

Using the Workbook Method to Make HIV/AIDS Estimates in Countries with Low-Level or Concentrated Epidemics

Participant Manual

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World Health Organisation, Geneva



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Introduction

How to Study this Module

Before you begin

This software package is meant primarily for national and sub-national surveillance officers. As a participant, you should have a basic understanding of HIV/AIDS and public health surveillance before studying the module.

Module structure

The module is divided into units. The units are convenient blocks of material for a study session.

Glossary

All terms are italicized the first time they are used in the manual. Acronyms are spelled out the first time they are used in each unit. Consult the Glossary at the end of this manual if you have questions about terms or acronyms.

Appendices

At the end of this module, more information is provided:

Appendix A, References and Further Reading Material
Appendix B, Glossary and Acronyms
Appendix C, Useful Links
Appendix D, Handout for Planning Workbook Structure
Appendix E, Description of Models

Additions, Corrections, Suggestions

Do you have changes to suggest for this manual? Is there other information you would like to see? Please fax or email us. We will collect your comments and consider them in the next update.

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Using the Workbook Method

The workbook approach to making HIV prevalence estimates and building future scenarios of HIV/AIDS prevalence was developed for use in countries with *low-level* and *concentrated epidemics*. There is no set of representative data that can be used to estimate adult prevalence in these countries so it is not like countries where the epidemic has become *generalized* and data from pregnant women is used as a proxy for adult prevalence.

In concentrated epidemics, HIV has spread rapidly in a defined sub-population, but is not well-established in the general population. This epidemic state suggests active networks of risk within the sub-population. The future course of the epidemic is determined by the frequency and nature of links between highly infected sub-populations and the general population. For concentrated and low-level epidemics, the approach has been to:

- develop estimates for populations who are most exposed to HIV/AIDS and then
- combined those estimates to produce an overall estimate of adult prevalence.

For further reading on HIV estimates, visit
<http://www.epidem.org/publications.htm>

Types of epidemics

Remember that the Workbook is only used for HIV-1 *low-level* or *concentrated epidemics*. Characteristics of the different types of epidemics are described below.

Low-level Epidemic (Use the Workbook Method for this)

- Although HIV infection may have existed for many years, it has never spread to significant levels in any sub-population.
- Recorded infection is largely confined to individuals with higher risk behaviour, such as sex workers, drug injectors and men who have sex with men.
- This epidemic state suggests that networks of risk are rather diffuse (with low levels of partner exchange or sharing of drug injecting equipment) or that the virus has been introduced only very recently.
- HIV prevalence has not consistently exceeded 5% in any defined sub-population.

Concentrated Epidemic (Use EPP if you have a lot of data. EPP is described next page. Otherwise, use the Workbook Method)

- HIV has spread rapidly in a defined sub-population, but is not well-established in the general population.

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- This epidemic state suggests active networks of risk within the sub-population.
- HIV prevalence is consistently over 5% in at least one defined sub-population. HIV prevalence is below 1% in pregnant women in urban areas.

Generalised Epidemic (Use EPP, described next page; DO NOT use the Workbook Method)

- HIV is firmly established in the general population.
- Although sub-populations at high 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 sub-populations at higher risk for infection.
- HIV prevalence consistently over 1% in pregnant women.

The Workbook spreadsheet

The Workbook was developed in Excel™ and is composed of:

- Point-Prevalence worksheets
- Epidemic Curve worksheets

You enter information collected in your country, then the Workbook provides an estimate of HIV prevalence and disease burden. So remember that the reliability of the Workbook estimates is only as good as your input data.

Use the Workbook to:

- make estimates for various regions
- generate an epidemic curve
- generate estimates of adult prevalence that can be imported into *Spectrum*

Your total estimate of prevalence calculated in Workbook will be the sum of the number of adults living with HIV/AIDS in:

- higher risk behaviour groups, such as injecting drug users (IDU), men who have sex with men (MSM), female sex workers (FSWs)
- lower risk behaviour groups

Related Software

Estimation and Projection Package

Use the Estimation and Projection Package (EPP) to derive *epidemic curves* for adult urban and rural populations in:

- generalised epidemics or
- concentrated epidemics with extensive data

The EPP software and manual are available at:

http://www.unaids.org/en/resources/epidemiology/epi_softwaretools.asp

Spectrum

Use Workbook and EPP estimates of adult prevalence in *Spectrum* to make HIV/AIDS estimates of:

- the number of adults and children living with HIV
- HIV incidence
- mortality
- orphanhood

Spectrum is described in a separate manual.

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Unit 1, Workbook Guided Tour

What you will learn

Start with this unit if you are new to Excel™ or new to the Workbook method. If you are interested in Excel™, many excellent courses are available. In this manual, we will just show the few things you need to know to get started with the Workbook Method. You will:

- practice using Excel
- see what's in the Workbook
- learn to navigate the Workbook

Using Excel

The Workbook was developed in Excel™. Open your Workbook now so we can practice using it.

A *cell* is identified by column (letter) and row (number) as shown in Figure 1-1 below. Cell C3 is circled.

Figure 1-1. Cell C3

		Population Size Estimate		HIV prevalence Estimate (%)		Estimates of adults living with HIV/AIDS				Average number of adults living with HIV	Female st	
Names of higher risk population groups		Low	High	Low	High	(Low Population x Low Prevalence)	(Low Population x High Prevalence)	(High Population x Low Prevalence)	(High Population x High Prevalence)		Percent (%) Female in risk group	Number women Infect
1	National country estimate for:	0										
2	National adult (15-49) population:	0										
3	% Urban population:	0%										
4	Urban adult population:	0										
5	Year	0										
1. Populations at higher risk (PHR)												
10	IDU	0	0	0	0	0	0	0	0	0	0	0
11	MSM	0	0	0	0	0	0	0	0	0	0	0
12	Sex workers	0	0	0	0	0	0	0	0	0	0	0
13	Clients of sex workers	0	0	0	0	0	0	0	0	0	0	0
14	Optional HR1	0	0	0	0	0	0	0	0	0	0	0
15	Optional HR2	0	0	0	0	0	0	0	0	0	0	0
16	Optional HR3	0	0	0	0	0	0	0	0	0	0	0
17	Optional HR4	0	0	0	0	0	0	0	0	0	0	0
18	Sub-Total PHR	0	0	0	0	0	0	0	0	0	0	0
2. Populations at lower risk (PLR) that are not already included in PHR												
Method A: Partners of high risk populations		Low	High	Low	High	(Low Population x Low Prevalence)	(Low Population x High Prevalence)	(High Population x Low Prevalence)	(High Population x High Prevalence)	Average number of adults living with HIV	Percent (%) Female in risk group	Number women Infect
23	Partners of IDU	0	0	0	0	0	0	0	0	0	0	0
24	Female partners of MSM	0	0	0	0	0	0	0	0	0	0	0
25	Partners of Clients of Sex workers	0	0	0	0	0	0	0	0	0	0	0

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Sheets and tabs

The Workbook contains *sheets*. The tabs along the bottom of the screen show the names of the sheets, shown in Figure 1-2. You click on a tab to go to that sheet.

Figure 1-2. Workbook Tabs and Sheets

1	1. GENERAL INFORMATION							
2	Country Name:							
3	Year:							
4	2. OTHER INFORMATION		Source Population	PERCENT URBAN	Source percent urban	POPULATION URBAN	Source Population Size Estimates	Source prevalence estimate
5	National	0				0		
6	R1					0		
7	R2					0		
8	R3					0		
9	R4					0		
10	R5					0		
11	R6					0		
12	R7					0		
13	R8					0		
14	R9					0		
15	R10					0		
16	R0	0				0		
17								
18								
19	3. RISK GROUPS USED TO MODEL EPIDEMIC		1. Populations at higher risk (PHR)		2. Populations at lower risk (PLR) that are not already included in PHR			
20	IDU				Partners of IDU			
21	MSM				Female partners of MSM			
22	Sex workers				Partners of Clients of Sex workers			
23	Clients of sex workers				Optional LR1			
24	Optional HR1				Optional LR2			
25	Optional HR2				Optional LR3			
26	Optional HR3							
27	Optional HR4							
28								
29								
30								
31								
32								



Since the Set-up tab is selected, the Set-up sheet is open.

Try entering some data now.

- In your open Workbook, click the **R1** tab at the bottom of your screen
- Click in cell B11
- Type in the number 14
- Press enter

You have added an MSM low estimate. The Excel cursor has moved down for you to add the next value. What is that value?

Now click the **R0** tab.

- Move the slider on the right of your screen to the top of the page.
- Now scroll down the page.
- Notice that the first six rows are fixed. Rows 1 through 6 never scroll off the page. This was done so that the information in those rows is never hidden.

