into account the impact of HAART on disease severity and mortality;

- Does not directly reflect observed variation in the level of generosity of ADAPs across States; and

- Relies exclusively on ADAP-reported enrollment data and "best guess" assumptions about enrollment growth based on past growth.

The framework we propose would address the above concerns by including more specific State-level information on program characteristics while at the same time folding in population-based data that are less vulnerable to State-by-State differences in reporting quality than the ADAP data alone.

A. Data Sources

The proposed model would make use of the following data sources:

- March Current Population Survey (CPS) – The Annual Demographic Survey of the March Supplement to the CPS supports State-level population estimates by income group and other demographic characteristics.

- Lewin Medicaid Eligibility Model – The Lewin Group has built this model from three years of pooled CPS data, combined with Medicaid financial eligibility criteria for 50 States plus the District of Columbia.

- HIV Cost and Services Utilization Study (HCSUS) – The HCSUS, while relatively old and not entirely representative of the current HIV/AIDS population in the US, may provide valuable information about the relationship between severity of illness and prescription drug use, and the relationship between income and severity of illness.

- Standard ADAP data – These data includes ADAP Monthly Reports (AMRs) containing enrollment counts, distribution by number of antiretrovirals (ARVs) purchased, and wait list information. The data also include the ADAP Quarterly Reports (AQRs) containing pricing data for selected drugs.

- Custom runs from selected State ADAPs – These data will provide additional information about the distribution of spending by drug class and disease severity (or number of ARVs in regimen). Tentative commitments from ADAPs operated by California, Florida, and New York have been received to produce custom runs. Texas was contacted but has not responded to the request for custom runs. Additional State ADAPs will be identified if these supplemental data are determined to be of use in refining the model or stabilizing the results.

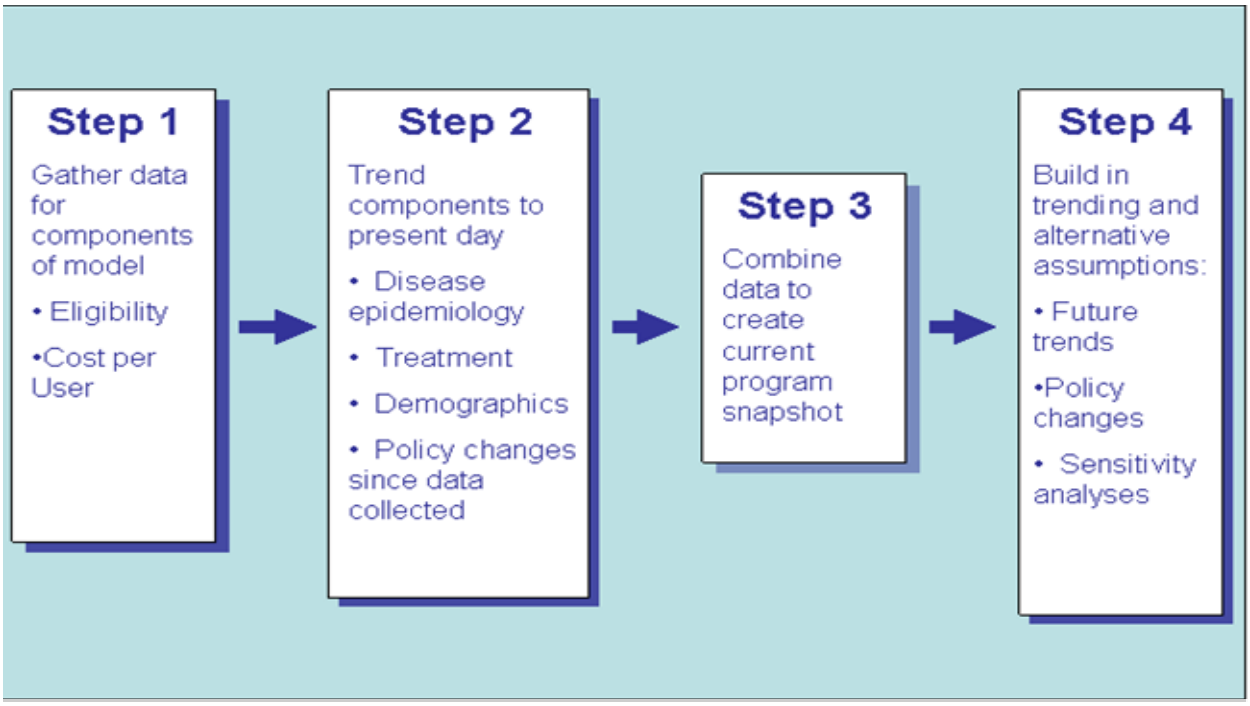
- CDC HIV/AIDS surveillance data – This will provide State-level estimates of the number of individuals with HIV and with AIDS, to use as benchmarks.

