

**Quick Start Guides for  
Estimation and Projection Package  
and Spectrum  
2009**

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**Part I. Overview of estimates and projections tools**

**Part II. Quick start guide for Estimations and Projections Package**

**Part III. Quick start guide for Spectrum**

# **Part I. Overview of estimates and projections tools**

## **I. Introduction**

### **A. Purpose of estimation and projection tools**

A well planned response to the HIV epidemic requires specific information on the projection of the disease over time. This projection needs to be based on previous measures of prevalence in the population as well as data from programs on their effectiveness and coverage.

UNAIDS and partners have developed software to assist countries to map their HIV epidemic and determine the consequences of the epidemic. Consequences such as number of people living with HIV, number of new infections, number of pregnant women infected with HIV, mortality due to AIDS and treatment needs are all provided from these programs. From these data countries can estimate their potential service and pharmaceutical needs, can plan for health care service requirements, and can get a general understanding of the overall impact of their response.

### **B. Reference Group on Estimates, Modeling and Projections**

The computer programs are informed by a Reference Group of experts from multiple disciplines and institutions. These experts include epidemiologists, demographers, clinicians, modelers, as well as implementers from countries with different types of epidemics. The functions and assumptions used in the models are based on the recommendations of this Reference Group. The Reference Group meets at least annually and updates the software every two years. For more information on the reference group go to [www.epidem.org](http://www.epidem.org).

### **C. Processes to create estimates and projections**

Every two years UNAIDS and partners hold regional trainings to explain new features and review the computer programs with country epidemiologists. Country teams usually consist of individuals from the national programs who have a strong capacity for epidemiology and modeling and may include development partners who work on HIV surveillance in the country. These teams work in groups at the trainings to update the estimates with the country's most recent surveillance and programme data. As a result, the country is able to use the software to estimate and project the future consequences of the epidemic for the country.

After the regional trainings, countries are expected to refine and share the outcomes with other interested parties in the country. Once the models are completed the country provides the final results to UNAIDS headquarters to inform the regional and global estimates of HIV. Countries are encouraged to create estimates and projections reports for their individual countries and to communicate the results to a broad spectrum of potential users of the data.

### **D. Different types of epidemics**

There are significant variations in HIV epidemics around the world. Different epidemics require different types of surveillance and modeling techniques. UNAIDS uses the following classifications to differentiate types of epidemics:

### **Generalised Epidemic**

- HIV is firmly established in the general population.
- Although sub-populations with higher risk may continue to contribute disproportionately to the spread of HIV, sexual networking in the general population is sufficient to sustain an epidemic independent of subpopulations at higher risk for infection.
- Numerical proxy: HIV prevalence is consistently over 1% in pregnant women.

In generalised epidemics, the prevalence among pregnant women is usually a fairly good indicator of prevalence in the total adult population. Prevalence is usually higher in urban areas than in rural areas. Therefore, most countries with generalised epidemics can be modeled using two distinct sub-populations (an urban population and a rural population).

### **Concentrated Epidemic**

- HIV has spread rapidly in at least one defined sub-population, but is not well-established in the general population. Most often more than one subpopulation with higher risk is affected.
- This epidemic state usually suggests active networks of risk exist within and between the sub-populations.
- Numerical proxy: HIV prevalence is consistently over 5% in at least one defined subpopulation. HIV prevalence is below 1% in pregnant women in urban areas.

In concentrated and low-level (low prevalence) epidemics HIV infection is primarily concentrated in certain sub-populations. Therefore, countries with concentrated epidemics are usually modeled by combining epidemic curves for several subpopulations.

The different types of epidemics also determines which computer programmes are necessary for modeling the epidemic and how to use those programmes.

## **II. Data Required for Estimation and Projection**

The quality and accuracy of the estimates depend on the quality and accuracy of the data used for the models. If very little information is available on HIV prevalence in the country the model will rely heavily on assumptions used in the model. On the other hand, countries which have conducted routine surveillance and covered groups which are most important to the epidemic will be able to inform the models with substantial data resulting in high quality estimates and projections.

In generalised epidemics, data from sentinel surveillance sites at antenatal clinics (ANC) are required. Data from population based surveys are also very useful for informing the models. The models are able to utilize data to distinguish urban and rural epidemics or different regional epidemics.

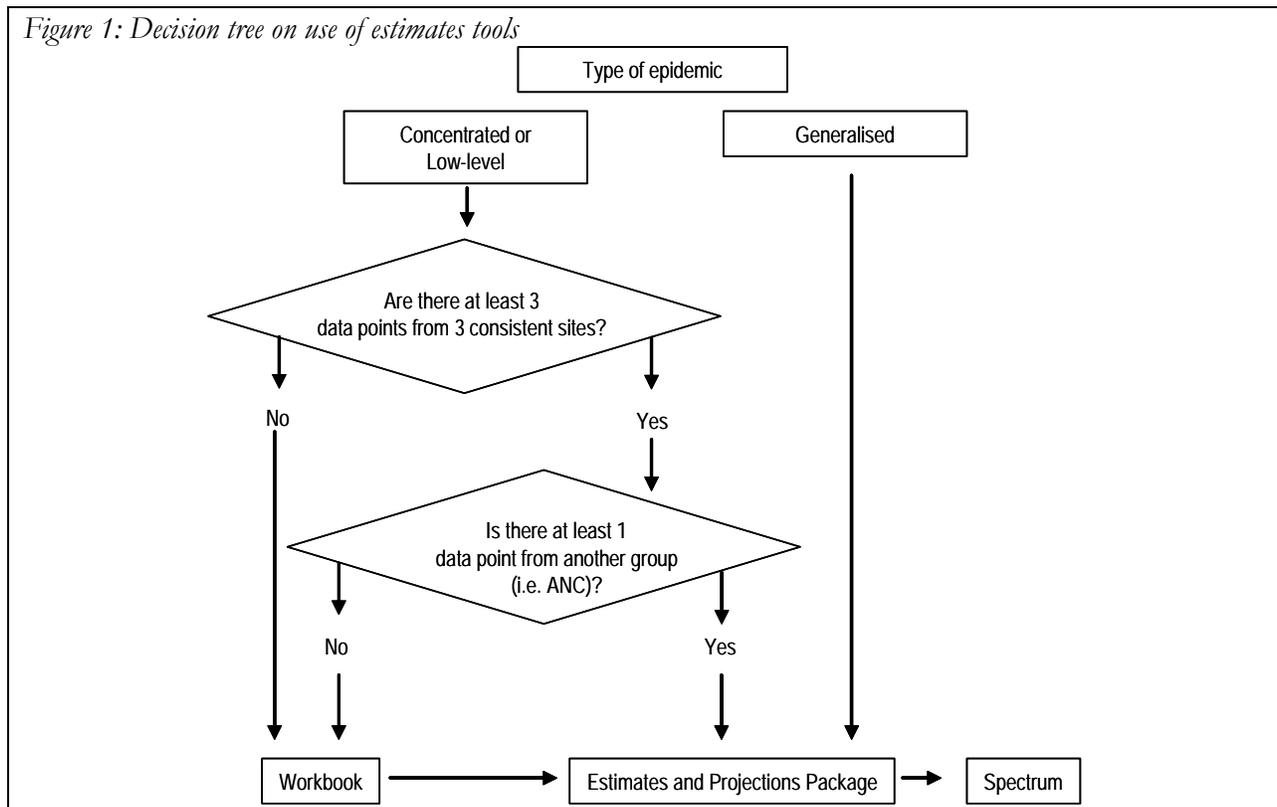
In concentrated epidemics more specific information is required about the populations that are at increased risk to HIV. The software separates the epidemic into sub-populations. However the user must have information on each of the sub-populations that are used in the epidemic structure. For example if a country specifies female sex workers and injecting drug users as important risk categories they will be required to enter data for those two sub-populations and the remaining general population. Data required for each sub-population include estimates of the population size, HIV surveillance data from the group over time, and estimates of the numbers in those groups on ART.

For all epidemic types, the software requires additional programme data on the number of people on ARVs, the number of women receiving ARVs for prophylaxis (PMTCT) and other demographic and epidemiological information to determine the impact of HIV.

If there are no recent data on HIV prevalence available in the country then no estimate should be created.

### III. Computer Programmes for Estimation and Projection

Three computer programmes are available to model the HIV epidemic for countries. The Estimates and Projections Package (EPP) is used to generate an epidemic curve. The curve generated in EPP is then imported into Spectrum to estimate the impact of HIV in the country. All countries will use both of these software programs. If a country with a concentrated or low-level epidemic has very little data it may necessary to use Workbook. The Workbook programme will generate an HIV point prevalence estimate for a given year. This should be repeated for several years; these prevalence estimates are then used in EPP to generate an epidemic curve. (See figure below.)



## Part II. Quick Start Guide for the Estimation and Projection Package (EPP)

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## Overview of EPP

The Estimation and Projections Package (EPP) creates an HIV epidemic curve based on the available data from a country. If the country has a generalised epidemic, data from surveillance at antenatal clinics (ANC) and any national surveys are used. If the country has a concentrated or low-level epidemic, surveillance data from the sub-populations that are at increased risk to HIV are used.

This guide provides the user with a quick summary of how to use EPP. Complete manuals for EPP for concentrated epidemics and EPP for generalised epidemics are available on the UNAIDS website [www.unaids.org](http://www.unaids.org) and should be read for a more detailed understanding of the software. In this section of the Quick Start Guide the instructions for generalised epidemic countries are separated from those for concentrated or low epidemics as necessary. If the same instructions apply to all types of epidemics no differentiation is made.

If a country does not have enough data to utilize EPP, creating a point prevalence estimate should be calculated through Workbook, using current and historical data. Instructions for using Workbook are in the Workbook manual at [http://www.unaids.org/en/KnowledgeCentre/HIVData/Epidemiology/epi\\_software2007.asp](http://www.unaids.org/en/KnowledgeCentre/HIVData/Epidemiology/epi_software2007.asp)

EPP can be downloaded from the UNAIDS website. Once the install programme is downloaded, double click on the programme icon and it will install the programme for you.

### Step 1: Create a workset

The first page of EPP allows you to create a new workset or use an existing workset. Unless you are using an existing workset that you created with EPP 2009 you should create a new workset. (Even if you used EPP 2007 to create a workset previously it is best to start a new workset for EPP 2009.)