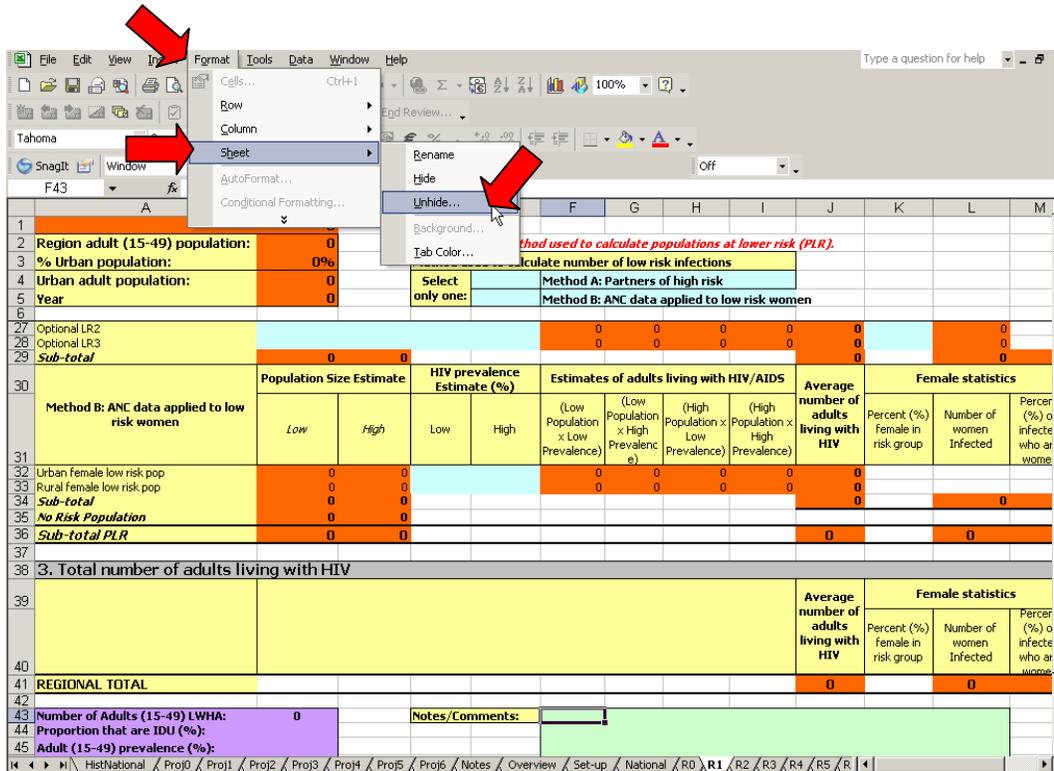
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Unhide sheets

As you work, you may need to ‘unhide’ additional regional sheets. In your Workbook, try un hiding sheet R7 now, shown in Figure 1-3.

- Choose the Set-up tab
- Click **Format** in the Excel toolbar at top of your screen
- Move your cursor to **Sheet** in the dropdown menu
- Click **Unhide...** in the next menu
- Click on R7 in the Unhide dialog
- Click OK

Figure 1-3. Unhide Rows or Columns



Now you know enough about Excel™ to get started. You will practice using Excel™ in the Point-Prevalence sheets.

Workbook Tabs and Sheets

Point-prevalence tabs and sheets

There are eleven sheets in the part of the Workbook on point-prevalence.

Set-up tab

When you first open the Workbook, the Set-up sheet is the first one you'll see. In the Workbook, cells are color-coded based on function.

Scroll down the Set-up page to see these areas:

- Cells that are yellow provide titles and information.
- Cells that are colored *light blue* need your input.
- Cells that are colored *light green* are optional, often as spots for your notes or comments.
- Cells that are *orange* have formulas that calculate values based on what you put in the light blue cells. The light orange cells are locked so that you will not accidentally change the formulas.
- Cells that are *purple* contain the estimates for that sheet.

If there are any colors you didn't see in Set-up, try a regional tab such as R1.

When you begin to enter data, you will start with the Set-up sheet, shown in Figure 1-4. You will enter regions and populations (age 15 to 49), percent urban. You will also document sources of your data on this sheet.

Figure 1-4. Set-up Sheet/Tab

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
1. GENERAL INFORMATION		Country Name:																													
		Year:																													
2. OTHER INFORMATION		REGION NAMES	POPULATION	Source Population	PERCENT URBAN	Source percent urban	POPULATION URBAN	Source Population Size Estimates	Source prevalence estimate																						
	National																														
	R1																														
	R2																														
	R3																														
	R4																														
	R5																														
	R6																														
	R7																														
	R8																														
	R9																														
	R10																														
	RO																														
3. RISK GROUPS USED TO MODEL EPIDEMIC		1. Populations at higher risk (PHR)				2. Populations at lower risk (PLR) that are not already included in PHR																									
	IDU																														
	MSM																														
	Sex workers																														
	Clients of sex workers																														
	Optional HR1																														
	Optional HR2																														
	Optional HR3																														
	Optional HR4																														

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Regional tabs, continued

- Each area (region, province, state, county or other area) will have its own regional sheet. You will use each regional sheet to record detailed HIV/AIDS information in that region.
- You may unhide additional sheets to calculate national prevalence for up to 10 regions (6 are visible, 4 are hidden).
- On each regional sheet, you enter estimates of percent females in each group in column K.

Click the **R1** tab now.

- Scroll down and look at the data required
- Look at column K

R0 tab

Use R0, shown in Figure 2-4, as a check sheet that sums up the regional population size inputs and checks that sum against your original national population value.

Figure 1-7. R0 Sheet

1	A	B	C	D	E	F	G	H	I	J	K	L	M	
2	Region adult (15-49) population:	0				<i>Please choose method used to calculate populations at lower risk (PLR).</i>								
3	% Urban population:	0%				Method used to calculate number of low risk infections								
4	Urban adult population:	0				Select only one:		Method A: Partners of high risk						
5	Year	0				Method B: ANC data applied to low risk women								
7	1. Populations at higher risk (PHR)													
8	Names of higher risk population groups	Population Size Estimate		HIV prevalence Estimate (%)		Estimates of adults living with HIV/AIDS				Average number of adults living with HIV	Female statistics			
9		Low estimate	High estimate	Low	High	(Low Population x Low Prevalence)	(Low Population x High Prevalence)	(High Population x Low Prevalence)	(High Population x High Prevalence)		Percent (%) female in risk group	Number of women Infected	Percent (%) of infected who are women	
10	IDU					0	0	0	0	0	0	0	0	
11	MSM					0	0	0	0	0	0	0	0	
12	Sex workers					0	0	0	0	0	0	0	0	
13	Clients of sex workers					0	0	0	0	0	0	0	0	
14	Optional HR1					0	0	0	0	0	0	0	0	
15	Optional HR2					0	0	0	0	0	0	0	0	
16	Optional HR3					0	0	0	0	0	0	0	0	
17	Optional HR4					0	0	0	0	0	0	0	0	
18	Sub-total PHR	0	0							0		0		
20	2. Populations at lower risk (PLR) that are not already included in PHR													
21	Method A: Partners of high risk populations	Population Size Estimate		HIV prevalence Estimate (%)		Estimates of adults living with HIV/AIDS				Average number of adults living with HIV	Female statistics			
22		Low estimate	High estimate	Low	High	(Low Population x Low Prevalence)	(Low Population x High Prevalence)	(High Population x Low Prevalence)	(High Population x High Prevalence)		Percent (%) female in risk group	Number of women Infected	Percent (%) of infected who are women	
23	Partners of IDU					0	0	0	0	0	0	0	0	
24	Female partners of MSM					0	0	0	0	0	0	0	0	
25	Partners of Clients of Sex workers					0	0	0	0	0	0	0	0	

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R0 tab, continued

When you complete your Set-up sheet, look at the R0 sheet (tab). Remaining regional populations that you have not yet accounted for in R1 through R6 are shown on the R0 sheet in cell B2, shown in Figure 1-8.

You would need to account for this group by checking your other R sheets (tabs) to see if :

- you have made an error in inputting your population values or
- this is an additional group that is outside your definition of region, such as transients, nomads, truck drivers.

The light blue boxes on the R0 sheet allow you to enter values for higher- risk behaviour groups to completely account for your country's entire population.

Figure 1-8. R0 with Unaccounted for Population (Discrepancy) Circled

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	Test Country	0											
2	Region adult (15-49) population:	2,000,000				<i>Please choose method used to calculate populations at lower risk (PLR).</i>							
3	% Urban population:	8%				Method used to calculate number of low risk infections							
4	Urban adult population:	0				Select only one:		Method A: Partners of high risk					
5	Year	2004						Method B: ANC data applied to low risk women					
6													
7	1. Populations at higher risk (PHR)												
8		Population Size Estimate		HIV prevalence Estimate (%)		Estimates of adults living with HIV/AIDS				Average number of adults living with HIV	Female statistics		
9	Names of higher risk population groups	Low estimate	High estimate	Low	High	(Low Population x Low Prevalence)	(Low Population x High Prevalence)	(High Population x Low Prevalence)	(High Population x High Prevalence)		Percent (% Female in risk group)	Number of women Infected	Percent (%) of infected who are women
10	IDU					0	0	0	0	0		0	0
11	MSM					0	0	0	0	0		0	0
12	Sex workers					0	0	0	0	0		0	0
13	Clients of sex workers					0	0	0	0	0		0	0
14	Optional HR1					0	0	0	0	0		0	0
15	Optional HR2					0	0	0	0	0		0	0
16	Optional HR3					0	0	0	0	0		0	0
17	Optional HR4					0	0	0	0	0		0	0
18	Sub-total PHR	0	0								0	0	0
19													
20	2. Populations at lower risk (PLR) that are not already included in PHR												
21		Population Size Estimate		HIV prevalence Estimate (%)		Estimates of adults living with HIV/AIDS				Average number of adults living with HIV	Female statistics		
22	Method A: Partners of high risk populations	Low estimate	High estimate	Low	High	(Low Population x Low Prevalence)	(Low Population x High Prevalence)	(High Population x Low Prevalence)	(High Population x High Prevalence)		Percent (% Female in risk group)	Number of women Infected	Percent (%) of infected who are women
23	Partners of IDU					0	0	0	0	0		0	0
24	Female partners of MSM					0	0	0	0	0		0	0
25	Partners of Clients of Sex workers					0	0	0	0	0		0	0

Notes tab

As you work through the regional sheets, you will have situations where you have to make decisions on estimates. Explain these decisions on the Notes sheet, shown in Figure 1-9.