- Expert opinion and peer-reviewed articles - The model would also rely on assumptions derived from the literature or from expert opinion.

B. Four Steps of Modeling

It is helpful to think of the modeling task as a four-step process (see ***Figure 1***). The first step is to gather the data that will serve as the component parts of the model. Data will come from a variety of sources and will represent different years. The second step is to trend each component forward to today. The third step is to actually assemble the model, combining the component parts to produce baseline estimates of current program use and spending. The fourth step is to build in assumptions that allow the model to provide projections into the future and to provide estimates under alternative assumptions. These could be changes to program policy (e.g., the impact of limiting coverage in all States to individuals with an AIDS diagnosis), expected changes in the HIV/AIDS therapeutics and treatment models (e.g., the impact of the introduction of a new drug therapy), or sensitivity analyses around certain model assumptions (e.g., the impact of alternative assumptions about severity of illness in the ADAP population). Section IV describes the steps involved in the modeling process.

Figure 1. Four Steps of Modeling



C. Model Mechanics

The proposed modeling approach would be easiest to implement as a "microsimulation model." That is, the database that would produce the estimates would contain person-level data (i.e., one record represents an individual) that includes the individual's socioeconomic and demographic characteristics, as well as health and utilization information. Each record would be weighted to match the total ADAP population by key characteristics in each State. This approach will allow for the most flexibility when modeling alternative scenarios and performing sensitivity analyses. The micro-level data can then be aggregated to produce national level estimates of users and costs.

V. DATA AND ASSUMPTIONS BY MODEL COMPONENT

This section summarizes the various steps of the model, describing the data and assumptions required for each component, and the process required for combining the data statistically.

A. Components of the Model

Exhibit A-1 in the Appendix describes the components required to construct a model of ADAP spending that is based on available historical data. This section focuses on the sources of data and the assumptions required in order to combine that data, and ignores the issue of making the data current or trending the data into the future. Though the framework relies on a complex combination of a variety of data sources, the model can be distilled into two key elements: the number of people using ADAP benefits and the average cost per user. Every component of the model described in Exhibit A-1 contributes to one of these two key elements. These components include:

- **Number of Users**
    - State population
    - State HIV prevalence by income, AIDS prevalence by income
    - Income and resources relative to ADAP limits
    - Income and resources relative to Medicaid limits
    - HIV/AIDS status relative to ADAP clinical eligibility criteria

- **Cost per User**
    - Average ARV spending per ADAP enrollee by class
    - Relationship between disease severity and ARV spending
    - Relationship between income and disease severity
    - Average OI spending per ADAP enrollee
    - Average Other Rx spending per ADAP enrollee

In developing the model and its data components, it will be important to carefully define ADAP users. While an individual may be enrolled in a State ADAP, they make not use ADAP benefits throughout a year. For the purposes of the model, custom runs from selected State ADAPs will be assessed to determine the impact on the model of including all enrolled clients versus an adjusted "active client" figure that accounts for clients that are enrolled but do not use ADAP benefits throughout a year.

Section C describes how these data will be combined to model enrollment and spending.

B. Trending Components to Present Day

The components of the model will be trended to the present day where necessary using the following assumptions:

- HIV/AIDS Population – We will assume the prevalence of HIV and AIDS grows at historic rates estimated from CDC surveillance data.[1]
- ADAP Program Policies – We will reflect major changes in State ADAP eligibility or coverage policies occurring since the reporting year of the latest ADAP policy data.
- Medicaid Program Policies – We will reflect major changes in States' Medicaid eligibility or coverage policies occurring since the CPS data used in the Lewin Medicaid Eligibility Model.
- ADAP Enrollment – We will assume that participation and turnover rates remain unchanged from he time data were collected.
- Drug Utilization – We will assume that the distribution of spending by drug class remains as reported.
- Drug Prices – We will trend drug prices forward based on recent trends derived from the Red Book and from ADAP quarterly reports.