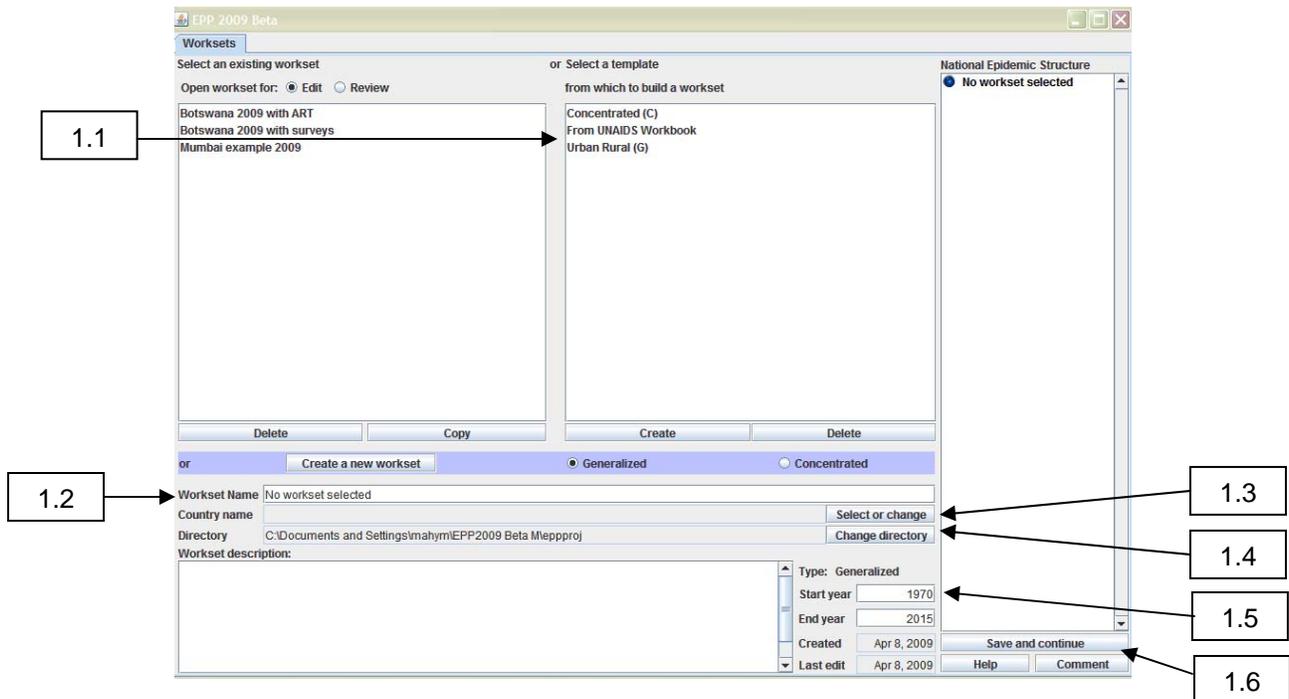
- 1.1 Select a workset template. On this page of EPP you will also define the epidemic structure of the country by selecting an appropriate template. (If none of the templates is appropriate for your country you can also create a new template. See the manual for additional instructions.) There are three template options: Generalised (urban/rural), Concentrated and From UNAIDS Workbook.
  - If a previously estimated prevalence is more than 1% or if ANC prevalence is more than 1% then use the Generalised template (also called the urban/rural template).
  - If prevalence is less than 1% and there are 3 or more data points from consistent surveillance sites, then use the Concentrated template.
  - In concentrated and low level epidemics, if there are less than 3 data points from consistent surveillance sites for sub-populations at increased risk to HIV, then use the Workbook template. (As described earlier, you will need to derive point prevalence estimates for several years using Workbook and then will enter those into EPP to generate a curve.)

**Tip:** In countries with well documented concentrated epidemics in which HIV in the general population has increased beyond 1% (such as, Russia, Ukraine, Myanmar, Thailand), the concentrated epidemic template should continue to be used.

- 1.2 Give the workset a name
- 1.3 Select the country to which the workset applies.

- 1.4 If needed, adjust the location of where your EPP files will be stored. Take note of where the EPP files are being stored. This will be important when using the files to make the Spectrum projection. By default the files are stored under C:\Documents and Settings\username\EPP 2009\EPPproj
- 1.5 Check the start and end date. In most instances this should be 1970 and 2015. These start and end dates need to be the same as those used for the associated Spectrum projection.
- 1.6 Press “Save and continue”

**Tip:** Be sure that when you save and continue that the correct template is selected. Otherwise you will have to go back and restart.



## Step 2: Define the epidemic structure

### Generalised epidemics:

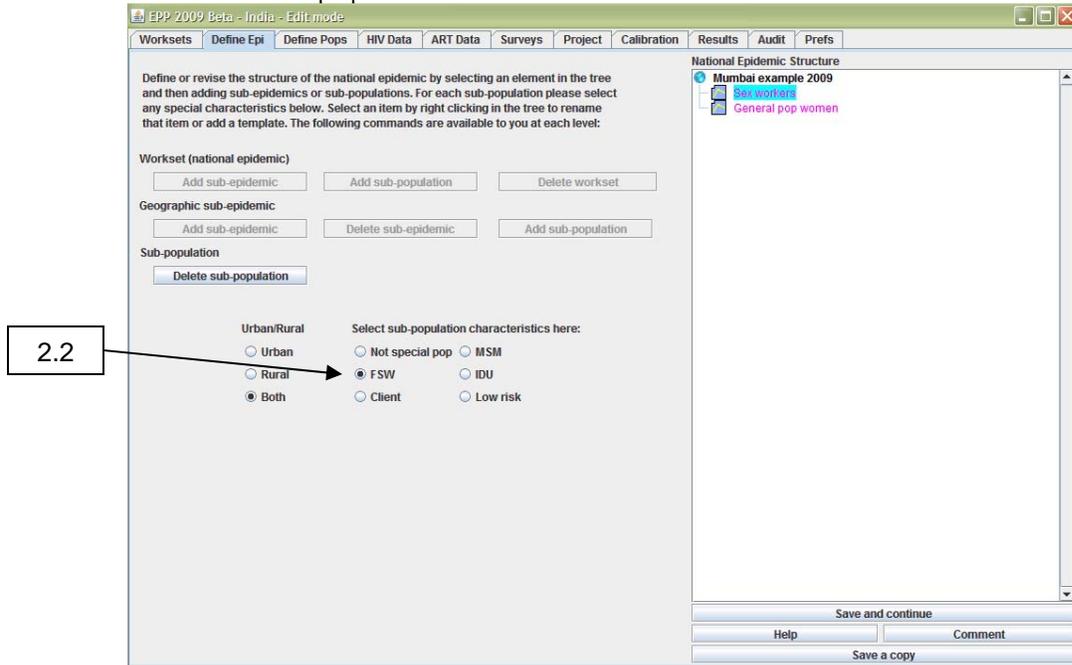
For many countries with generalised epidemics, one urban and one rural sub-population are sufficient to describe the epidemic. Alternatively you could create sub-epidemics by region if there were significant differences in regions of the country (see the manual for a full description). If no variations are needed then simply keep the default settings which characterize the urban sub-population as urban and the rural sub-population as rural.

### Concentrated epidemics:

For concentrated epidemics it is important to ensure that each sub-population is assigned the appropriate characteristics.

- 2.1 Highlight the sub-population in the epidemic structure.
- 2.2 Click on the characteristic of that sub-population (for examples sex workers should be “FSW” and the “General pop women” should be “low risk”).
- 2.3 Repeat this for each sub-population

**Tip:** Only create sub-epidemics if you have data on the populations within those sub-epidemics. Data required includes population size, HIV prevalence data, and proportion of those on ART which come from this sub-population.



### Step 3: Define the populations

This page allows you to define the size of each sub-population. At the top of the page is the total number of persons 15 years and older in the population (based on the UN Population Division estimates). You must assign all of this population to different groups within the epidemic structure.

#### Generalised epidemic:

In a generalised epidemic, using the urban/rural structure, you would define the number of the adult population in urban areas and the number of the adult population in rural areas.

- 3.1 Select the sub-population (rural or urban) in the epidemic structure tree
- 3.2 Enter the number of adults in that population. This number can be calculated based on the proportion urban calculated in the UN Pop Division statistics. This value is available on the CD provided at the training workshops.
- 3.3 Once you have entered the number of the urban adult population click “Save and continue” which will take you to the next sub-population. Repeat these steps until you have entered population data for each of the groups. Check to see that the “population still to assign” is 0. The software will not let you continue until the “population still to assign” is equal to 0.

#### Concentrated epidemics:

For concentrated epidemics this page is more challenging. Estimates of the number of persons in each sub-population are needed. In addition information is required on the proportion of the sub-population that is male and the average duration an individual stays in this sub-population. For most of these populations, the default values for the demographic characteristics should be used. Finally there is a button to designate whether there is turnover in this sub-population.

- 3.1 Select the sub-population (sex workers, MSM, IDU, etc) in the epidemic structure tree.
- 3.2 Enter the estimated population size for that sub-population

**Box 1. Estimates of the size of key populations at increased risk to HIV (For low and concentrated epidemics)**

Ideally, the estimates of the size of key populations should be based on data from the country itself. In cases where there are no data available it is possible to borrow information from neighboring countries. Below are some tips on estimating population sizes.

Consider applying the percent of the population with increased risk to HIV (for example MSM or IDU) to only the urban population if these behaviours are relatively rare in the rural populations. Similarly, consider using a smaller percent when applying percent of rural population that are sex workers and clients of sex workers.

Also it is important to carefully review the assumptions about whether prevalence measured in a sub-population in one location is generalisable to that entire sub-population. For example is HIV prevalence among IDU in the capital city generalisable to IDU in rural areas. If there is evidence of subgroups within the key population at increased risk which might have different HIV prevalence, then consider splitting the epidemic structure per these subgroups (for example by regions within the country).

For clients of sex workers, consider using higher estimates than those available from DHS or other population-based surveys. The West African Modes of Transmission project suggests that estimates of client of sex workers are higher than the estimates from these surveys, when calculated on the basis of estimates of number of sex workers combined with data on number of clients reported by sex workers.

**Some estimates of population sizes by region**

(MSM and clients as % of male pop; FSW as % of female pop)

<b>Men having sex with men</b>		<b>High risk</b>		<b>Injecting drug users</b>	
E. Asia	3 – 5%	<2.8%		E. Europe and C. Asia	0.06 – 5.21%
S & SE Asia	6 – 12%	1.2-7.2%		Asia and the Pacific	0.021 – 1.33%
E. Europe	6 – 15%	1-5.5%		M East, N. Africa and sub-Saharan Africa	0.05 – 2.07%
Latin America	6 – 20%	0.8-4.8%		Latin America & Caribbean	0.29 – 1.15%
<b>Female sex workers</b>				<b>Clients of sex workers</b>	
Sub-Saharan Africa	0.4 – 4.3%			All	9 – 10%
Asia	0.2 – 2.6%			Central Africa	13 – 15%
Russian Federation	0.1 – 1.5%			Eastern and southern Africa	10 – 11%
E. Europe	0.4 – 1.4%			Asia	5 – 7%
W. Europe	0.1 – 1.4%			Latin America	5 – 7%
Latin America	0.2 – 7.4%				

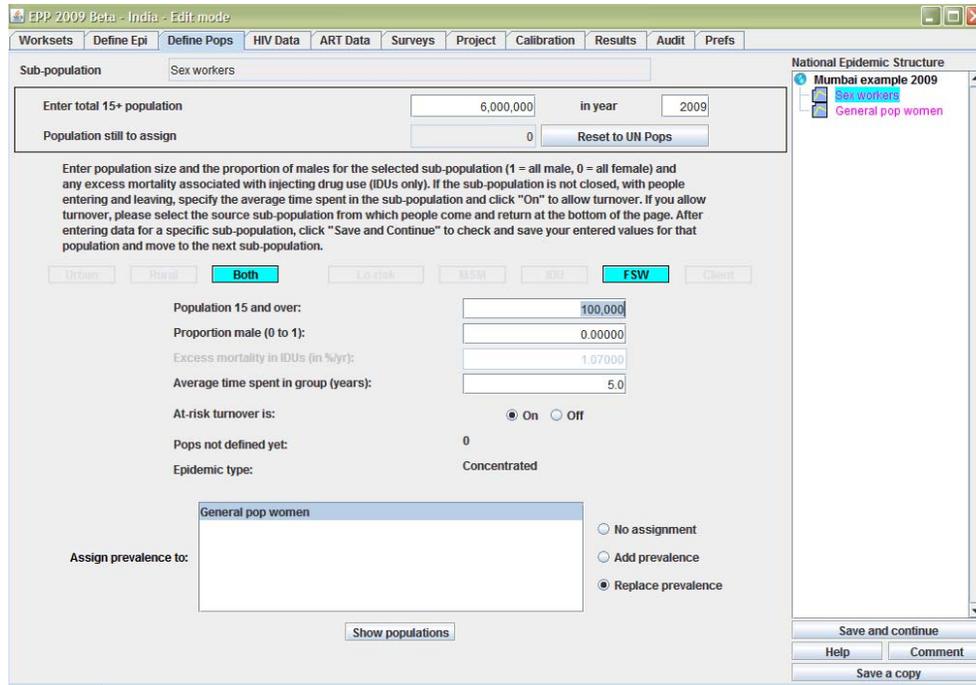
Source: Sexually Transmitted Infections, 2006 Jun; 82 (suppl)3; Mathers B et al Lancet 2008, 372:1733-1745.