- Click the **Notes** tab
- Make an entry on your decision to use or not use certain estimates
- Date and initial or sign each entry

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Figure 1-9. Use the Notes Sheet to Document Your Work

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1	Notes														
2															
3															
4															
5															
6															
7															
8															
9															
10															
11															
12															
13															
14															
15															
16															
17															
18															
19															
20															
21															
22															
23															
24															
25															
26															
27															
28															
29															
30															
31															

National tab

Once you have entered all the regional information, the national sheet automatically combines the regional sheets to produce a national estimate in the *purple* cells, shown in Figure 1-10:

- Click the National tab now
- Scroll down to rows 43-49, A and B columns
- Look for purple cells

Figure 1-10. National Sheet Estimates, cells A-B43 to A-B49

	A	B	C	D	E	F	G	H	I	J	K	L
1	National country estimate for:	Test Country										
2	National adult (15-49) population:	5,000,000										
3	% Urban population:	39.0%										
4	Urban adult population:	1,950,000										
5	Year	2004										
38	3. Total number of adults living with HIV in this region											
39											Estimated number of adults living with HIV	Female st.
40	REGIONAL TOTAL										0	0
43	Country:	Test Country										
44	Year:	2004										
45	Number of Adults (15-49) LWHA:	0										
46	Proportion that are IDU (%):											
47	Adult (15-49) prevalence (%):											
48	Number of women (15-49) LWHA:	0										
49	Percent female (%):											
51	Consistency check											
53	Higher risk population size estimates	% behaviour	Check	Comment								
54	IDU	0	Missing IDU	While the extent of injecting drug use varies dramatically among countries few countries will have more than 0.7% of the								
55	MSM	0	Missing MSM	Research has found that in most countries between 2% and 5% of men aged 15-49 have sex with other men.								
56	Sex workers	0	Missing Sex	Few countries have good estimates of the number of sex workers. In Thailand the estimated number of sex workers is not								
57	Clients of sex workers	0	Missing client	Few countries have good estimates of the number of clients of sex workers. In Thailand the estimated number of clients is								

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National tab, continued

Inputs from the regional sheets for populations at higher risk (PHR) behaviour are used to calculate the national PHR subtotal in national cells A7-A18 and labeled:

1. Populations at higher risk (PHR)

Inputs from the regional sheets for populations at lower risk (PLR) behaviour are used to calculate the national PLR subtotal in national cells A20-A36 and labeled:

2. Populations at lower risk (PLR)

The national sheet uses consistency checks, shown in Figure 1-11. Check cells A50-A63 to see if your estimate is producing results that are consistent with known (default) information related to various risk groups.

Figure 1-11. National Sheet Consistency Checks

	A	B	C	D	E	F	G	H	I	J	K	L
1	National country estimate for:	Test Country										
2	National adult (15-49) population:	5,000,000										
3	% Urban population:	39.0%										
4	Urban adult population:	1,950,000										
5	Year	2004										
52												
53	Higher risk population size estimates	% behaviour	Check	Comment								
54	IDU	0	Missing IDU	While the extent of injecting drug use varies dramatically among countries few countries will have more than 0.7% of the								
55	MSM	0	Missing MSM	Research has found that in most countries between 2% and 5% of men aged 15-49 have sex with other men.								
56	Sex workers	0	Missing Sex	Few countries have good estimates of the number of sex workers. In Thailand the estimated number of sex workers is rou								
57	Clients of sex workers	0	Missing client	Few countries have good estimates of the number of clients of sex workers. In Thailand the estimated number of clients is								
58												
59	Higher risk HIV prevalence estimates	% HIV	Check	Comment								
60	IDU	0	Missing IDU	Above 70% is unusually high.								
61	MSM	0	Missing MSM	Above 40% is unusually high.								
62	Sex workers	0	Missing sex	Above 60% is unusually high.								
63	Clients of sex workers	0	Missing IDU	Above 30% is unusually high.								
64												
65	Model	Value	Check	Comment								
66	Female:Male ratio	0										
67	PLR to PHR ratio	0										
68	National percent urban (%)	39.0%	Low - Check Set-up sheet.	National percent urban is lower than given in 'Set-up' sheet.								
69												
70												
71												
72												
73												
74												
75												
76												
77												

On the National sheet, find:

- cells A7-A18, **1. Populations at higher risk (PHR)**
- cells A20-A36, **2. Populations at lower risk (PLR)**
- check cells A50-A63

EC tabs/ sheets

After entering all data, you will develop an epidemic curve or alternative curves. An epidemic curve shows how the epidemic has developed over time. But it is not a projection of what will happen in

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the future. In the Workbook, you will enter your HIV prevalence calculations from the National sheet in cells for each year from 1980 to 2005. The year 1980 was chosen for the start date because there were few cases identified before then. If you have a value for 1980 (you probably will not), it should be zero or very small.

An EC sheet is shown below as Figure 1-12. Column H has the years. You will fill in the cells to the right of each year that you have data for. You should have data for at least three years. But more years is better and gives a more accurate curve.

Figure 1-12. An Epidemic Curve (EC) Sheet

Need this

Now let's try using the Workbook.

Unit 2, The Point-Prevalence Sheets

Getting Started

What you will learn

When you complete this unit, you will be able to:

- plan how to structure your data
- apply your structure to the Workbook in the Set-up sheet
- add additional details in the regional sheets
- interpret your estimates on the national sheet

Develop a Structure

The key to using the Workbook Method is to plan in advance.

- First, develop a structure for your Workbook.
- Second, apply your structure to the Workbook software and enter your data.
- Third, get your results and output.

Fill out the tables

Most of the work of preparing a national estimate is the initial data collection and planning. Before you set up your workbook, plan how you want your final estimate to look. To do this, you will use:

- Tables 2-1, 2-2 and 2-3 in the pages that follow. (An extra set of tables are provided in Appendix D for future use).
- the data you brought to class.

We will just do part of the set-up and detailed information in the tables to give you an idea of what is needed. The tables will ask you for these details:

- your geographical regions
- the groups in your country who are at higher risk of HIV infection
- the groups in your country who are at lower risk of HIV infection
- how you decide to handle missing data

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**Geographical
regions**

Begin by deciding if you:

- will only be using countrywide data or
- have geographically distinct regions you want to combine to develop a national estimate.

Consider these factors:

- In a very large or geographically disparate country, you may want an HIV prevalence estimate for each region.
- In a smaller country, you may also have an estimate for each region or province. Remember that you must have data for population sizes of groups at higher risk of HIV/AIDS and HIV prevalence at the regional levels for these estimates to be meaningful.
- For each region, you will be asked to enter in Workbook the regional population (age 15-49 years) and the percent of the population that lives in urban areas.
- Some countries don't divide into regions, so you may consider the whole country as one region. If so, put your country in row R1 below.

Write in Table 2-1 below the regions (districts, provinces or other areas) you want to include in the spreadsheet. Remember that your whole country may be used instead of dividing into regions. We have room for 10 regions, the same number as in the Workbook.

Table 2-1. Your Regions
(These entries go in Set-up)

Region	Regions (or Districts, Provinces, Counties, Departments, etc)
R1	
R2	
R3	
R4	
R5	
R6	
R7	
R8	
R9	
R10	

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Higher-risk groups

Now decide which populations higher-risk behaviour for HIV/AIDS are in your country or province. The Workbook already includes these groups (and they are included in the table below):

- injecting drug users (IDU)
- men who have sex with men (MSM)
- female sex workers (FSW)
- clients of FSWs

These populations exist in almost all countries. But your country may have other higher-risk groups or more details on the group above. Let's take IDUs as an example:

- are some long term users, longer than five years?
- are some casual users that have only used drugs a few times or recently?
- are some former users who now don't use drugs?

If you have data on these special groups, break them out separately in the table below. You will:

- define those special groups on the Workbook Set-up page
- describe them in the comments area of the page or in your notes page.

Review your data and think about the higher-risk behaviour groups you want to include. Write them in Table 2-2.