C. Combining Data to Create Current Program Snapshot

1. Number of ADAP Users

We propose producing separate estimates of the size of the ADAP population in each state based on disease epidemiology and population characteristics. These estimates will serve as a point of comparison to historical ADAP enrollment counts and may provide insight into the reasons for waiting lists in some states.

To estimate potential ADAP enrollment, we need to consider both financial and epidemiological criteria for eligibility. Further, we need to be able to take into account State-by-State variation in these two sets of criteria. While good sources of data exist for both of these pieces (more on this below), there is no single data source that includes both the economic and disease aspects *and* can be considered representative at the State-level.

For this reason, we intend to statistically *combine* separate data sets to create a hybrid data source that incorporates both types of data elements. This is an established practice in the modeling/simulation field.[2] The idea is to impute *expected HIV positive status* to individual records in a database that includes financial and other characteristics. Expected HIV status is

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[1] See http://www.cdc.gov/hiv/stats/hasrsupp.HTM .

[2] See, for example, McNally and Wolf (1996) @ http://www-cpr.maxwell.syr.edu/microsim/micro2ab.htm or Alecxih and Foreman (2002) @ http://www.quintiles.com/NR/rdonlyres/emtnm5wtnlnjholfylm4a56zvat5cghtyvjyuef7pnmmjd5d5joimgwbvlnetnva2vs2ncjxok7fyj/HCBSToolmethodology.pdf .

simply the conditional probability that an individual would be HIV positive, given their age, sex, race, state of residence, and various economic measures.

The epidemiological component of the hybrid database would be drawn from two sources: the 1996-97 HIV Cost and Services Utilization Study (HCSUS)[3] and Centers for Disease Control (CDC) surveillance data. HCSUS data would be used to determine the relationship between HIV positive status and a variety of demographic ("X") and economic ("Y") factors, or $P(H_i \mid X_i, Y_i)$. We will be implicitly assuming that the breakdown of HIV prevalence among different population groups have not changed significantly since the time of the HCSUS study. Where this assumption appears tenuous (e.g. in the case of minority women) we will rely on expert opinion and more recent CDC data to recalibrate the HCSUS weights. These "first-take" probabilities would be calibrated to the CDC's State-specific estimates of the number of people living with HIV to produce demographic-, economic-, and State-specific HIV prevalence rates, or $P(H_i \mid X_i, Y_i, S_i)$. The same approach would be used to impute an AIDS diagnosis status to individual records. This would allow us to model State ADAP restrictions on HAART access that depend on the progress of the disease. The file would then be reweighted to match State-level estimates of HIV and AIDS cases from the CDC.

ADAP eligibility will then be modeled using the financial component of our hybrid database, which is based on three years of the most recent March Supplement to the CPS.[4] This annual survey measures income and employment variables and is representative at the State level. However, there is the added wrinkle that financial eligibility for ADAP funding depends also on the State's rules for Medicaid eligibility. That is, individuals with income or resources below Medicaid's eligibility limits will qualify for Medicaid, and would therefore not require ADAP.

While Medicaid eligibility these rules are notoriously difficult to model, we have an advantage in that The Lewin Group has already developed a State-level Medicaid Eligibility Model based on March CPS input data. Minor adjustments to this model would allow us to produce a modified March CPS data set that estimates Medicaid *and* ADAP eligibility at the individual level. We would then need to make some assumptions about the availability of private insurance among the ADAP-eligible population.

We would combine these two data sets by using the Medicaid Eligibility Model (modified CPS) data as a base, and then applying the highly specific prevalence rates derived from the HCSUS and CDC data to each individual record. The final data set will thus include data elements on demographics, State of residence, eligibility for Medicaid and ADAPs (determined with reference to state rules), and the individual's probability of being HIV positive.