- 3.3 Enter the estimated duration (in years) that a persons spends in that sub-population. This is used to determine the rate at which new members enter and old members leave the population. For example if it is set to 5 years, then 1/5 of the population must change every year, i.e., 20% of older members are replaced by newer ones. Sex workers in particular are known in most countries to have a short average duration (few years).
- 3.4 Indicate whether people are likely to move in and out of this sub-population. If you have evidence that there is a turnover in these groups (i.e. that sex workers move in and out of the sex work occupation) you should select the “on” button. Populations that are static such as the remaining populations will have no turnover.
- 3.5 In EPP 2009 there is a new feature that allows you to assign prevalence from the different sub-populations (a similar feature was on the calibration page of EPP 2007). This box will appear only for sub-populations where turnover has been selected. You need to specify where the population will go after “turnover”. Only populations without turnover will be available in the box.
- 3.6 You also need to determine whether to add the prevalence of each sub-population to the overall prevalence or to replace it. You should choose “add prevalence” if those who are HIV positive from the former at-risk group members are added to the HIV positive members of the target population. This means they have NOT been captured in surveillance. You will need to “replace prevalence” if some of the people who are HIV positive in the target population are assumed to come from the former at-risk populations. The remaining infections that occurred “within group” are calculated.

**Box 2. Examples of adding or replacing prevalence in concentrated epidemics**

*Replacing prevalence:* Suppose we have former sex workers who are detected in antenatal testing. If we fit the data to ANC prevalence, then some of the prevalence here is due to former sex workers and some is due to other sources of infection, e.g., husband-to-wife or boyfriend-girlfriend heterosexual transmission. Thus, the HIV infections among ex-sex workers replace some of the detected prevalence in ANC women. They do not increase the overall prevalence rate among ANC women, but they do mean that less transmission occurred through the other routes of transmission.

*Adding prevalence:* On the other hand men who injected drugs while young and then stopped are unlikely to be detected since we do not have routine surveillance in male populations. We do not detect these infections in our surveillance, but the infections are definitely still out there. We need to add these undetected infections into our total prevalence picture. For former male clients or injecting drug users then, we would want to add these additional infections into the overall prevalence in the male population.



## Step 4: Enter HIV data

Once the epidemic structure and populations have been defined it is time to enter the available HIV prevalence data. There is a separate data entry spreadsheet for each sub-population. When the page is initially open it only has one row (each row represents the data from one site).

- 4.1 Count the number of sites with data for the sub-population. Add rows on the data entry page by clicking on “Add sites” so that there is one row per site.
- 4.2 Enter the surveillance data: If the data are already available in a spreadsheet format it is easy to copy and paste the data into the workset. Copy and paste the site names into the far left column. Copy and paste the data into the page for that sub-population (e.g. for urban sites or for sex workers). When pasting the data, be sure that the years align correctly.
- 4.3 Press “Save and continue”. If you forget this step you will lose the data that you have pasted into the page! Enter the data for all of the remaining sub-populations using the same steps as above.

**Tip:** If the sample sizes for each site are not available change the “Display” variable to be “% HIV”. This will allow you to copy and paste just the prevalence information by site into the workset.

**Tip:** Prevalence estimates should be entered as whole numbers not as percentages. So prevalence of 12% should be entered as 12, not as 0.12.

**Tip:** Be sure the boxes on the left corner are ticked. If they are not ticked the site will not be included in the fitting of the model.

Year	In	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
MEDIAN PREV							6.00	8.00	10.30	26.76	27.80	34.15	37.60	38.44		
MEAN PREV							6.00	9.00	19.20	26.75	28.17	34.15	37.43	38.45		
Jones town (%)	<input checked="" type="checkbox"/>	-	-	-	-	-	-	9.00	23.70	34.30	29.70	39.60	42.10	42.90		
(N)		-	-	-	-	-	-	300	300	300	300	300	300	300		
Smith town (%)	<input checked="" type="checkbox"/>	-	-	-	-	-	6.00	-	14.90	19.20	27.80	28.70	31.40	34.00		
(N)		-	-	-	-	-	300	-	300	300	300	300	300	300		
Capital city (%)	<input checked="" type="checkbox"/>	-	-	-	-	-	-	-	-	-	27.00	-	37.00	-		
(N)		-	-	-	-	-	-	-	-	-	300	-	300	-		

### Step 5: Enter ART data

EPP 2009 takes into consideration the effect of increasing coverage of anti-retroviral therapy on the epidemic curve. Thus data on ART coverage needs to be included in the EPP software.

- 5.1 The ART data page first requires the user to describe the current policy on ART provision in the country. Users should choose whether national guidelines call for ART treatment for individuals with CD4 levels < 200 or CD4 levels < 350.
- 5.2 By default values are provided for survival through the first year on ART (including the survival of those lost to follow-up). These values should only be adjusted if data are available from your country, otherwise, use the default value.
- 5.3 National adult ART coverage is the estimated percent of the adult population in need of ART who are receiving ART (by first line and second line therapy). Projected ART coverage should be entered through the end of the projection period based on the most realistic expectations and national targets.

**Tip:** You can create a linear projection of ART coverage using the “Project ART” button at the bottom of the page. To use this option first fill in the target ART coverage values for the last year of the projection. This needs to be done for each sub-population and for 1<sup>st</sup> and 2<sup>nd</sup> line therapy. Click on “Project ART”. In the window that pops up, select the first year from which you wish to project ART coverage (the final year is always the final year in the projection). EPP will fill in the number according to your target using a linear interpolation.

- 5.4 To improve the projected impact of ART you need to specify ART coverage for each sub-population. For generalised epidemics this means you need to identify which portion of the population on ART is from an urban setting versus a rural setting. In a concentrated epidemic you need to estimate which proportion of the individuals receiving ART are sex workers, IDU, etc. A best estimate is appropriate until more accurate data are available. Using the buttons at the bottom of the screen you can determine whether to enter coverage as a percent of the total number on ART or as a number. These proportions need to be entered for the population on 1<sup>st</sup> line therapy and the population on 2<sup>nd</sup> line therapy.

**Tip:** You can not move on from this page until the values in the row titled “Still to be assigned among sub-populations” is equal to 0 across all the years in the projection.

### Box 3. Tips for estimating ART coverage by sub-population in generalised epidemics

Few countries currently have data on ART coverage by sub-populations. In cases where ART data are not yet collected in a format which can be disaggregated by urban and rural (or by sex workers, IDU or MSM), estimates should be made based on the best available information.

For generalised epidemics the following issues should be considered:

- prevalence of HIV in urban vs. rural settings
- proportion of the population living in urban vs. rural settings
- coverage of ART services in urban vs. rural settings
- proportion of individuals going to urban clinics for ART who are from rural settings

For example in many countries urban HIV prevalence is higher than in rural areas. However the rural population is much larger than the urban population. On the other hand, ART services might not have reached the rural areas thus keeping ART coverage low, however despite this some persons residing in rural areas will take the initiative to go to an urban clinic to get treatment.

Some countries have chosen a fixed ratio of urban ART coverage versus rural ART coverage (such as 70% urban and 30% rural). Other countries have hypothesized that rural coverage has increased over time (from 0% coverage in rural areas in the early 2000s and moving toward 50% by 2010). Determining these values will depend largely on the roll out of ART in your country and the distribution of HIV infections in your country. Once you have completed the EPP projection view the “ART Results” on the Results page. If coverage goes above 100% in some sub-populations consider revising the distribution of ART coverage among the sub-populations and then rerunning the projection.

## Step 6: Enter survey data

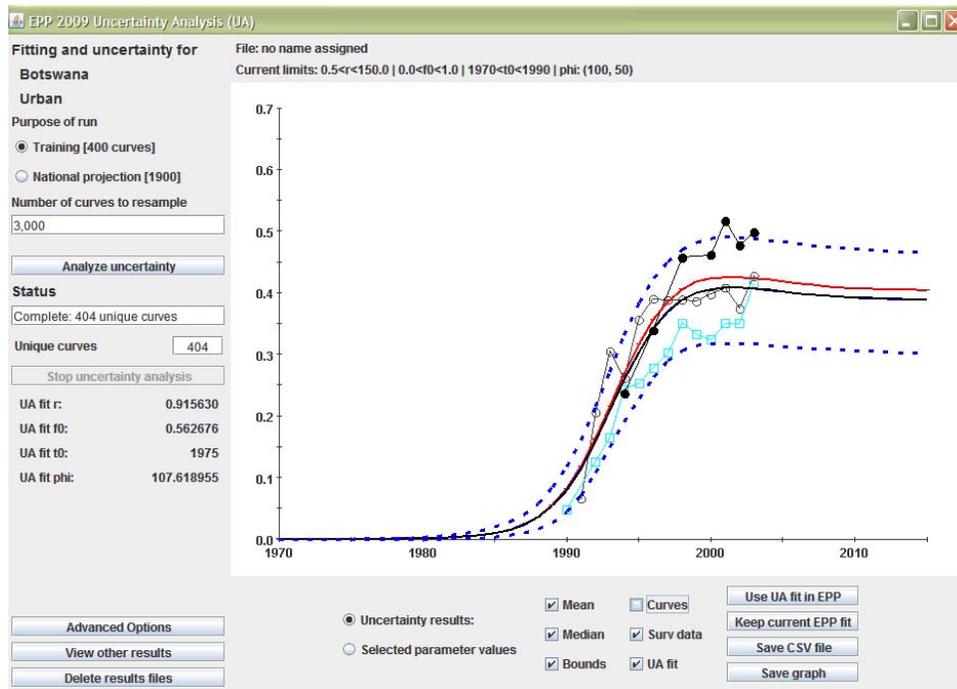
If your country has collected HIV prevalence in a national population based survey you can add those data here to inform your curve. Data can be entered for up to 3 surveys. Be sure to include the prevalence, survey year, standard error, and the sample size for the survey. In some surveys the HIV prevalence results from national population based surveys can be biased because of persons refusing to take part in the survey or persons who are absent from the household at the time of the survey. Many surveys thus publish an estimate of HIV prevalence adjusted for any non-response bias. These adjusted values are available on the training workshop CD or in the published reports. HIV prevalence values which have been adjusted for non-response should be used in the EPP model.

If your country does not have HIV prevalence data from a national population survey, click on the button labeled “Do not include any surveys in the fitting process”.

## Step 7: Project the curve

On this page the data entered in the previous pages are used to create an HIV epidemic curve and to analyze the uncertainty around that curve.

- 7.1 To produce an initial curve, click on “assess uncertainty” which will bring you to the uncertainty page.
- 7.2 If you are running the model as an exercise, click the “Training” button under “Purpose of run” a smaller number of curves will be calculated (400). If you are running the model as your final country estimation, click “For national projection” under “Purpose of run” which will increase the number of curves to 1,900. This number of curves will take about 10 minutes to run (depending on the computer capacity).
- 7.3 From there press “analyse uncertainty” to produce a curve.
- 7.4 Review the curve. The best fitting UA curve will be shown as a red line while the 95% confidence intervals will be shown as blue dashed lines. The black curve represents the median and the blue curve the mean of the number of curves that have been fitted in the uncertainty analysis.
- 7.4 If you are satisfied with the fit choose “Save UA fit” and move on to fitting a curve for the next sub-population. You will be prompted to save the uncertainty results file associated with each sub-population. This file with extension .bm2 will be saved in a sub-directory “resample results” in the directory C:\Documents and Settings\username\EPP2009\epout
- 7.5 If you are not satisfied with the curve you can use the advance options to constrain the curves. For example if there is little data for early on in the epidemic, EPP will often allow the curves to grow very quickly at the start of the epidemic. This can be constrained by limiting the prevalence in 1980 to <5% (or some appropriate value). In addition on the project page it is possible to choose the phi shift option which allows the model to adjust in later years. (See the manual for additional guidance)



## Step 8: Calibrate the curve

On the Calibration tab EPP 2009 allows you to calibrate the curve based on additional data sources.

### Generalised epidemics:

On this page you are able to adjust the curves based on any national population based survey data that you have entered. If you have had one or more national surveys then you can use all of the data from those surveys. Alternatively you could use the most recent survey if it better represents HIV prevalence than the earlier survey.

If you have not had a national population based survey then leave the default setting on “Adjust the results to global defaults for urban/rural bias in surveillance data”. This shifts urban and rural prevalence down to 80% of the original value based on evidence from numerous surveys that ANC surveillance overestimates adult HIV prevalence.