Table 2-2. Your High and Low-Risk Groups

Higher-Risk Behaviour Groups	Lower-Risk Behaviour Groups
IDUs	partners of IDUs
MSM	female partners of MSMs
FSWs	partners of clients of sex workers
Clients of FSWs	

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Lower-risk groups

Now for Table 2-2, decide which groups to include as lower-risk behaviour for HIV infection. Some lower risk groups are already in the table and in the Workbook:

- partners of IDUs
- female partners of MSMs
- partners of clients of sex workers

There are several basic assumptions you can make about the spread of HIV infection within lower-risk behaviour populations:

- Transmission, if it occurs, is through sexual partners from the higher-risk population
- There is little or no spread of HIV infection
 - within lower-risk behaviour populations
 - from unsafe blood transfusion or
 - from unsafe medical injection practices
- Early in the epidemic, the number of people who are HIV positive in these lower-risk groups will be very small because there has not been enough time for spread from their higher risk sexual partners. The best way to identify this group may be through behavioural studies. If you don't have the data, you might estimate the number of people with HIV/AIDS in this group by using an estimated rate of sexual transmission.
- Over time, the number of people with HIV/AIDS in these groups at lower risk for exposure to HIV/AIDS can be much larger. If the epidemic in your country is considered to be long-standing, use prevalence in other low risk populations, such as in pregnant women, as the basis for the estimate of the rate of sexual transmission.

Note in Table 2-2 the lower-risk groups you want to include.

Data sources

What are the sources of data in your country? Look at the information you brought and think about it now. In Table 2-3, put a check by each type of data that you have. Add more to the list if you have other sources.

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Table 2-3. Data Sources

Data	Check	Comments (years, regions, groups covered, etc)
DHS or DHS+ survey results		
ANC surveys		
Behavioural surveys		
Case reports		

Missing data points

Now decide how to handle missing data. The two most important types of missing data are:

- missing estimates of higher-risk population size
- missing estimates of HIV prevalence

These two forms of missing data should be approached differently.

Estimate population size - If there is no reliable local estimate of the size of a higher-risk population, you may estimate it by borrowing values from neighboring or similar countries where data does exist.

For example, if East Texas and North Kansas are countries that are similar culturally, ethnically, economically:

- If the size (% of population) of the East Texas IDU population is unknown and
- If North Kansas has a reasonable estimate of the size of the North Kansas IDU population,
- Consider using the North Kansas IDU size (% of population) for East Texas IDU.
- If you decide to do this, **clearly document** it in your report. For example, you could write:

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“North Kansas IDU population size value was used for unknown East Texas IDU value.”

Use caution with HIV prevalence estimates - If there is no HIV prevalence data for the higher-risk behaviour population, estimates should be calculated with great care. Do not borrow prevalence values from any other sources. If you have no surveillance data, use whatever appropriate or applicable data you have and clearly document your decisions.

National results for countries missing HIV prevalence in certain higher-risk groups should clearly identify the missing estimates and the effect this may have on the national estimate.

“North Kansas value for IDU prevalence has not been calculated. Since IDU is a higher-risk behaviour group, this will cause North Kansas overall prevalence value to be lower than actual value.”

In Table 2-4, add the information you have on Region 1.

- Note in Table 2-4 whether you have missing data.
- Decide how you will consider that data, that is, will you estimate or use other data if you have no surveillance data for your country.

Table 2-4. Your Regional Data

Category	Entry or estimate	Source of Your Data
Region 1 name (tab R1)		
Population (age 15-49)		
% Urban		
Is epidemic early or long-standing?		
List missing data	Missing population data: Missing prevalence data:	

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Low-Risk Estimates		
IDU partner	Size: HIV Prev Range:	
MSM female partner	Size: HIV Prev Range:	
FSW client partner	Size: HIV Prev Range:	
Other	Size: HIV Prev Range:	
Other	Size: HIV Prev Range:	
Other	Size: HIV Prev Range:	

Apply Your Structure to the Workbook

When you're ready with your data and you've planned your structure using the tables, you're ready to develop your Workbook.

Add Set-up information

Begin with the Set-up tab, shown in Figure 2-1. You will be adding information to the light blue cells:

- Country name and year
- Region names, population sizes, percent urban
- Additional risk group categories
- Data sources

Figure 2-1. Set-up Sheet

	A	B	C	D	E	F	G	H	I
1	1. GENERAL INFORMATION	Country Name:							
2		Year:							
3									
4	2. OTHER INFORMATION	REGION NAMES	POPULATION	Source Population	PERCENT URBAN	Source percent urban	POPULATION URBAN	Source Population Size Estimates	Source prevalence estimate
5	National	0					0		
6	R1						0		
7	R2						0		
8	R3						0		
9	R4						0		
10	R5						0		
11	R6						0		
12	R7						0		
13	R8						0		
14	R9						0		
15	R10						0		
16	RO	0					0		
17									
18									
19	3. RISK GROUPS USED TO MODEL EPIDEMIC	1. Populations at higher risk (PHR)			2. Populations at lower risk (PLR) that are not already included in PHR				
20	IDU								
21	MSM								
22	Sex workers								
23	Clients of sex workers								
24	Optional HR1								
25	Optional HR2								
26	Optional HR3								
27	Optional HR4								
28									
29									
30									
31									
32									

Add regional information

Each region or geographical area will have its own sheet. Use your planned structure that you developed in your tables and follow the steps below.

Procedure 2-1. Fill in the Set-up Sheet

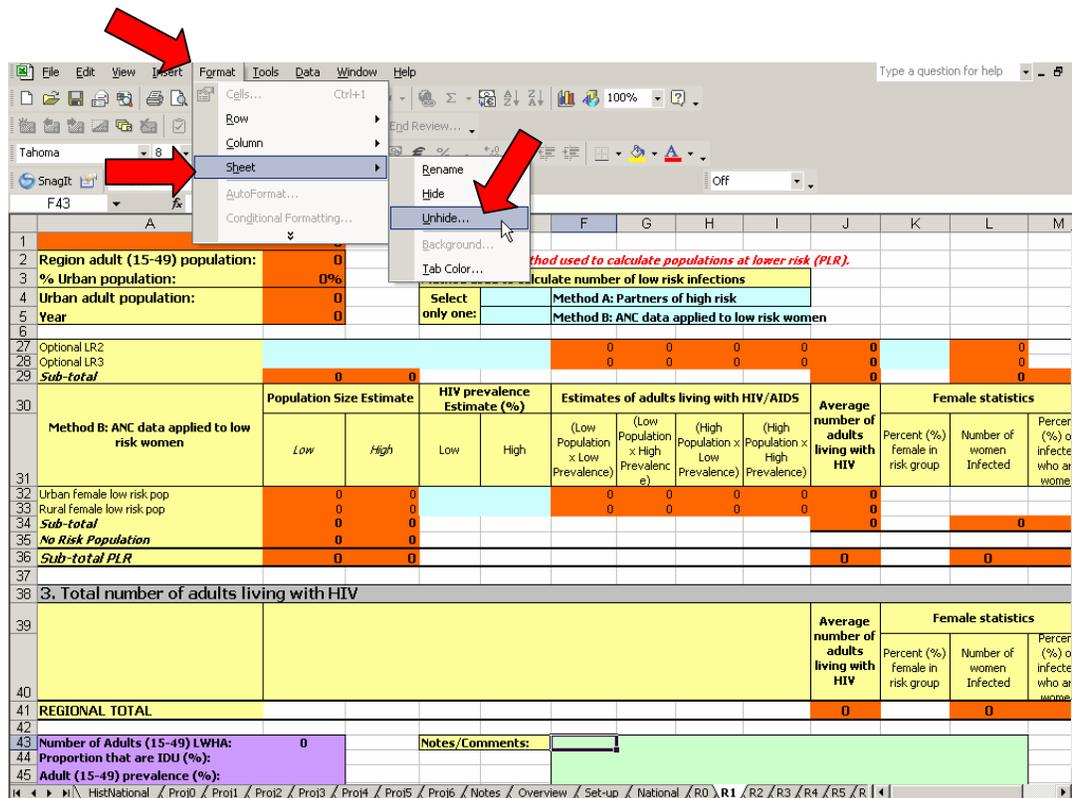
Step	Do this:
1	Click the Set-up tab.
2	Add General Information: <ul style="list-style-type: none"> ▪ Add your country name in cell C1 ▪ Add the data year in cell C2

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3	Click in cell B6. Fill in the name of your first region, shown in Figure 2-1.
4	Add the first region population, age 15-49 years in cell C6.
5	Add your source for population data (for example, national census or UN estimate) in cell D6.
6	Add the percent of the population that lives in urban areas in cell E6.
7	Add your source for urban population data in cell F6.
8	Add H6 What is the source of your data? A national census?
9	Add I6 What is the source of you data? A regional study?
10	Save your Workbook after you finish the first region: <ul style="list-style-type: none"> ▪ Click File/Save <u>A</u>s... on the Excel toolbar ▪ Give your workbook a new name ▪ Choose a folder to store it in
11	Add Region 2 (R2) on the Set-up sheet in row 7, following steps 3 through 10 above.
12	Save your work after each region.
13	If you have more than six regions, unhide more regional sheets as shown in Figure 2-2: <ul style="list-style-type: none"> ▪ Click Format in the Excel toolbar ▪ Roll your mouse to Sheet in the dropdown menu ▪ Click Unhide... from the dropdown menu ▪ Click the sheet you want from the list ▪ Click OK

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Figure 2-2. Unhide Sheets



Add higher-risk data

The four existing higher-risk behaviour groups are:

- IDUs
- MSMs
- FSWs
- clients of FSWs

You may have identified additional higher-risk groups on your worksheet. Look at your planning worksheet again to see if you have missing population size data.