2. Program Spending per User

Because the standards of treatment for HIV/AIDS are rapidly evolving, it will be important to have the most recent possible data on utilization and expenditures for HIV treatment. While the HCSUS has excellent information on these data elements, even the latest wave of the survey is

[3] An overview of the HCSUS is available at http://www.ahcpr.gov/data/hcsus.htm .
[4] The most recent March CPS survey that is currently available is from March 2002. Details on the survey are available at http://www.bls.census.gov/cps/ads/adsmain.htm .

now more than five years old. Moreover, ADAPs receive significant rebates and/or discounts from manufacturers, meaning that drug price data from other sources may not accurately reflect what ADAPs are spending.

For these reasons, we believe the model should draw heavily from utilization and expenditure data from the ADAPs themselves. For the baseline historical estimates, then, we need only calculate the average spending per user from the most recently available ADAP reports. We note here that per-user spending varies widely by State ADAPs. HAB may question what drives these differences and to what degree these difference are warranted. This issue is discussed in the section on alternative scenarios and sensitivity analyses. Trends over time in pricing will be handled through adjustments described in the section on near term projections below.

3. Output: Expected Annual State and National ADAP Spending

Having estimated the size of the user population and the average spending per user, straightforward multiplication produces our estimate of total spending. As described above, the model would perform these calculations for each record in a person-level dataset. Thus, each person in the file will have a weight (indicating the number of people he or she represents), a set of probabilities (values between 0 and 1 – for example, the probability of using ADAP), and a potential spending amount. Thus, an individual's expected ADAP spending can be calculated as:

$$E(SPENDING_i) = E(ARV_i) + E(OI_i)$$

$$E(ARV_i) = P(H_i \mid X_i, Y_i, S_i) * A_i * (1-M_i) * F(ARV \mid S_i) * E(ARV_i \mid H_i=1)$$

$$E(OI_i) = P(H_i \mid X_i, Y_i, S_i) * A_i * (1-M_i) * F(OI \mid S_i) * E(OI_i \mid H_i=1)$$

where:

- P(Hi|Xi,Yi,Si) is the individual probability (between 0 and 1) of being HIV positive, conditional on demographic factors (X), economic factors (Y), and state of residence (S).
- Ai is a binary dummy variable that equals 1 if the individual would be eligible for the ADAP in their state, and equals 0 otherwise.
- Mi is a binary dummy variable that equals 1 if the individual would be eligible for the Medicaid program in their state, and equals 0 otherwise.
- F(*|Si) is a binary dummy variable that equals 1 if the individual's state of residence covers that class of drugs under their formulary and equals 0 otherwise. We expect that F(ARV|S) will be 1 for all states (except, in some cases, those States that restrict access to ARV drugs to those below a certain CD4 count). F(OI|S) will be 0 for those few State ADAPs that do not cover drugs for opportunistic infections (IO).[5]

[5] Because most State ADAPs cover *some*, but neither all nor none, of the OI drugs, we will investigate whether accounting for the relative generosity of OI drug formularies would add value to this analysis.

- E(*|Hi=1) is simply the expected annual per capita ARV or OI expenditures that the individual would incur if he or she were HIV positive and enrolled in his or her State ADAP and the program covered that class of drugs).

To obtain State-level total ADAP drug expenditure amounts, we will sum across all State residents' *expected* spending, as follows:

$$E(\text{SPENDING IN STATE "s"}) = \sum_{\text{all } i: S_i = s} E(SPENDING_i)$$

D. Projections for the Near Term

Exhibit A-2 in the Appendix describes the assumptions required to trend the components of the model forward from the State the data were collected to the present time. We plan to project State and national enrollment and spending estimates forward a maximum of four years. As mentioned above, the pace of medical research and the development of treatment options make projecting much further into the future an exercise in guesswork. In this section, we lay out proposed assumptions for trending forward each of the elements of the model described above.

- General Population – The general State populations will increase at the growth rates projected by the US Census Bureau by age, sex, and race.[6]
- HIV/AIDS Population – The prevalence of HIV and AIDS will grow at historic rates estimated from CDC surveillance data.[7]
- ADAP Policies – We will assume for our baseline projections that ADAP eligibility and formulary policies remain unchanged going forward (unless in those cases where we know a change is forthcoming). However, we will still be able to alter these assumptions to investigate alternative future policies.
- Medicaid Program Policies – Again, we will assume that State Medicaid policies remain constant going forward. These assumptions may be changed as one of the policy levers to investigate the effects of alternative Medicaid policies on ADAP enrollment and expenditures.
- ADAP Enrollment – We assume that take-up and turnover rates remain unchanged in the near term.
- Drug Utilization – As a base case, we will assume that the distribution of spending by drug class remains constant.
- Drug Prices – We will compare HIV/AIDS drug price inflation trends from the Red Book and from ADAP quarterly reports to derive appropriate assumptions.