Once completed you should click on “Save and continue”

### Concentrated epidemics:

The calibration page gives you the option of specifying either an expected prevalence in a given year or a scale factor for each individual sub-population.

To use the calibration section:

- 8.1 Select the sub-population you wish to scale in the list of sub-populations shown
- 8.2 Select one of the options
  - No adjustment
  - Scale the results up or down by a factor of \_\_\_\_\_. This will adjust prevalence in this sub-population by the factor entered. (See box 4 below.)

- Adjust HIV prevalence to a value of \_\_\_\_ in year \_\_\_\_\_. Enter the desired prevalence level and the year in which that prevalence is to be achieved. EPP 2009 will then automatically calculate and apply the scaling factor for you.

8.5 Select another sub-population if you wish to do more adjustments.

#### **Box 4. Adjusting prevalence for the “remaining population” (low risk populations)**

ANC prevalence can represent the remaining female population. However, when using surveillance data from ANC to describe the remaining female population the ANC estimate needs to be adjusted because women attending ANC are likely to have higher HIV prevalence because of biases in the geographic selection of antenatal clinics in the sentinel surveillance as well as a bias in the age of women attending ANC versus women in the general population. Comparing data available from ANC against HIV prevalence coming from population based surveys in 12 low and concentrated epidemic countries (or states), show that on average, HIV prevalence among all women was 60 percent of that measured in ANC prevalence. Thus a proposed adjustment value for women in the remaining population of **0.6** is required when assigning the ANC data to the remaining female population. The option “Scale HIV by factor of” should be chosen and 0.6 should be entered into the cell.

For men a similar analysis showed that the scale of HIV prevalence in the remaining male population is approximately 0.5 of ANC prevalence. Thus the adjustment from ANC data to men in the general population should be **0.5**. (Note that these adjustments are based on a small number of countries.)

If prevalence is available from a population-based survey (e.g. India, Cambodia, Dominican Republic, Senegal, or Mali) use the survey results to calibrate the general population prevalence.

Where universal PMTCT is standard practice (as in Russian Federation, Thailand, among others) it is possible to use these data to also inform the prevalence among the female remaining population. However it is important to standardize the data coming from the PMTCT system to the age structure of the general female population. Similarly if there are data on men from a universal service, such as mandatory military service, (which does not increase their risk to HIV) these data can also be used to inform prevalence among the male remaining population.

## **Step 9: Population change**

### **Generalised epidemics:**

Over time the proportion of the population living in urban areas has been changing in most countries. To reflect that in the model you can click on “Adjust to UN values” and the proportion of the adult population that is urban for every year of the projection will be incorporated into the model. These proportions come from the UN Population Division.

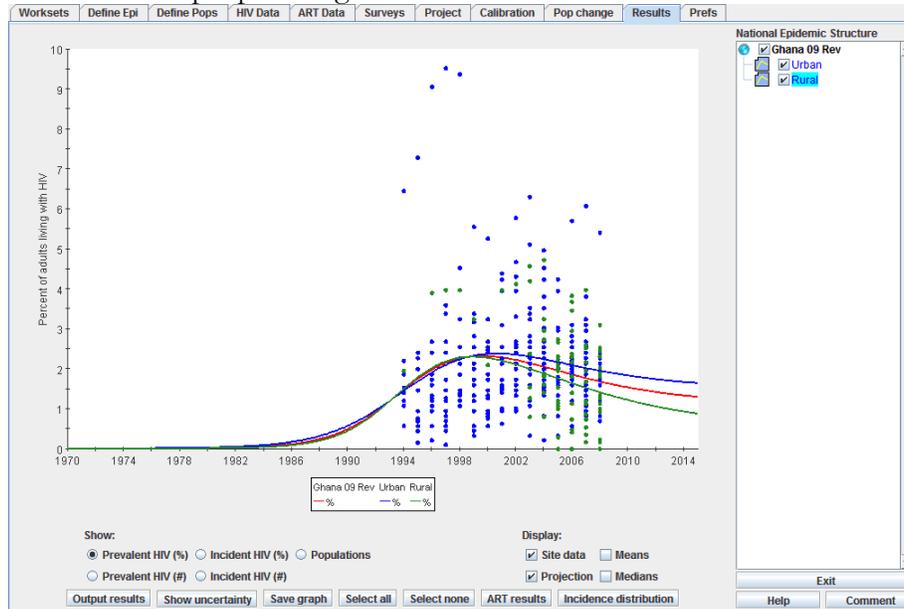
If there are more recent data than the UN Population Division values, or if you want to create a fixed ratio over the years of the projection, the percent urban and percent rural can be entered for each year of the projection period. The value on the “still to be assigned among sub-populations” must equal 0 for each year before you are able to save and continue.

### **Concentrated epidemics:**

In EPP 2009 there is no population change page for concentrated epidemics.

## Step 10: Review results

By clicking on each of the populations (national and sub-populations) on the review page you can see the associated HIV prevalence or incidence curves. In addition you can see the number of new infections or the number of people living with HIV.



To examine the results as a table, click the “Output results” button below the graph. To write the results to a file that can be read by Spectrum, click the “Write Spectrum File” button that is visible when you are looking at the table format of the results. You will be requested to enter the name of the file, which will end in an “.spt” extension. The file will be saved in the directory C:\Documents and Settings\username\EPP2009\epout.

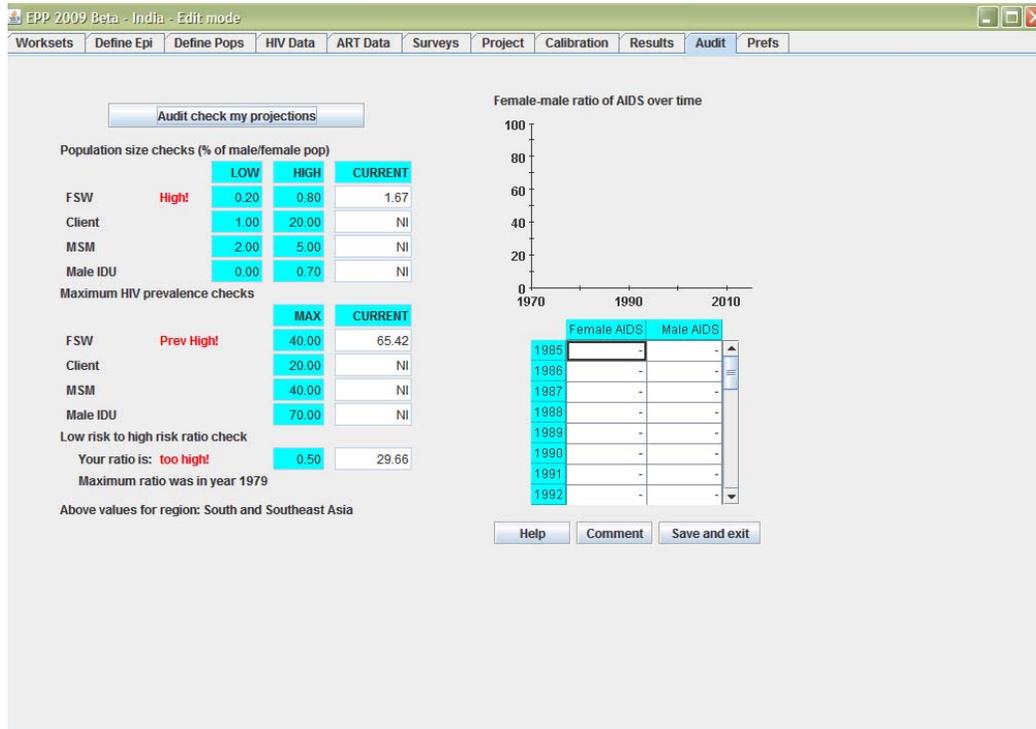
Next, you can view the national uncertainty results (for generalized epidemics only) by clicking “Show uncertainty”. From this screen you can save a \*.spu uncertainty file for use in Spectrum by clicking “Save Spectrum uncertainty file”. The file will be saved in the directory C:\Documents and Settings\username\EPP2009\epout.

Finally it is useful to look at the ART results by clicking on the ART results button. This provides information on the coverage of ART entered in your model and allows you to see whether your targets have exceeded the number in need for the different sub-populations. It is important to keep in mind that EPP is just fitting a curve for you. The results from this page should not be taken as coverage values. Once the data are imported into Spectrum more accurate demographic variables are applied and the correct estimates of coverage are provided.

A new feature in EPP 2009 is the ability to see the distribution of new infections by sub-population. This is done by clicking the button labeled “Incidence distribution” on the Results page. A bar chart shows either the percentage of total incidence in each sub-population or the actual number of new infections in each sub-population. This will be especially informative for identifying the major sources of new infections in concentrated epidemics where incidence is distributed among at-risk populations.

## Step 11: Audit (for concentrated epidemics only)

In EPP 2009 for concentrated epidemic there is a final page which allows you to check some of the assumptions that were made in the projection. For example it checks your population sizes against observed values elsewhere in the model. It also looks at male versus female ratios of HIV prevalence to make sure they fall within expected bounds. When a value appears to be out of an appropriate range a note is made in red alerting you to a possible incorrect assumption or value.



## Preferences and file locations

The preferences tab is the last page in the EPP programme. It is strongly recommended that these preferences (except the language) only be changed by advanced users. These preferences must be set before you start any projection. If you change the preferences after creating a model all of the fits will be invalidated.

By default, the files related to EPP projections are saved in your EPP programme file C:\Documents and Settings\username\EPP2009.

- The file that describes the curve created in EPP has an “\*.epr” extension and is located in C:\Documents and Settings\username\EPP2009\eppproj.
- The uncertainty files with extension “\*.bm2” are saved in C:\Documents and Settings\username\EPP2009\epppout\resample results
- The files needed to import into Spectrum can be found in C:\Documents and Settings\username\EPP2009 \epppout. These include the .spt and .spu file (the .spu file is the output uncertainty file).

# Spectrum

## Quick Start Tutorial

April 2009



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## ***Introduction***

Spectrum is a policy modeling system. It contains modules for a number of reproductive health areas. For the purposes of making a national HIV estimate, two Spectrum modules are used: DemProj (for the demographic projection) and AIM for the epidemiological projection. This manual describes the basics of using these modules to make a national HIV estimate and projection. This tutorial just provides the minimum information needed to use Spectrum. Additional details are available in the manuals for these modules:

- Stover, John. ***DemProj. A computer program for making population projections.*** Washington, DC: USAID | Health Policy Initiative, March 2009.
- Stover, John. ***AIM. A computer program for making HIV/AIDS projections and examining the social and economic impacts of AIDS.*** Washington, DC: USAID | Health Policy Initiative, March 2009.

These manuals are available from the USAID | Health Policy Initiative, c/o Futures Group International, One Thomas Circle, Washington, DC 20005 or from the project web site at [www.HealthPolicyInitiative.com](http://www.HealthPolicyInitiative.com) (Select Software and Spectrum).

This Quick Start Manual describes how to:

- Create a demographic projection using data from the United Nations Population Division.
- Create an HIV/AIDS projection using data from EPP or the Projections Workbook.
- Display various HIV/AIDS indicators such as the number of people infected, the number of new infections, AIDS cases, AIDS deaths, the number of people needing ART and the number of orphans.

## ***Basic Steps in Using Spectrum***

### ***Step 1. Installing Spectrum***

The Spectrum program is distributed on CD-ROM and through the Internet at <http://www.HealthPolicyInitiative.com> or [www.FuturesInstitute.org](http://www.FuturesInstitute.org). Spectrum will run on any computer running Windows 95 or later Windows versions. It requires about 30MB of hard disk space.

To install Spectrum from a CD-ROM or from a file downloaded from the internet, just double click on the file named "SpecInstall.exe". This will start the installation program. Just follow the instructions on the screen to complete the installation.

If you have trouble installing Spectrum it may be that you do not have the appropriate permission to install programs on your computer. In that case you should contact your IT support office to do the installation for you.