If data is missing, you will need to estimate the size of the higher-risk population and determine HIV prevalence.

Population size estimates are difficult to make accurately. For best results, use both a low and a high estimate for each group to reflect the uncertainty around estimates:

- Use a minimum and maximum value or
- If you have a good estimate of population size, use a lower and upper confidence interval around your estimate.

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If you do not have good population size estimates, you may use estimates of population size from similar countries, such as in our North Kansas example.

For populations where a nationally representative survey is not available, consider using larger ranges of the minimum and maximum value based on your judgment of the quality of the estimate.

Document your estimate; that is, explain your thinking in the Workbook on the Notes sheet.

For each higher-risk behaviour population you identify, you will also need to have low and high estimates of HIV prevalence. Ideally, the range used would be based on measured prevalence in each population, but often few data are available. Remember that in this case, you should not borrow a value from North Kansas. If you do not have country surveillance data, make an estimate based on your best data and document your sources.

Procedure 2-2. Enter Regional Higher-risk Population Data

Step	Do this:
1	Click the tab for regional sheet R1.
2	Enter your estimate for each population at higher risk (PHRs) behaviour. Include a high and low range of values. As shown in Figure 2-3, put: <ul style="list-style-type: none">▪ the low estimated values for each group in cells B10 to B17▪ the high estimated values for each group in cells C10 to C17
3	Document your decisions about estimating values on the Notes page.

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Figure 2-3. Add Information on Populations at Higher Risk (PHR)

1. Populations at higher risk (PHR)		Population Size Estimate		HIV prevalence Estimate (%)		Estimates of adults living with HIV/AIDS				Average number of adults living with HIV	Female statistics		
Names of higher risk population groups	Low estimate	High estimate	Low	High	Low Population x Low Prevalence	Low Population x High Prevalence	High Population x Low Prevalence	High Population x High Prevalence	Average number of adults living with HIV	Percent (%) female in risk group	Number of women Infected	Percent (%) of infective who are women	
	IDU	9,000	24,000	10.00%	12.00%	900	1,080	2,400					2,880
MSM	6,000	9,000	12.00%	15.00%	720	900	1,080	1,350	1,013	0.0%	0	0	
Sex workers	2,400	3,000	25.00%	35.00%	600	840	750	1,050	810	100.0%	810	0	
Clients of sex workers	15,000	9,000	2.00%	3.00%	300	450	180	270	300	0.0%	0	0	
Optional HR1	0	0	0	0	0	0	0	0	0	0.0%	0	0	
Optional HR2	0	0	0	0	0	0	0	0	0	0.0%	0	0	
Optional HR3	0	0	0	0	0	0	0	0	0	0.0%	0	0	
Optional HR4	0	0	0	0	0	0	0	0	0	0.0%	0	0	
Sub-total PHR	32,400	45,000							3,938		1,445	36.7%	

2. Populations at lower risk (PLR) that are not already included in PHR		Population Size Estimate		HIV prevalence Estimate (%)		Estimates of adults living with HIV/AIDS				Average number of adults living with HIV	Female statistics		
Method A: Partners of high risk populations	Low estimate	High estimate	Low	High	Low Population x Low Prevalence	Low Population x High Prevalence	High Population x Low Prevalence	High Population x High Prevalence	Average number of adults living with HIV	Percent (%) female in risk group	Number of women Infected	Percent (%) of infective who are women	
	Partners of IDU	0	0	0	0	0	0	0					0
Female partners of MSM	0	0	0	0	0	0	0	0	0	0.0%	0	0	
Partners of Clients of Sex workers	0	0	0	0	0	0	0	0	0	0.0%	0	0	

Procedure 2-2. Enter Higher-risk Population Data, continued

Step	Do this:
4	Enter your estimate of prevalence for the populations at higher risk (PHRs), shown in Figure 2-3. Enter a range of values: <ul style="list-style-type: none"> cells D10 to D17 for low cells E10 to E17 for high
5	Document your decisions on the Notes sheet (tab).
6	As you complete each higher-risk group, save your work.
7	Include the percentage of women in each higher-risk behaviour group in cells K10 to K17. The Worksheet will create: <ul style="list-style-type: none"> an automatic calculation of the population of lower-risk behaviour women an estimate of the female-to-male ratio in the overall estimate of HIV prevalence
9	Document your decisions on the Notes sheet (tab).
10	When you complete the percentage of women in each higher-risk group, save your work.

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Add lower-risk data

Some people have lower risk behaviour for HIV infection. That is, they have no other known risk factor than being the regular sexual partners of members of a higher risk behaviour group. The Workbook includes three existing lower-risk groups:

- sexual partners of IDUs
- partners of MSMs
- partners of clients of FSWs

There are two ways to estimate lower-risk behaviour population HIV prevalence, Method A and Method B. We explain each of those methods now and give a step-by-step procedure for each.

Method A

Method A for estimating lower-risk population prevalence requires you to:

- estimate the number of sexual partners of people with higher-risk behaviours in the region then
- apply HIV prevalence in this lower-risk group.

For example, to estimate of the number of sexual partners, you need behavioural information about the higher-risk groups, such as the percentage of men who have sex with men who are married or have regular female sex partners.

Prevalence of HIV infection in these groups is often not readily available. You may have to make a reasonable estimate of prevalence in these sexual partners.

For some situations, you can estimate prevalence by assuming a frequency of sex and multiplying that by a reasonable probability of transmission during heterosexual sex. For example:

- Assume that sex occurs once a week (and there are 52 weeks in a year) and the transmission probability (male to female) is 0.2% per act (which is a standard number substantiated elsewhere), then

$$52 * 0.2\% = \text{approximately } 10\% \text{ rate of infection}$$

- You might conclude that 10% of the lower-risk sexual partners of the high risk group will be infected in a year as a result of heterosexual sex. Use these types of calculations to get a rough estimate of prevalence for these sexual partners of populations at higher risk. **For example**, if 20% of STI patients are HIV positive, then 10% of their partners will be infected, i.e., HIV = 2% among low risk partners. Document your decisions.

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- Keep in mind that this is merely an example. Many IDUs are younger and may have more sex partners than assumed in the above example.

PLR sexual partners should be assumed to have no other risk factors. If they do, include them in the *groups at higher risk* estimates.

Procedure 2-3. Method A, Apply Low Risk Prevalence Data

Step	Do this:
1	Click tab R1 to open regional sheet 1.
2	To include this information in your final regional and country estimate, put an X in box E4, shown in Figure 2-4.
3	Enter your Region 1 population size estimate for the populations at lower risk (PLRs), shown in Figure 2-4. Include a range of values for each PLR. Put: <ul style="list-style-type: none"> the low estimated values in cells B23 to B28 the high estimated values in cells C23 to C28
4	Document your decisions on the Notes sheet.

Figure 2-4. Enter a PLR Estimate Using Method A

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	Test Country	sub test 1											
2	Region adult (15-49) population:	3,000,000											
3	% Urban population:	65%		Method A to calculate number of low risk infections									
4	Urban adult population:	1,950,000		Select only one:	X	Method A: Partners of high risk							
5	Year	2004				Method B: ANC data applied to low risk women							
6													
19													
20	2. Populations at lower risk (PLR) that are not already included in PHR												
21	Method A: Partners of high risk populations	Population Size Estimate		HIV prevalence Estimate (%)		Estimates of adults living with HIV/AIDS				Average number of adults living with HIV	Female statistics		
22		Low estimate	High estimate	Low	High	(Low Population x Low Prevalence)	(Low Population x High Prevalence)	(High Population x Low Prevalence)	(High Population x High Prevalence)		Percent (%) Female in risk group	Number of women Infected	Percent (%) of infective who are women
23	Partners of IDU	500	800	2.00%	3.00%	10	15	16	24	16	65.0%	11	
24	Female partners of MSM	500	60	0.10%	0.50%	1	3	0	0	1	100.0%	1	
25	Partners of Clients of Sex workers	2,000	2,500	0.10%	0.15%	2	3	3	4	3	100.0%	3	
26	Optional LR1					0	0	0	0	0		0	
27	Optional LR2					0	0	0	0	0		0	
28	Optional LR3					0	0	0	0	0		0	
29	Sub-total	3,000	3,360							20		14	71.4%
30	Method B: ANC data applied to low risk women	Population Size Estimate		HIV prevalence Estimate (%)		Estimates of adults living with HIV/AIDS				Average number of adults living with HIV	Female statistics		
31		Low	High	Low	High	(Low Population x Low Prevalence)	(Low Population x High Prevalence)	(High Population x Low Prevalence)	(High Population x High Prevalence)		Percent (%) Female in risk group	Number of women Infected	Percent (%) of infective who are women
32	Urban Female low risk pop	967,590	971,393			0	0	0	0	0			
33	Rural Female low risk pop	521,010	523,058			0	0	0	0	0			
34	Sub-total	1,488,600	1,494,450							0		0	
35	No Risk Population	2,951,640	2,964,600										
36	Sub-total PLR	3,000	3,360							20		14	71.4%
37													

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Procedure 2-3. Method A, Apply Low Risk Prevalence Data, continued

Step	Do this:
5	<p>Enter your Region 1 estimate for prevalence for the populations at lower risk (PLRs), shown in Figure 2-4.</p> <p>Enter a range of values for each PLR with:</p> <ul style="list-style-type: none"> ▪ cells D23 to D28 for low ▪ cells E23 to E28 for high
6	Document your decisions on the Notes sheet.
7	Save your work.
8	Click the Region 2 tab to add PLR data. Follow steps 2 through 8 above.
9	Continue with all your other regions.