[6] See http://www.census.gov/population/www/projections/stproj.html .
[7] See http://www.cdc.gov/hiv/stats/hasrsupp.HTM .

E. Alternative Scenarios and Sensitivity Analyses

Much of the power of the proposed model lies in its ability to accommodate alternative assumptions about enrollment, spending, or some of the key assumptions that underlie them. The following components of the model could be modified to produce estimates of policy changes, alternative trends, or changes in underlying assumptions (see ***Exhibit A-3*** in Appendix):

- Increasing HIV or AIDS prevalence – Straightforward change to prevalence rate or rate of growth over time.
- Alternative financial eligibility criteria for ADAP – Straightforward change to criteria specified for "Medicaid Eligibility Model" portion of model.
- Changes in Medicaid eligibility criteria - Straightforward change to criteria specified for "Medicaid Eligibility Model" portion of model.
- Alternative clinical eligibility for ADAP – Model would have only limited clinical information about enrollees, primarily HIV and AIDS diagnosis. We could build in distribution by CD4 count if required, based on literature and HCSUS.
- Expanded outreach (which would increase enrollment) – Would require an assumption about the expected effect of outreach on enrollment, based most likely on evidence from demonstration programs.
- Changes in treatment patterns – One way to model alternative treatment patterns would be to use alternative assumptions about the distribution of ADAP users by intensity of use (i.e., number of ARVs in regimen), based on the range of alternatives observed in the ADAP data. For example, the model could report the impact of having the highest intensity use in all State ADAPs.
- Changes to discount/rebates – To estimate the impact of changes to pricing levels, we will develop a discount score for each drug class for each state based on the price levels observed in the ADAP quarterly reports. These scores can then be modified to model changes (e.g., to the lowest pricing levels observed).
- Changes to level of generosity of ADAP formulary and other restrictions (e.g., prior authorization) – As with drug pricing, we will develop a drug availability score based on the spending distribution by drug class, adjusted for price differences by the pricing level factor.

VI. LIMITATIONS

Several important limitations to the proposed approach should be noted:

Modeling Issues

- **Uncertainty –** The future is inherently uncertain. Science, public policy, and epidemiology are all changing in the HIV/AIDS field, and in ways that we cannot predict. We will use historical trends and the "best guesses" of experts to model the future, but projections should still be taken with a healthy dose of skepticism. Even the estimates for the current year are just that--estimates. Because there is a gap between when the model data was collected and the present, we will need to invoke assumptions, guesses, and historical trends to produce even the "baseline present day" numbers.
- **Necessary Simplification –** Our model, even after attempts to account for the variation in State ADAP and Medicaid programs, will remain a somewhat stylized and simplified representation that ignores some of the specifics of each State's policies. For example, we do not intend to model any cost differences incurred by States purchasing insurance premiums for ADAP clients, but will instead model expenditures as though the clients were insured directly through ADAP. Moreover, as discussed above, we expect State Medicaid and State ADAPs to change their policies over time, and to do so endogenously, in response to some of the other model elements (e.g. unexpectedly high enrollment).

Data Issues

- **Old or poorly reported data –** The model inherits the weaknesses of the data used for its component parts. For example, if ADAP data under-report expenditures for OI drugs, the model will do the same. In some cases, we are aware that the data have weaknesses, but are left with few alternative sources. The HCSUS, for example, is the only national source of microdata regarding people with HIV/AIDS and our only opportunity to link HIV infection with socio-economic status. There is concern among members of our team and other researchers, however, that the HCSUS sample is somewhat skewed toward people in the middle and later stages of the disease in relatively optimal systems of care. In these cases, we intend to use alternative data (which are less detailed) in order to benchmark results from suspect sources and to minimize these types of bias.
- **Lack of data –** With some model elements, there are no impaired data with limitations, but rather no data at all. In these cases, we will be forced to use assumptions drawn from similar situations or the "best guesses" of experts. For example, no data exist on the take-up rate of ADAP benefits among those who are eligible for the program. Diffusion rates for new therapeutics are also not available, limiting our ability to model the likely impact of newly introduced medications on future ADAP spending.
- **Lack of sufficient detail –** In some other cases, the data that exist do not allow us to provide output numbers at the level of detail that HAB might desire, but rather force us to adopt a "reduced form" strategy. For example, it is highly unlikely that we will be able to predict the number of units of Combivir or Viracept that a particular ADAP will use in 2004. Rather, we will be confined to reporting the total expenditures on ARV drugs.