### ***Step 2. Changing the language in Spectrum***

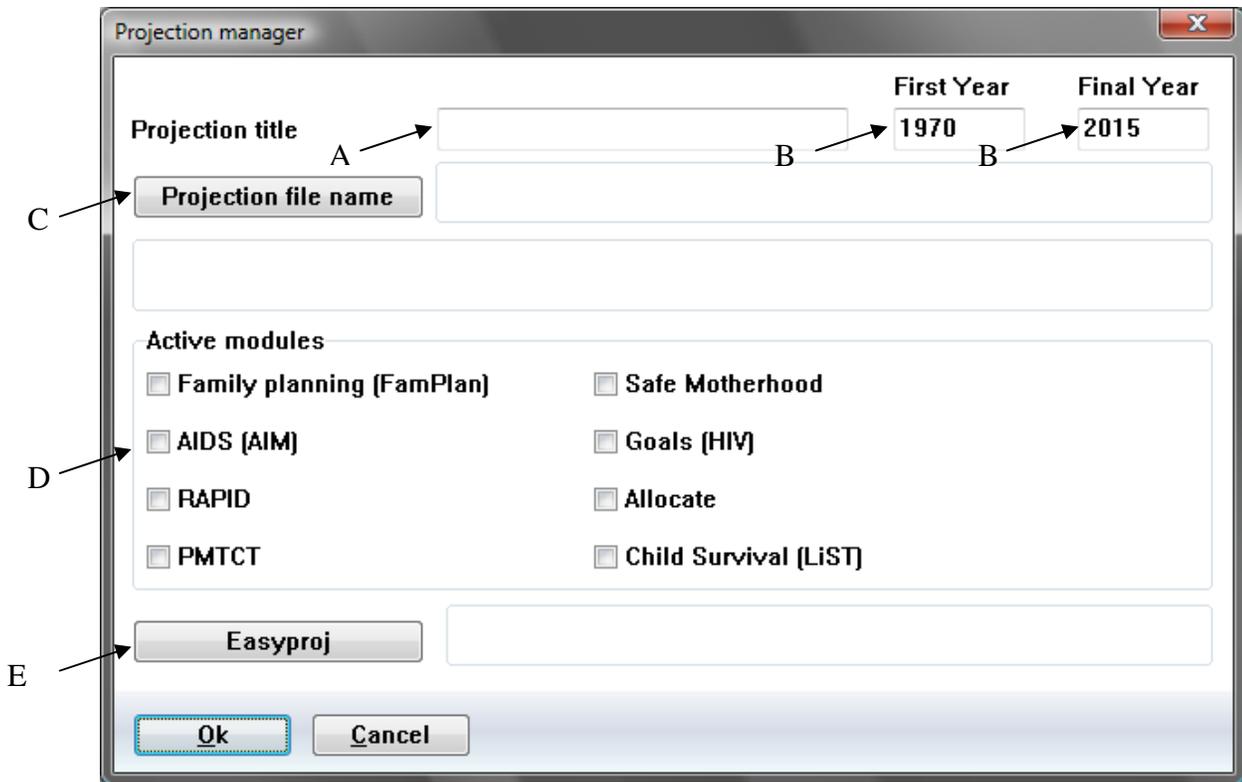
The first time you run Spectrum after installing it, all the displays will be in English. You can change to another language by selecting "Options" and "Environment" from the Spectrum menu. Then select the language you want to use and click on the "Ok" button. If you select a language other than French, Spanish or Portuguese, you must have the proper fonts or version of Windows to display the language correctly.

### ***Step 3. Start Spectrum***

Start the Spectrum program by selecting it from the "Start" menu on your computer.

### ***Step 4. Create a population projection***

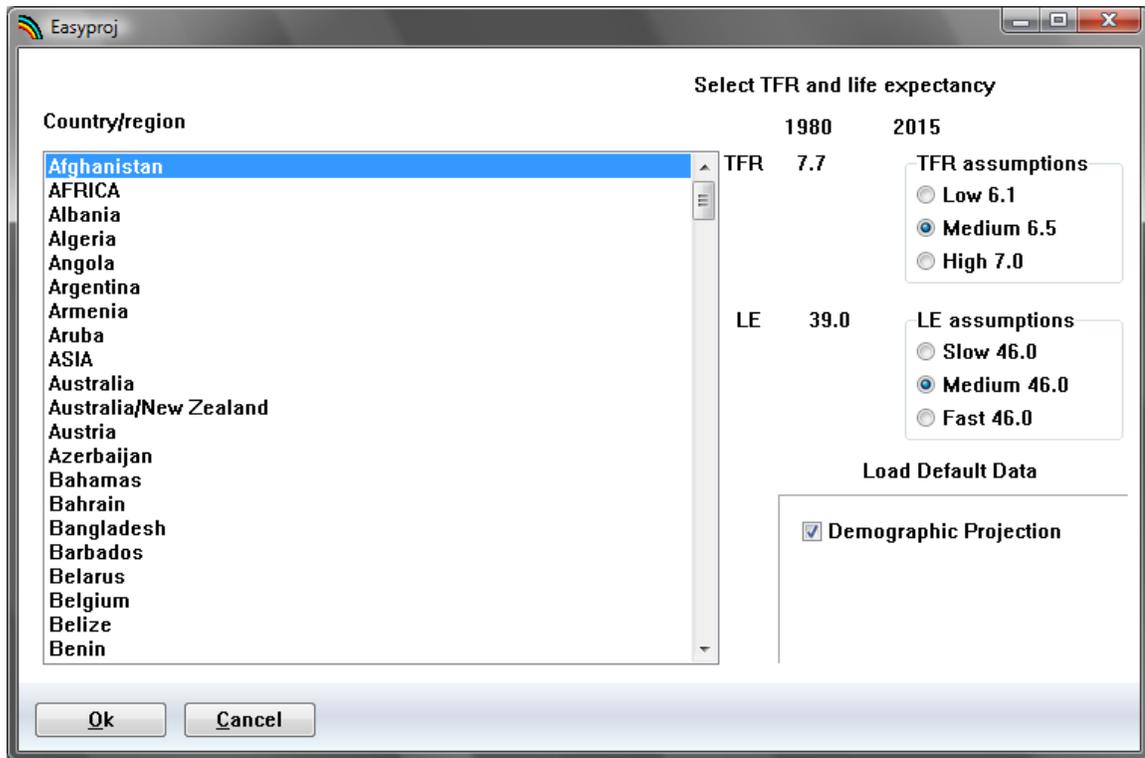
Create a new population projection by selecting "File" and "New projection" from the Spectrum menu. (If you start to start with a projection prepared in a previous version of Spectrum go to Step 11 below.) The "Projection manager" dialogue box will appear and will look like the following screen:



Follow these easy steps to complete the “Projection manager” screen:

- A. Click in the box next to “Projection title” and type a title for the projection.
- B. Set the “First year” to 1970 and the “Final year” to 2015.
- C. Click on the “Projection file name” button and enter a file name for this projection. (Be sure to select a location on the hard disk for the file and not on the CD-ROM since the program cannot write a file to the CD-ROM.)
- D. Click the check box next to “AIDS (AIM)” to add the AIM module to the program.

- E. Then click the “EasyProj” button. The EasyProj dialogue box will appear and will look like the following screen:

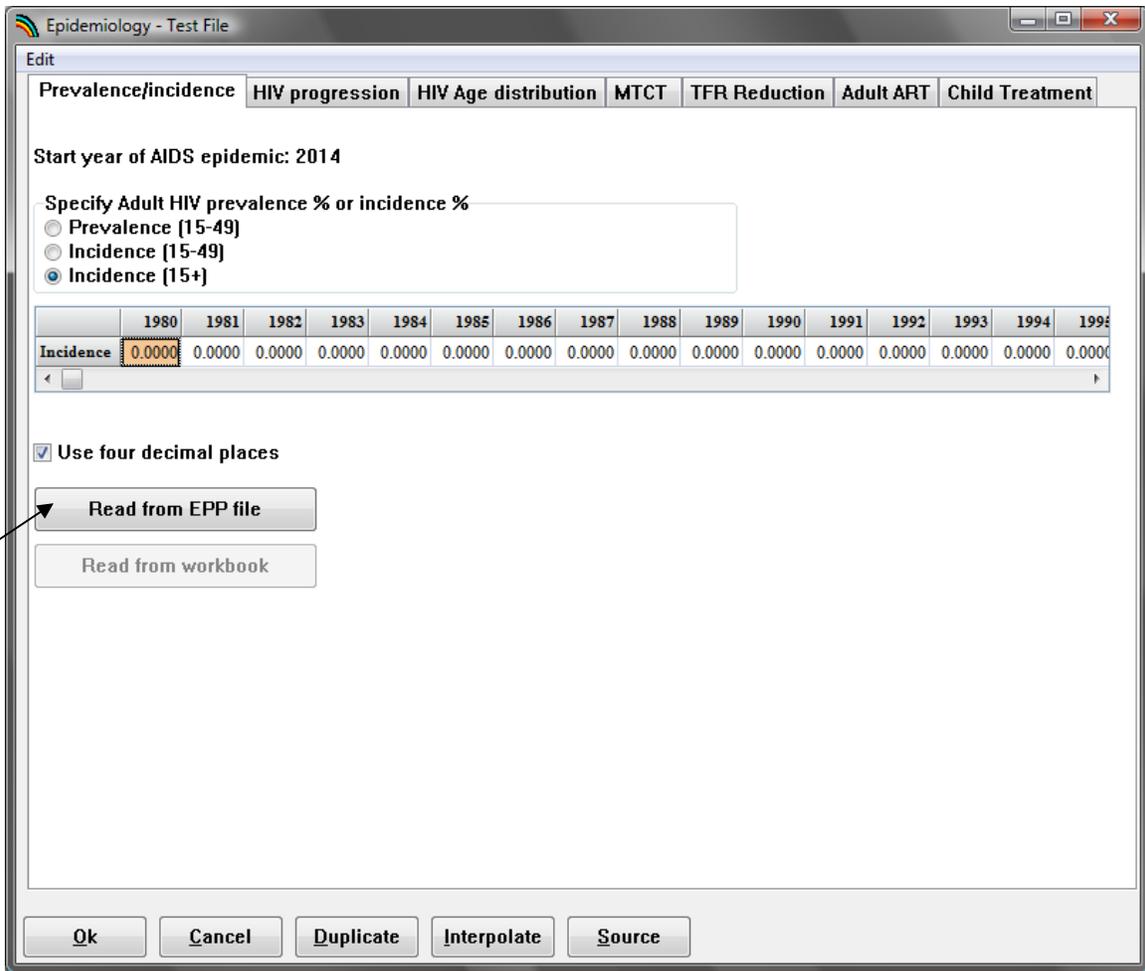


On the EasyProj screen scroll down the list of countries until you find yours. Highlight the country by clicking it once. Then select “OK” and “OK” again on the “Projection Manager” dialogue box and the program will load all the necessary demographic data.