Method B

For Method B, use HIV prevalence data from pregnant women as your lower-risk behaviour prevalence.

- To use this method, put an **X** in cell E5 (regional sheet), Method B, shown in Figure 2-5.
- From your national population numbers, the spreadsheet will use the number of women in reproductive age (15-49) minus women in the populations with higher-risk behaviour, shown in regional sheet cells B-C32 to B-C33.

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Figure 2-5. Enter PLR Estimate Using Method B

Row	Column	Value
1	A	Test Country
2	B	sub test 1
2	B	3,000,000
3	B	65%
4	B	1,950,000
5	B	2004
28	B	3,000
29	B	3,360
30	B	Population Size Estimate
30	C	HIV prevalence Estimate (%)
30	D	Estimates of adults living with HIV/AIDS
30	E	Average number of adults living with HIV
30	F	Female statistics
32	D	Low
32	E	High
32	F	Low
32	G	High
32	H	(Low Population x Low Prevalence)
32	I	(Low Population x High Prevalence)
32	J	(High Population x Low Prevalence)
32	K	(High Population x High Prevalence)
32	L	24,237
32	M	7,831
34	B	1,488,600
34	C	1,494,450
35	B	1,460,550
35	C	1,479,000
36	B	1,488,600
36	C	1,494,450
41	B	36,005
41	C	33,513
41	D	93.1%

The HIV prevalence for both urban and rural pregnant women will be used to calculate the overall HIV prevalence rate in this group.

You will need to lower this value if you have enough information to suggest an overlap with the higher-risk population. For example, pregnant female sex workers or female injecting drug users may also utilize ANC clinics, and therefore could be double counted in your estimate.

Procedure 2-4. Method B, Use ANC Data

Step	Do this:
1	Click tab R1 to open Regional sheet 1.
2	Place an X in cell E5, Method B.
3	<p>Enter your estimate for prevalence for the populations at lower risk (PLRs), shown in Figure 2-5.</p> <p>Enter a range of values with:</p> <ul style="list-style-type: none"> ▪ cells D32 and E32 for urban low and high estimate ▪ cells D33 and E33 for rural low and high estimate <p>Note: The population size is calculated automatically; you don't have to enter the values above.</p>

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4	Document your decisions on the Notes sheet.
5	Save your work.
6	Click the Region 2 tab to add PLR data. Follow steps 2 through 5 above.
7	Continue with all your other regions.

Select one method

Both methods are good for estimating the number of lower-risk behaviour adults infected in the population. To make your estimate, you selected either Method A or B on each regional sheet. You may:

- change your choice between E4 or E5 and the estimate will change automatically to reflect the approach you have chosen. To check your results, toggle back and forth: choose E4, then E5 and look at the male/female ratio. Do results reflect what you know is happening in your country?
- choose different options on different regional sheets. The **national estimate sheet** will calculate the national estimate using the approaches selected on each regional sheet.

Regional total

Once you have entered the estimates of population size and prevalence for a particular risk group for each region, the estimated average number of Adults Living with HIV/AIDS in that higher-risk behaviour group is calculated and will appear in cell A38 of both the regional tabs and the national tab:

3. Total number of adults living with HIV

You will see three estimates, shown in Figure 2-6:

- Average number of adults living with HIV (J41)
- Number of women infected (L41)
- Percent (%) of infected who are women (M41).

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Figure 2-6. Completed Regional Estimate

1	Test Country	sub test 1												
2	Region adult (15-49) population:	3,000,000												
3	% Urban population:	65%			Method used to calculate number of low risk infections									
4	Urban adult population:	1,950,000			Select only one:	Method A: Partners of high risk								
5	Year	2004				Method B: ANC data applied to low risk women								
37	3. Total number of adults living with HIV													
39											Average number of adults living with HIV	Female statistics		
40												Percent (%) Female in risk group	Number of women Infected	Percent (%) of infected who are women
41	REGIONAL TOTAL										36,005	33,513	93.1%	
42	Number of Adults (15-49) LWHA:	36,005		Notes/Comments:										
43	Proportion that are IDU (%):	5.0%												
44	Adult (15-49) prevalence (%):	1.20%												
45	Percent female (%):	93.1%												
46	Consistency check													
47														
48	Higher risk population size estimates % behaviour Check													
49	IDU	0.6%	OK!											
50	MSM	0.5%	Unusually LOW value!											
51	Sex workers	0.2%	Unusually LOW value!											
52	Clients of sex workers	0.6%	Unusually LOW value!											
74														
75														
76														
77														

Your Results and Output

National estimate

Once you have filled out each of the regional sheets, Workbook fills in the National sheet. The National estimate is the sum of the estimates in each region.

National prevalence

The national population HIV prevalence estimates are in cells A-B60 to A-B63 and shown in Figure 2-7.

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Figure 2-7. National Population HIV Prevalence Estimates

	A	B	C	D	E	F	G	H	I	J	K	L
1	National country estimate for:	Test Country										
2	National adult (15-49) population:	5,000,000										
3	% Urban population:	39.0%										
4	Urban adult population:	1,950,000										
5	Year	2004										
52												
53	Higher risk population size estimates	% behaviour	Check	Comment								
54	IDU	0.3%	ok!	While the extent of injecting drug use varies dramatically among countries few countries will have more than 0.7% of the								
55	MSM	0.3%	Unusually LO	Research has found that in most countries between 2% and 5% of men aged 15-49 have sex with other men.								
56	Sex workers	0.1%	Unusually LO	Few countries have good estimates of the number of sex workers. In Thailand the estimated number of sex workers is not								
57	Clients of sex workers	0.5%	Unusually LO	Few countries have good estimates of the number of clients of sex workers. In Thailand the estimated number of clients is								
58												
59	Higher risk HIV prevalence estimates	% HIV	Check	Comment								
60	IDU	11.0%	ok!	Above 70% is unusually high.								
61	MSM	13.5%	ok!	Above 40% is unusually high.								
62	Sex workers	30.0%	ok!	Above 60% is unusually high.								
63	Clients of sex workers	2.5%	ok!	Above 30% is unusually high.								
64												
65	Model	Value	Check	Comment								
66	Female:Male ratio	1344.7%										
67	PLR to PHR ratio	8.14	Unusually HIGH ratio!	Using this approach to estimating prevalence, the majority of people living with HIV/AIDS should be from								
68	National percent urban (%)	39.0%	Low - Check Set-up sheet.	National percent urban is lower than given in 'Set-up' sheet.								
69												
70												
71												
72												
73												
74												
75												
76												
77												

Consistency checks

A series of consistency checks are provided in cells C54-C63, shown in Figure 2-8.

The consistency checks compare the values seen in your national estimate to those in other countries with *low-level* or *concentrated* epidemics. Average population sizes of groups at higher-risk and estimates of prevalence are compared.

So these values simply give a comparison to average values.

- If a value you used in making your national estimate falls outside of this range, a warning is given, for example, “The percentage of men who have sex with men is unusually low.”
- If the values are within the range, you will see **OK** in the cells D54 to D63.

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Figure 2-8. Consistency Checks with Numbers

	A	B	C	D	E	F	G	H	I	J	K	L
1	National country estimate for:	Test Country										
2	National adult (15-49) population:	5,000,000										
3	% Urban population:	39.0%										
4	Urban adult population:	1,950,000										
5	Year	2004										
52												
53	Higher risk population size estimates	% behaviour	Check	Comment								
54	IDU	0.3%	ok!	While the extent of injecting drug use varies dramatically among countries few countries will have more than 0.7% of the								
55	MSM	0.3%	Unusually LO	Research has found that in most countries between 2% and 5% of men aged 15-49 have sex with other men.								
56	Sex workers	0.1%	Unusually LO	Few countries have good estimates of the number of sex workers. In Thailand the estimated number of sex workers is ro								
57	Clients of sex workers	0.5%	Unusually LO	Few countries have good estimates of the number of clients of sex workers. In Thailand the estimated number of clients is								
58												
59	Higher risk HIV prevalence estimates	% HIV	Check	Comment								
60	IDU	11.0%	ok!	Above 70% is unusually high.								
61	MSM	13.5%	ok!	Above 40% is unusually high.								
62	Sex workers	30.0%	ok!	Above 50% is unusually high.								
63	Clients of sex workers	2.5%	ok!	Above 30% is unusually high.								
64												
65	Model	Value	Check	Comment								
66	Female:Male ratio	1344.7%										
67	PLR to PHR ratio	8.14	Unusually HIGH ratio!	Using this approach to estimating prevalence, the majority of people living with HIV/AIDS should be from								
68	National percent urban (%)	39.0%	Low - Check Set-up sheet.	National percent urban is lower than given in 'Set-up' sheet.								
69												
70												
71												
72												
73												
74												
75												
76												
77												

Once you are satisfied with the national estimate for the year, develop an epidemic curve that shows the course of the epidemic over time.