On a technical level, it should be pointed out that bottom-up models like the one proposed in this document do not lend themselves well to estimates of uncertainty about their outputs. This is because each of the individual model components is essentially an uncertain statistic, with its own standard error and confidence intervals. Once these various components are combined (often in a non-linear fashion) and benchmarked to other estimates (which are often themselves uncertain) it becomes very difficult to compute the degree of uncertainty inherent in the final outputs. While it is often possible to recover estimates of this uncertainty, the process is usually arduous and intensive computationally.

APPENDIX

Exhibit A-1: Combining Model Components, for Given State

Number of Users

Step	Model Element	Explanation	Data Source	Caveats
1	State Population		Source: Pooled CPS microdata, 2000-02	
2	HIV Population			
	HIV prevalence by income	Assign each person in database a probability of HIV based on multivariate equation that includes income, age, race, sex, etc.	Source: HCSUS	HCSUS data are old and sample is skewed. Need to augment with other data. May be able to re-weight based on income, race, age using Census and other data.
	Calibrate to match CDC totals	Ensures that prevalence rates are current	CDC data for reporting states, CDC estimates for non-reporting states	Prevalence of known HIV increasing due to new diagnostic tools and outreach. CDC estimates for estimating non-reporting states may be low.
3	AIDS Population			
	AIDS prevalence by income	Assign each person in database a probability of AIDS based on multivariate equation that includes income, age, race, sex, etc.	Source: HCSUS	HCSUS data are old and sample is skewed (see above)
	Calibrate to match CDC totals	Ensures that prevalence rates are current	CDC data	
4	ADAP Eligibles			
	Falls below ADAP income/resource limits	Apply eligibility rules to individuals using Lewin Medicaid Eligibility Simulation Model database, but modifying criteria to reflect ADAP.	Lewin model uses pooled CPS data 2000-2002.	Will need to ensure latest Medicaid eligibility rules are reflected.
	Falls above Medicaid income and resource limits	Lewin Medicaid Eligibility Simulation Model, and Medicaid prevalence in underlying CPS data, to determine number meeting financial criteria	Lewin model uses pooled CPS data 2000-2002.	Model incorporates an adjustment for Medicaid underreporting in CPS.
	Meets ADAP Clinical Eligibility Criteria	AIDS diagnosis, HIV diagnosis, or something else	Latest ADAP Monitoring Report	May be difficult to operationalize if other than AIDS or HIV.
5	ADAP Users			
	Enrollment rate	Need assumption for % eligible that enroll.	As a guide, compare modeled # eligible to actual enrollment by state.	May require sensitivity analysis.
	Percent of Year Using	Need assumption for average proportion of year enrolled	Assumed	Medicaid eligibility model currently assumes average turnover. AIDS population on Medicaid probably has much lower turnover.
6	ADAP users by "intensity of use"	Distribution by # ARVs in treatment regimen (as a proxy for disease severity), to account for differential costs	ADAP data	

Exhibit A-1: Combining Model Components, for Given State (Continued)