### ***Step 5. Read the incidence trend from EPP***

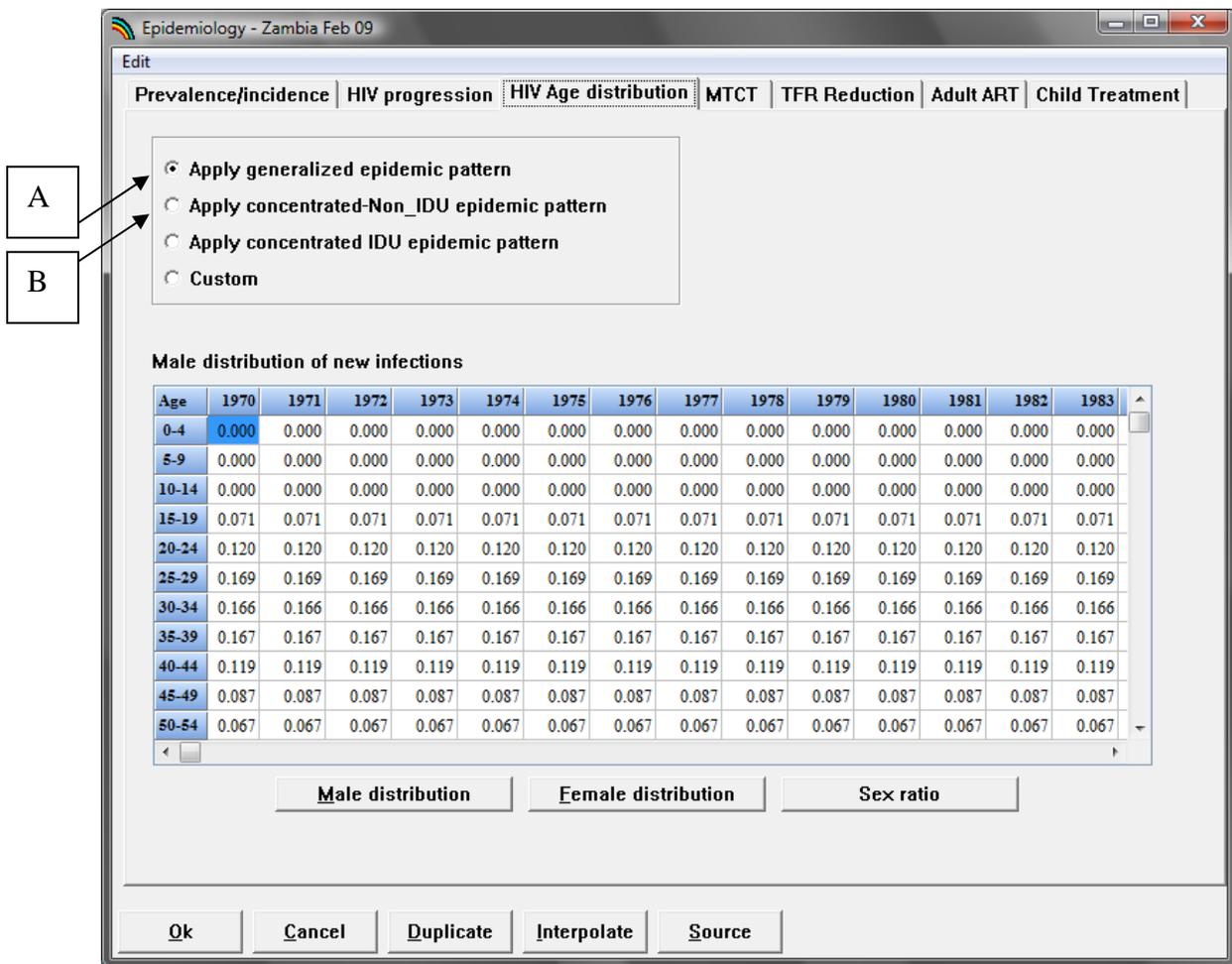
Select “Edit” and “AIDS (AIM)” from the Spectrum menu. Next, click “Epidemiology” from the dialog box. Then you will see the editor for the incidence trend. It will look like the screen shown below.

From this editor you can read the incidence trend that was prepared in EPP. Click the button “Read from EPP file” [A]. This will display a “file open” dialog box. Navigate to the directory where your EPP file is stored (for example C:\Program files\EPP 2009\epput), select the appropriate file and click “Open” to complete this step. The incidence projection from this file will be read into Spectrum and displayed in the editor.



***Step 6. Set the pattern of incidence by age and sex***

Select the tab “HIV Age distribution” and the following screen will appear. This editor shows the age distribution of new infections for males and females and the ratio of female to male incidence over time.



Here you have four options.

- A. If your country has a generalized epidemic you should click the button “Apply generalized epidemic pattern”. This will insert the default age and sex pattern for generalized epidemics.
- B. If your country has a low level or concentrated epidemic and is not driven by transmission among injecting drug users, you should click the button, “Apply concentrated non-IDU epidemic pattern”. This will insert the default age and sex pattern for low level and concentrated epidemics.
- C. If your country has a concentrated epidemic and is driven by transmission among injecting drug users, you should click the button, “Apply concentrated IDU epidemic pattern”. This will insert the default age and sex pattern for concentrated epidemics driven by IDU transmission.

## Step 7. Describe mother-to-child transmission

Select the tab “MTCT” and the following screen will appear:

Distribution of HIV+ pregnant women by treatment regimen

	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
<b>No prophylaxis</b>											
Percent	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
<b>Single dose nevirapine</b>											
Number	0	0	0	0	0	0	0	0	0	0	0
Percent	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<b>Dual ARV</b>											
Number	0	0	0	0	0	0	0	0	0	0	0
Percent	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<b>Triple ARV prophylaxis</b>											
Number	0	0	0	0	0	0	0	0	0	0	0
Percent	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<b>Triple ARV Treatment</b>											
Number	0	0	0	0	0	0	0	0	0	0	0

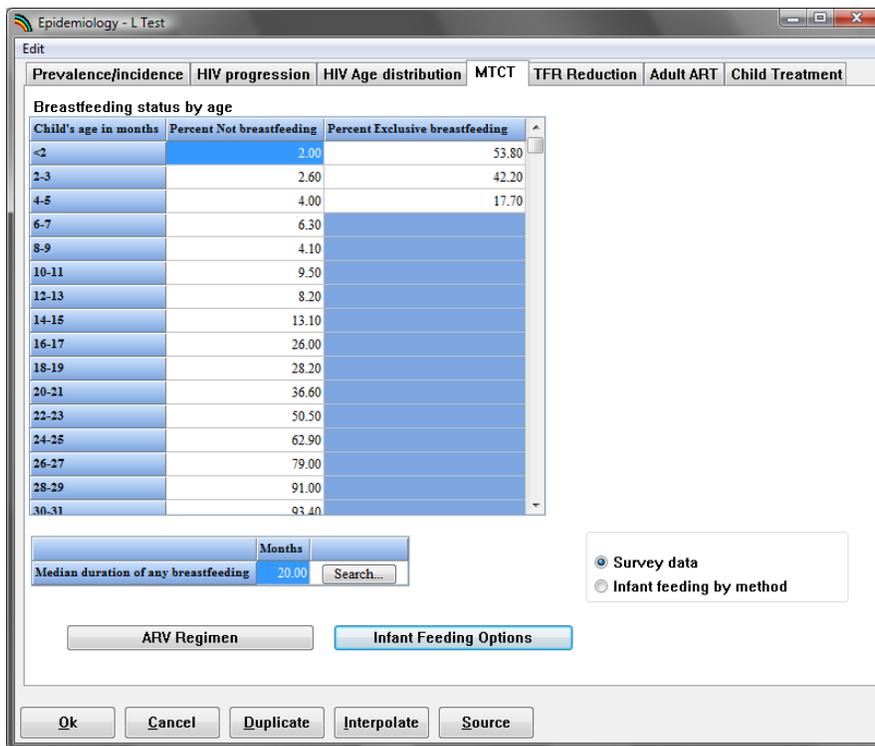
Buttons: Prophylaxis Regimen, Infant Feeding Options, Abortion

Bottom buttons: Ok, Cancel, Duplicate, Interpolate, Source, Transmission probability

You can use this editor to describe the PMTCT program. When the screen first appears it will show the editor for the prophylaxis regimens. You can switch to the Infant Feeding Option or Abortion screens by clicking on the appropriate button.

- A. **Prophylaxis Regimen.** Enter either the percentage of pregnant women receiving each type of treatment (the top row will show the percent not receiving any treatment) or the number of women receiving each type of treatment (the bottom row will show the total number receiving any type of treatment. You can enter percentages in one column and numbers in another but do not mix them in the same column (year).
- B. **Infant feeding options.** If you click on the Infant Feeding Option button you will see a new screen like the one below. There are two ways to enter information about infant feeding practices. If you have a DHS or other national survey you can enter the proportion of mothers not breastfeeding and the proportion practicing exclusive

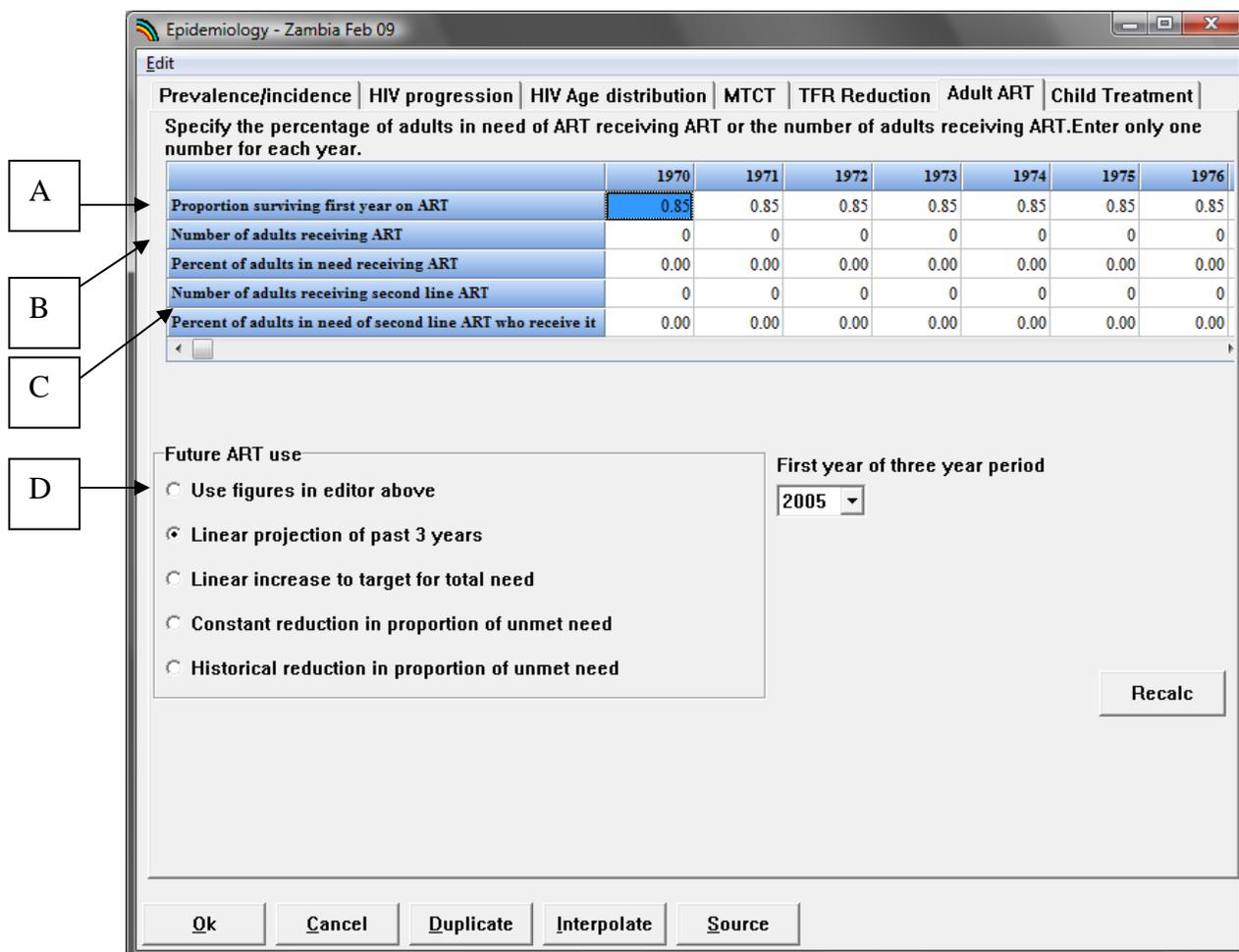
breastfeeding by the age of the child. This is the editor you will normally see when you enter this screen. If you created your projection using EasyProj these data will already be filled in if there is a DHS for your country. If you do not have this information you can select 'Infant feeding by method' from the radio button at the bottom right of the screens. Then you can enter directly the number or proportion of mothers by type of feeding. You may enter either the percentage or the number of HIV+ women using each infant feeding option. You can enter percentages in one column and numbers in another but do not mix them in the same column (year). You also need to enter the median duration of breastfeeding (in months). If you press the 'Search' button you will see a list of countries with survey data.



- C. **Abortion.** If abortion is a legal option for HIV+ women you can click the 'Abortion' button and enter the number or percentage of HIV+ women terminating pregnancies.

### ***Step 8. Describe the adult ART program***

Select the Adult ART tab and you will see a screen that looks like the one below. Here you can describe the scope of antiretroviral treatment.