Unit 3, Epidemic Curves

Getting Started

You will use the Epidemic Curve sheets for two purposes:

- to fit an epidemic curve to the data points so that you can assess the trend over time.
- to determine doubling time of the epidemic, rate of growth of the epidemic and the current prevalence level.
- to develop prevalence data that can be exported to Spectrum, a program used to estimate the impact of HIV prevalence on incidence, mortality, orphanhood and other variables.

The primary purpose for developing HIV prevalence and epidemic curves is to use them in Spectrum.

What you will learn

When you complete this unit, you will be able to:

- develop an epidemic curve that shows your country's prevalence over time
- develop estimates of prevalence that can be used in Spectrum to estimate mortality and the impact of HIV/AIDS

Developing Epidemic Curves

Add Set-up information

You have several sources of prevalence data to develop epidemic curves:

- your past country or province reports
- your calculations in the Point-Prevalence sheets over several years

If you used the Point-Prevalence sheets, the set-up data you entered are already in the sheets where you will develop epidemic curves.

If not, add set-up data. Follow Procedure 2-1, steps 1 through 10, for each region.

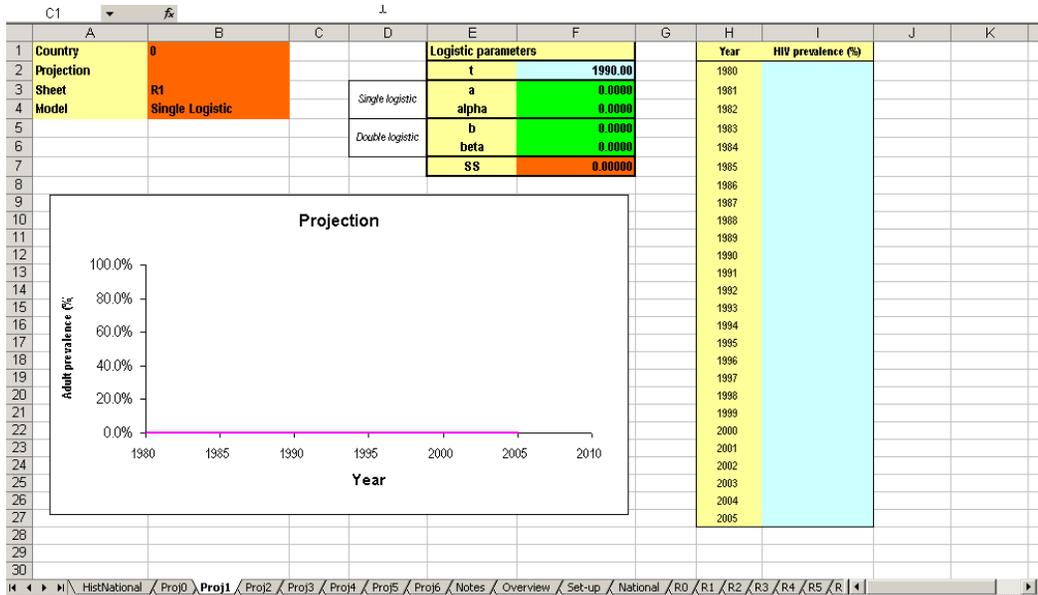
If you have not used Excel before, there are directions in the Introduction to this module.

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EC sheets

You will use the tabs marked EC1, EC2 and so forth, shown in Figure 3-1, to enter data.

Figure 3-1. Sheet EC1



You must have at least three points (years of prevalence data) to fit an accurate curve. You will get the most accurate curve if you have some points early in the epidemic. Use as many widely spread points as possible.

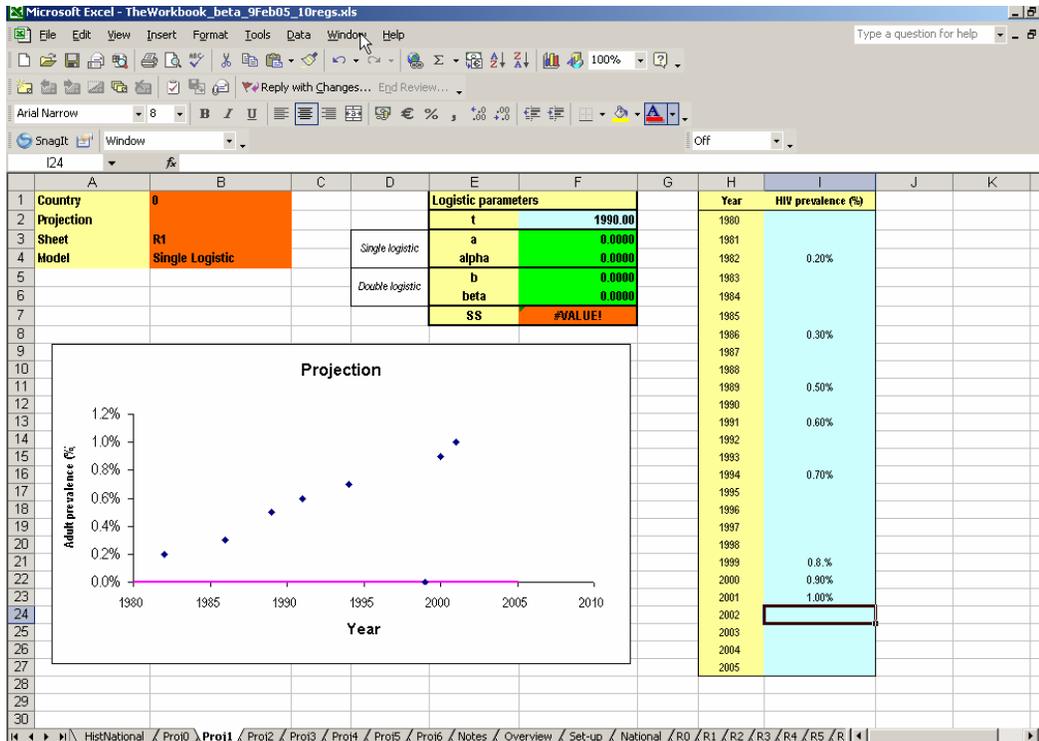
Procedure 3-1. Add Prevalence to an Epidemic Curve Sheet

Step	Do this:
1	Click EC1 tab.
2	<p>Enter the first prevalence value you have in the light blue cell next to the year it was calculated:</p> <ul style="list-style-type: none"> ▪ cell I2 for 1980 through ▪ cell I27 for 2005 <p><i>You will not have data for every year of course.</i></p>
3	<p>Press Enter when you finish entering the prevalence value.</p> <p>Note the point that has been plotted on the graph as a blue diamond, shown in Figure 3-2.</p>

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4	<ul style="list-style-type: none"> ▪ Add prevalence values for each year that you have data. ▪ Press Enter after each value is entered.
5	<p>Save your work.</p> <ul style="list-style-type: none"> ▪ If this is your first time to save, Click File, Save As... to give your Workbook a new name.

Figure 3-2. Blue Diamond Points Plot the Epidemic Curve



Curve Fitting

Curves are fitted to data in order to determine epidemic trends.

Install Solver

To perform curve fitting, you must have Excel™ *Solver* installed. Solver is an add-on program and is not usually included in the basic Excel™ installation.

Solver enables you to vary a set of parameters to produce a desired outcome. In this workbook, Solver allows us to obtain the best fitting curve to the data points by minimizing the Sum of Squares. In order to ensure that the parameter values fall within acceptable ranges, constraints have been added. More information about those constraints can be found in the Appendix E.

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To install Solver, follow the steps.

Procedure 3-2. Install Solver

Step	Do this:
1	Open the Workbook, any sheet.
2	Click Tools on the Excel™ toolbar.
3	Click Add-Ins... in the Tools dropdown box.
4	In the Add-Ins dialog, click in the box next to Solver Add-in to add a check.
5	Click OK .

Set curve-fitting parameters

Using *Solver*, parameters are varied to produce an epidemic curve that gives a historical perspective of how the epidemic has developed in your country. The EC sheets enable you to fit the data to:

- a logistic curve using three parameters or
- a double logistic curve using five parameters.

Appendix E and Table 3-1 explain single logistic and double logistic curves.