Program Costs per User

Step	Model Element	Explanation	Data Source	Caveats
9 ▲	Adjustments for supplemental funding from states	Remove portion contributed by state	ADAP Monitoring Report	
8	Title I funding shift			
	Average ARV spending	Average spending by class of ARVs (PI, NRTI, etc) for each "severity" group (i.e., patients on 3 ARVs, 4 ARVs, etc.) Need some assumption for joint distribution of types of drugs used and severity of illness, in order for model to accommodate assumed changes in severity or treatment.	HCSUS probably too outdated. Data from selected State ADAP data systems would be better. Calibrate to spending and user subtotals from ADAP data.	Tricky because spending distribution by type of ARV depends on relative discounts and drug utilization review as well as severity of disease. (Note: We do not propose building in CD4 data directly because no ADAP benchmark available.)
	Average OI spending	ADAP OI drug spending divided by all ADAP enrollees in state	ADAP data	We use simple approach for OI drugs because they account for a relatively small proportion of total drug spending. Note that this approach assumes OI prevalence remains fixed regardless of changes in available treatment for or epidemiology of HIV/AIDS. (Hepatitis C treatment may affect this)
	Average Other spending	ADAP other drug spending divided by all ADAP enrollees in state	ADAP data	We use simple approach for other drugs because they account for a very small proportion of total drug spending.
7	Average ADAP Rx Spending per enrollee			Note: We rely here on ADAP reporting, which reflects existing discounts/rebates, utilization review, formularies, etc. If these data cannot be used for a state, a proxy might be constructed using a state's "generosity score" based on their formulary and other information, and a “discount score” based on pricing levels observed in ADAP quarterly pricing data.

Exhibit A-2: Baseline Near Term Projections, for Given State

	Step	Baseline Today Model Element	Trending Assumptions	Data Source	Caveats
Number of Users	1	State Population	Reflect expected trends in age, race, etc.	Census projections	Demographics will play a very small role.
	2	HIV Population	Assume steady prevalence of HIV		
		HIV prevalence by income			
		Calibrate to match CDC totals			
	3	AIDS Population	Assume steady prevalence of AIDS		
		AIDS prevalence by income			
		Calibrate to match CDC totals			
	4	ADAP Eligibles			
		Falls below ADAP income/resource limits	Assume income and assets grow by real wage growth		
		Falls above Medicaid income and resource limits			
		Meets ADAP Clinical Eligibility Criteria			
	5	ADAP Users			
		Enrollment rate			
		% of Year Using			
	6	ADAP users by "intensity of use"			
Program Costs per User	9	Adjustments for supplemental funding from states			
	8	Title I funding shift			
		Average ARV spending	Reflect expected/known changes in state's generosity w/r/t ARVs	Create generosity scores for all 50 states based on historical per capita spending and/or Hidalgo paper. Can move between generosity levels and assume associated relative change in spending level. Similarly, produce discount level score based on ADAP pricing data.	
		Average OI spending	Reflect expected/know n changes in state's generosity w/r/t OI drugs.	Same	Probably not worth developing elaborate assumptions because dollars are relatively small.
		Average Other spending	Reflect expected/know n changes in state's generosity w/r/t Other drugs.	Same	Keep simple because dollars are very small, even for states with very large formularies.
		Pricing levels	Price levels per class grow at recent historical rates	ADAP pricing data, industry pricing trends	
	7	Average ADAP Rx Spending per enrollee			

Exhibit A-3: Alternative Near-Term Projections and Sensitivity Analysis, for Given State

	Step	Baseline Today Model Element	Trending Assumptions	Data Source	Caveats
Number of Users	1	State Population			
	2	HIV Population	Increasing HIV prevalence		
		HIV prevalence by income			
		Calibrate to match CDC totals			
	3	AIDS Population	Increasing AIDS prevalence		
		AIDS prevalence by income			
		Calibrate to match CDC totals			
	4	ADAP Eligibles			
		Falls below ADAP income/resource limits	Alternative financial eligibility for ADAP		
		Falls above Medicaid income and resource limits	Changes in Medicaid eligibility criteria		
		Meets ADAP Clinical Eligibility Criteria	Alternative clinical eligibility for ADAP		
	5	ADAP Users			
		Enrollment rate	Expanded outreach	Demonstrations	
		% of Year Using			
	6	ADAP users by "intensity of use"	Sensitivity analyses		
Program Costs per User	9	Adjustments for supplemental funding from states			
	8	Title I funding shift			
		Average ARV spending	Alternative assumptions for discounts/rebates, program generosity		
		Average OI spending	Same		
		Average Other spending	Same		
		Pricing Levels	Alternative assumptions for price growth within class of ARV		
	7	Average ADAP Rx Spending per enrollee	Sensitivity analyses		