- A. Proportion surviving first year on ART.** If you have information on the proportion of ART patients that survive their first year on ART you may enter it here. Survival may increase as coverage rises and the patients get started at higher CD4 counts. Some programs report first year survival but do not take into account the mortality that may occur among those lost to follow-up. If you use program-specific data be sure to include an estimate of mortality among those lost to follow-up.
- B. Set the program scope for first line therapy.** You can describe the scope of the ART program for first line therapy either as the number of people receiving ART or the percent of those who need it.
- C. Specify the use of second line therapy.** You can describe the scope of the ART program for second line therapy either as the number of people receiving ART or the percent of those who need it.
- D. Project future treatment.** You can enter estimates of the future coverage of first line ART directly or use one of the methods shown to project future coverage. When you select a particular method using the radio buttons, the screen will change to request the necessary information for the projection.

### Step 9. Describe the child treatment program

Select the Child Treatment tab and you will see a screen that looks like the on below. Here you can describe the type and scope of child treatment.

**Child Treatment**

Specify the percentage of children (0-15) receiving treatment or the number of children receiving treatment. Enter only one number for each year.

	1970	1971	1972	1973	1974	1975	1976	1977	1978
Number receiving cotrimoxazole	0	0	0	0	0	0	0	0	0
Percent receiving cotrimoxazole	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Number Receiving ART	0	0	0	0	0	0	0	0	0
Percent Receiving ART	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

**Effectiveness of cotrimoxazole in reducing mortality rate by years on prophylaxis**

	1 year	2 years	3 years	4 years	5 years	6 years	7 years	8 years	9 years	10 years
Reduction in mortality with no ART	0.33	0.33	0.33	0.33	0.33	0.00	0.00	0.00	0.00	0.00
Reduction in mortality with ART	0.33	0.16	0.08	0.04	0.02	0.00	0.00	0.00	0.00	0.00

**Percentage of infants diagnosed with PCR**

	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
PCR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

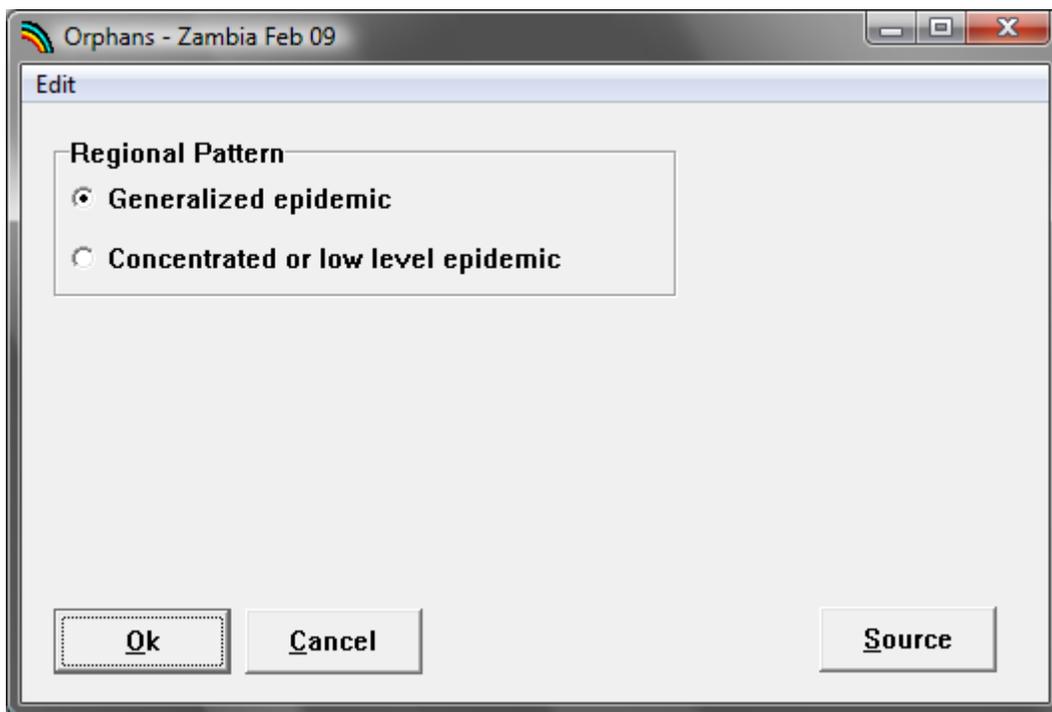
Ok Cancel Duplicate Interpolate Source

- Coverage of cotrimoxazole prophylaxis.** Enter the number of children receiving cotrimoxazole or the percentage of those children in need that receive it.
- Coverage of ART.** Enter the number of children receiving ART or the percentage of those children in need that receive it. .
- Effectiveness of cotrimoxazole.** This is the default assumption about the effect of cotrimoxazole in reducing child mortality from AIDS.
- Early diagnosis.** With the typical antibody tests in use in most developing countries children born to HIV+ mothers cannot be diagnosed has HIV+ until the age of 18 months. Therefore cotrimoxazole is recommended for all children born to HIV+ mothers until their own status can be determined and ART is generally not recommended until HIV+ status can be confirmed. Early

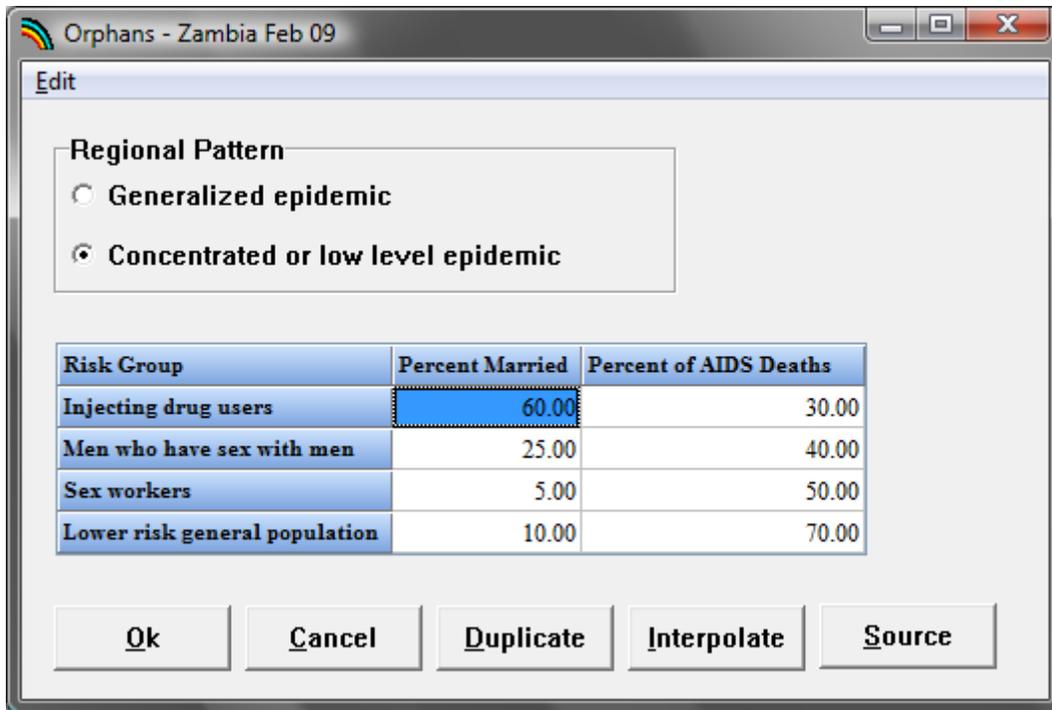
diagnosis of HIV is possible with PCR tests. If early diagnosis is available then ART can start earlier. Once you have completed this section click 'Ok' to move to the next step.

### ***Step 10. Specify approach to estimating orphans***

Click on the 'Orphans' button to set the procedure for estimating the number of orphans. Spectrum calculates the number of AIDS and non-AIDS orphans by type: maternal, paternal and double. These calculations are based on data from generalized epidemics in Africa but estimates of the number of AIDS orphans can be made for concentrated epidemics with additional information about the fertility of those who are HIV+.



If you select 'Generalized epidemic' no additional information is needed. If you select 'Concentrated or low level epidemic' then you need to enter information on the percentage married and the percentage of AIDS deaths by risk group as shown below. Once you have completed this, click 'Ok' twice to return to the main menu.



### ***Step 11. Reading an existing Spectrum file***

You can save your projection files and read them again at a later time. You can read a projection file created with a previous version of Spectrum but you will probably want to update the data and assumptions before looking at the output.

1. *You should complete Step 5 above to read your new incidence trend from EPP.*
2. *You should complete Step 6 to designate the type of epidemic for the age and sex patterns of incidence.*
3. *You may want to complete Steps 7, 8 and 9 to update data on PMTCT and treatment programs.*

### ***Step 12. Display the output***

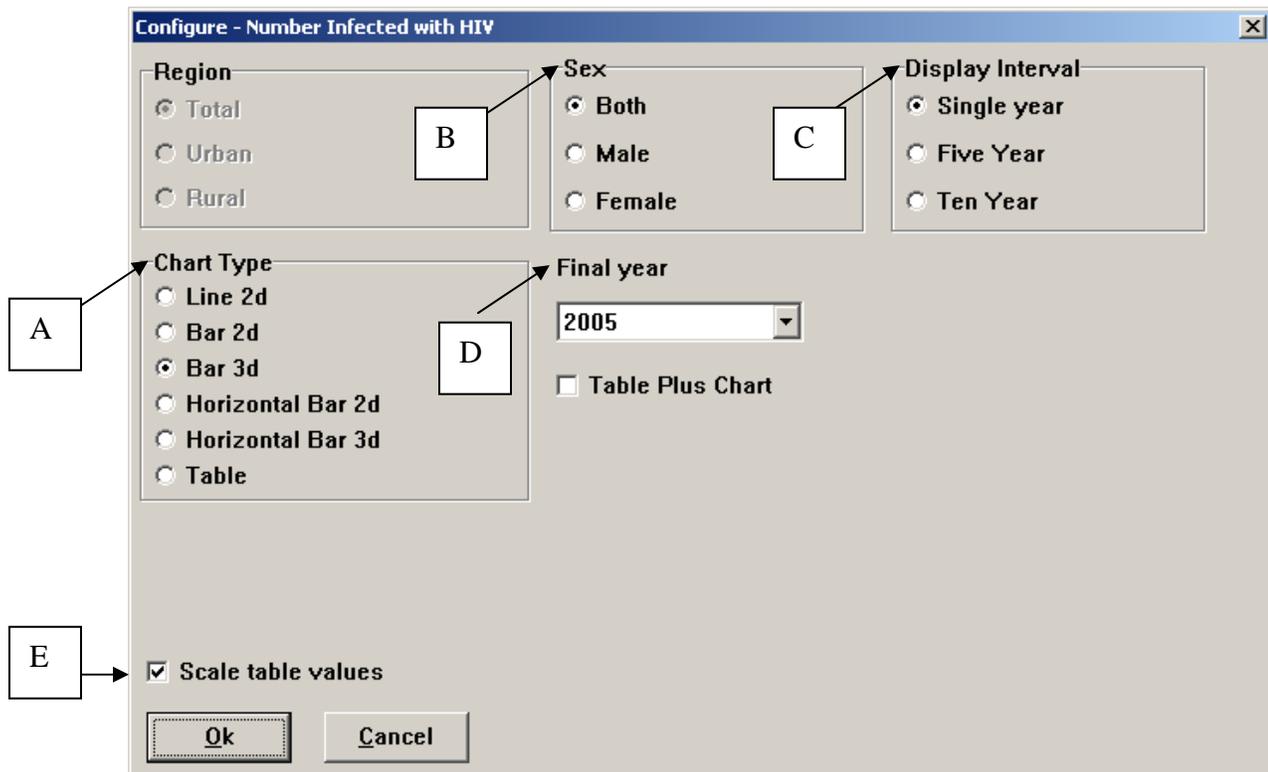
From the main Spectrum menu, select “Display” and the “AIDS (AIM)”. You will then see a drop down menu with the categories of HIV/AIDS indicators. They are:

- Total population
- Adults (15-49)
- Adult 15+
- Children (0-14)
- Children under 1

- Children 1-4
- Regional table
- AIDS impacts
- Orphans

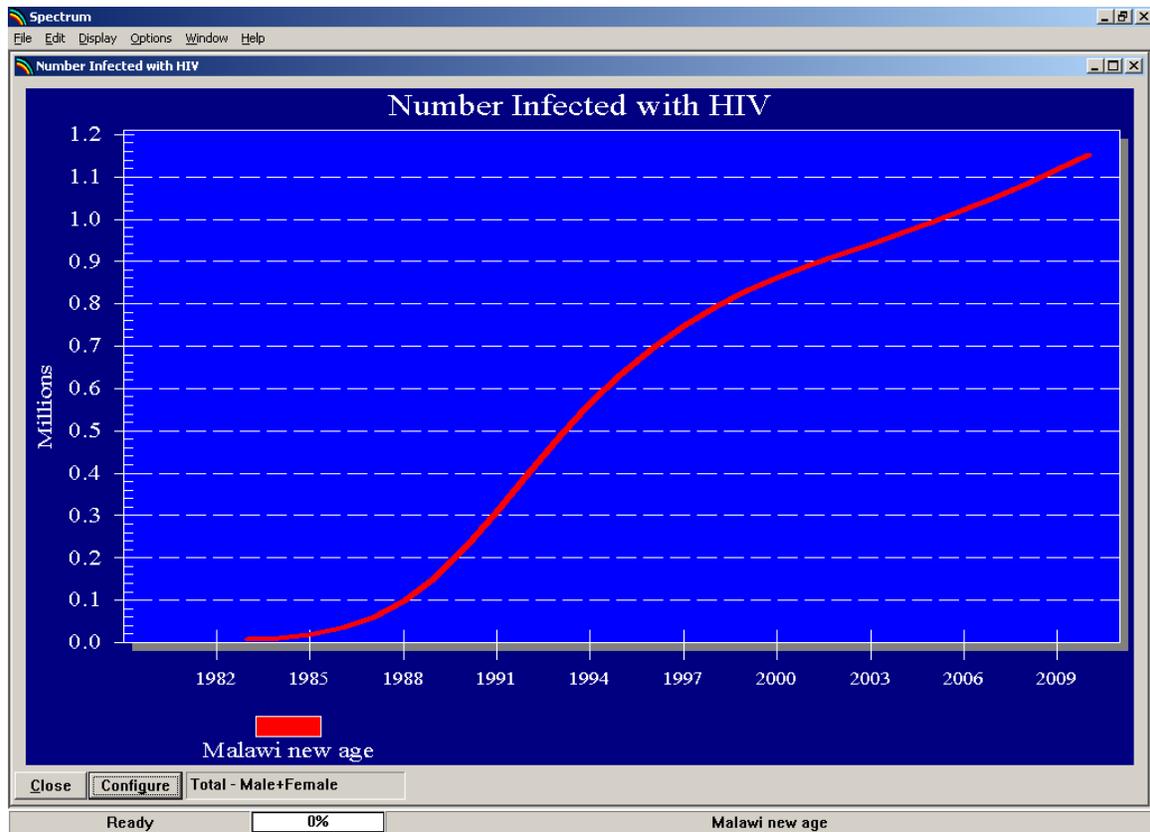
Each category contains indicators that Spectrum can display. Choose one of these indicators, for example, “Number Infected with HIV.” The following screen will appear:

On this screen you can set the options for displaying the results.



- Chart type.** Select the type of chart you wish to display.
- Sex.** By default this is set to display both sexes, but you can change it to male or female only.
- Display interval.** By default this is set to display every year.
- Final year.** By default this is set to the final year of your projection.
- Scale.** When this box is checked, Spectrum will calculate an appropriate scale for each indicator, such as thousands or millions. If you want to compare results for several indicators or several countries, you may want to turn scaling off, by removing the check mark, in order avoid different indicators having different scaling factors.

Once you have set the options, click “OK” at the bottom of the screen. This will display a chart showing the indicator you have chosen, according to the variables you have selected on the previous screen. The following is an example of a line graph:

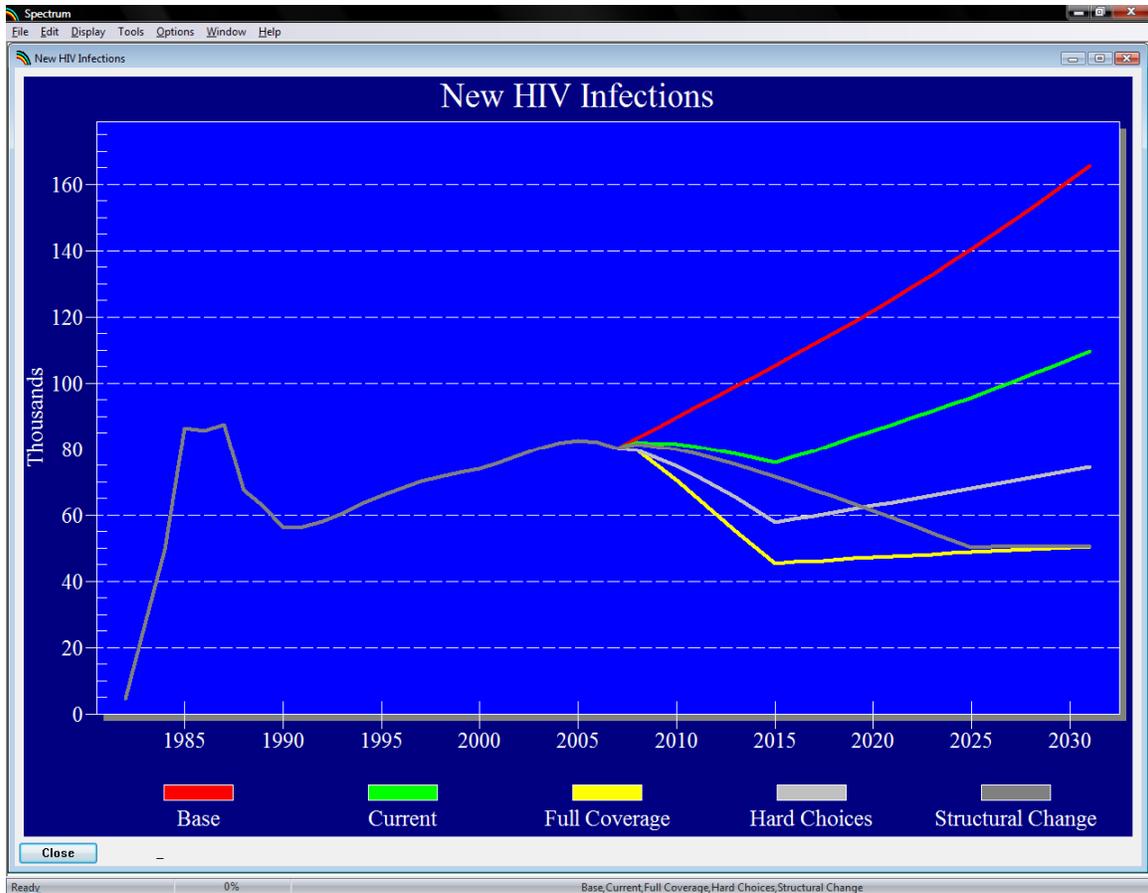


### ***Step 13. Save the projection***

Save the projection by selecting “File” and “Save” or “Save As” from the Spectrum menu.

### ***Step 14. Display multiple projections***

You can open up to 10 projections at one time and display the results in the same chart. The name of each projection that you open will appear at the bottom of the screen. In the example below there are five projections open.

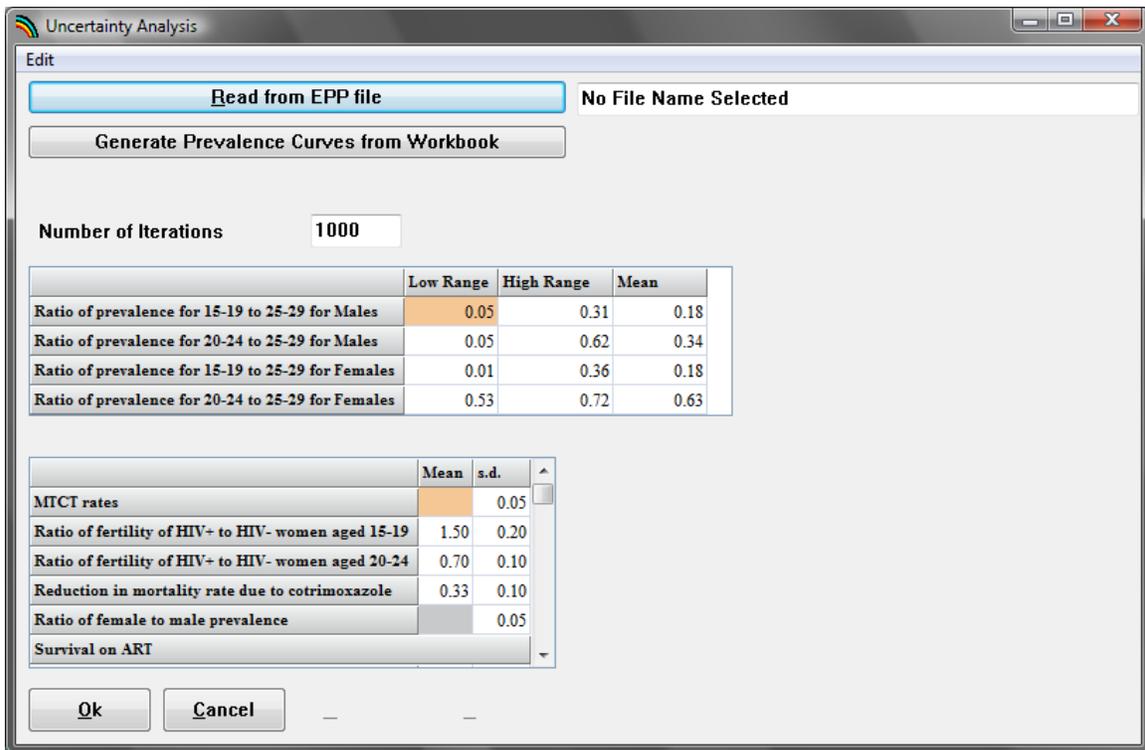


### ***Step 15. Creating alternate projections***

You can compare alternate projections by opening two or more files that have exactly the same inputs except for one indicator that you wish to examine. For example you might want to see the effect on AIDS deaths of increasing ART coverage. The easiest way to do this is to start by opening the base file. Then open the same file again. When you try to do this Spectrum will recognize that you are trying to open the same file twice. It will ask you if you want to go ahead and do this or if you want to rename the projection as you load it. If you choose to rename it, you can provide a new name, such as 'Expanded ART'. Then you will have two projections opens that are exactly the same. You can then edit the 'Expanded ART' projection and change the projected ART coverage. Then you can display the number of AIDS deaths to see the effect of expanded coverage.

### ***Step 16. Uncertainty analysis***

Spectrum can calculate the range of plausible values for each of the output indicators. To use this feature you should open one, and only one, projection. If you have more than one projection open the uncertainty menu option will not appear. To start, select 'Tools' from the horizontal menu bar, then select 'Uncertainty analysis'. You will see a display like the one below.



If you have used EPP to estimate the incidence trend for a generalized epidemic or for a Workbook application you should have saved a Spectrum uncertainty file while in EPP. (See the EPP manual for instructions on how to do this.) You can now click on the ‘Read from EPP file’ button and browse to select the EPP uncertainty file.

If you used EPP to estimate the incidence curve for a concentrated epidemic, then you will not have an uncertainty file from EPP. In that case you should click the ‘Generate incidence curves’ button and Spectrum will generate a range of uncertainty curves for you.

By default the number of iterations is set to 1000. It will take 20-40 minutes to generate 1000 runs. You can test the procedure by changing this to a smaller number but should generate 1000 curves for your final analysis.

When you are ready to go, click the button ‘Process uncertainty analysis’ to start the analysis. When it is finished you can select any of the indicators to display the average curve and the 95% plausibility bounds.