Table 3-1. When to Use Each Logistic Curve Model

Use this model...	For these conditions
Single logistic curve	<ul style="list-style-type: none"> ▪ the most common model ▪ used when the epidemic is still growing or starting to stabilize ▪ requires more than three data points (years of prevalence data)
Double logistic curve	<ul style="list-style-type: none"> ▪ used when epidemic shows signs of decline ▪ requires more than five data points (years of prevalence data). Five parameters are calculated, so you need more than five estimates.

When you use Solver, these three or five parameters are initially solved for you.

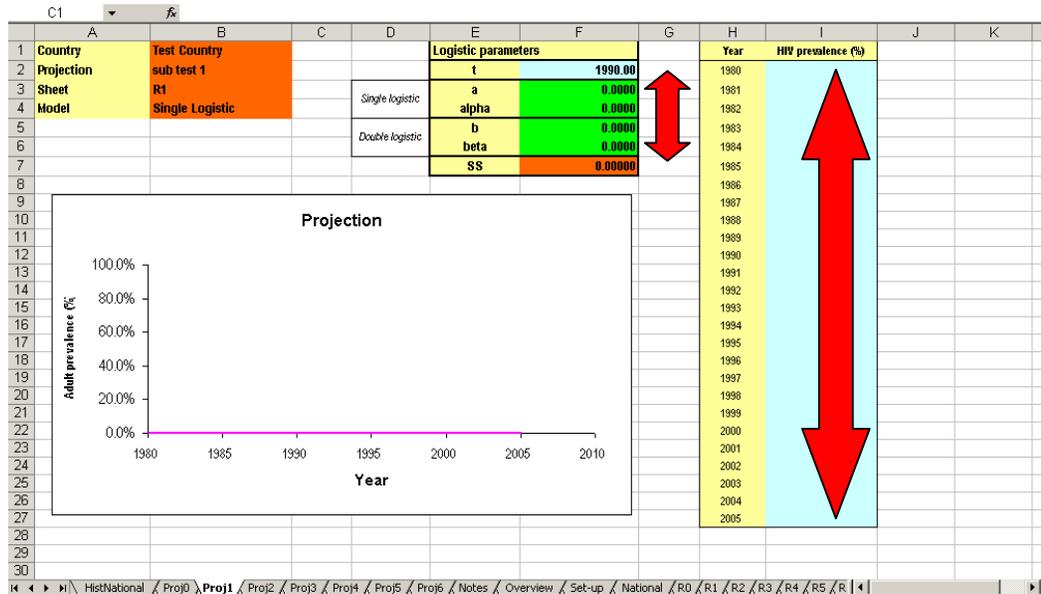
- Remember that you do not need to have prevalence estimates for all years but the more data, the better. In other words, more data

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allows you to more accurately assess what is happening in the epidemic over time. See Figure 3-3.

- You need at least two previous years' estimates before the base year estimate to produce a reasonable logistic curve; preferably more and preferably some in the early stages of the epidemic.
- If you have estimates for more years, include those as well.
- For a more accurate picture do not use just the most recent years. Use national prevalence estimates from years that reflect both the *early* and *middle* stages of the epidemic when you are fitting the epidemic curve. For example, if you have data every two years from 1985 to present, use all that data, not just 1997, 1999, 2001, 2003.

Figure 3-3. Logistic (Curve Fitting) Parameters and
Space to Enter Yearly Data from 1980 to Present



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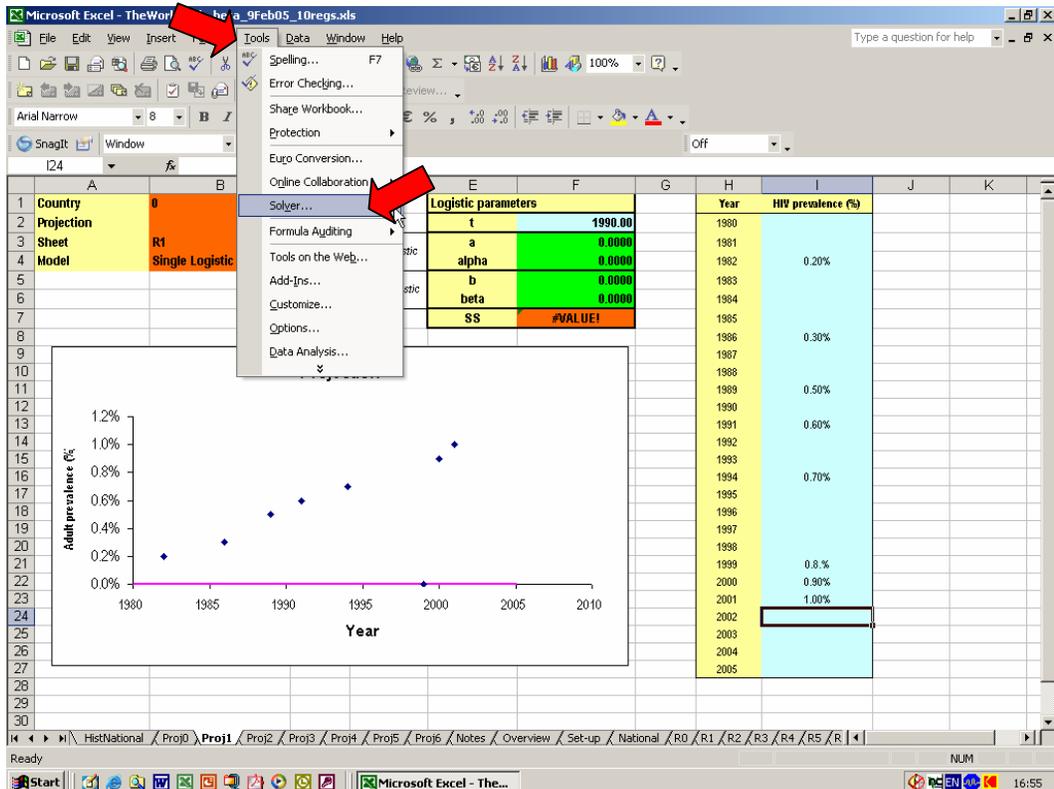
Run the curve fitter

Follow the steps below to run the curve fitter, shown in Figure 3-3.

Procedure 3-3. Run the Curve Fitter

Step	Do this:
1	Click T ools in the Excel™ toolbar at the top of your screen as shown in Figure 3-4.
2	Select S olver... from the Tools menu.
3	In the Solver parameters dialog, click the Solve button in the upper right shown in Figure 3-5. Solver will fit the curve to your data points.
4	Click on the Keep Solver Solution radio button, shown in Figure 3-6.
5	Click OK .

Figure 3-4. Run the Curve Fitter



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Figure 3-5. In the Solver parameters dialog, click the Solve button

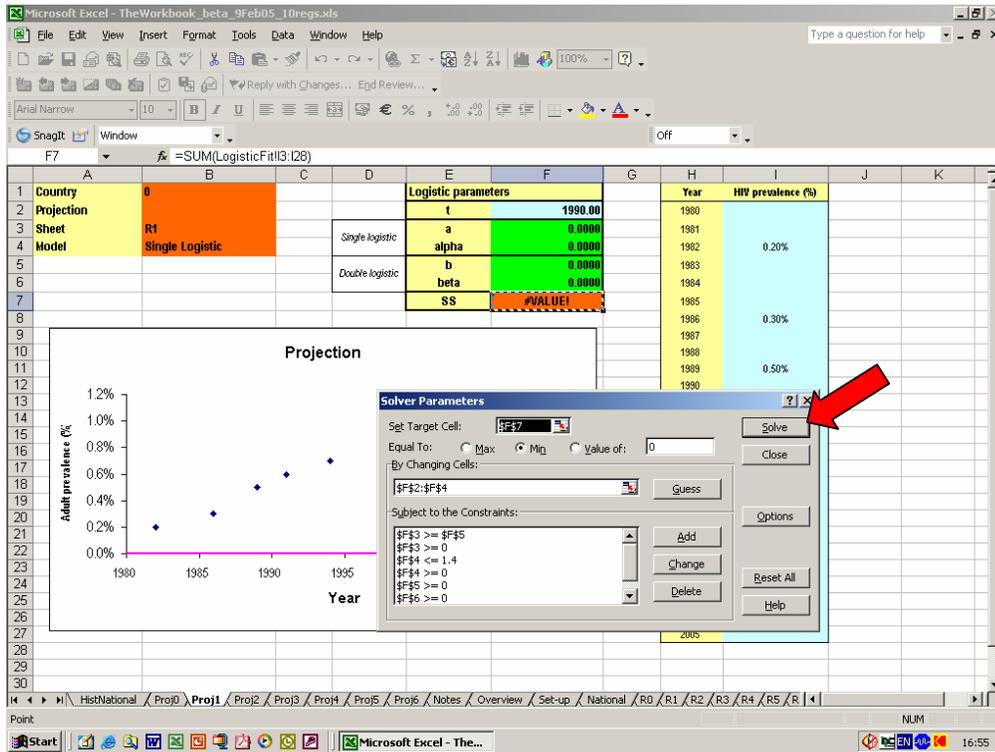
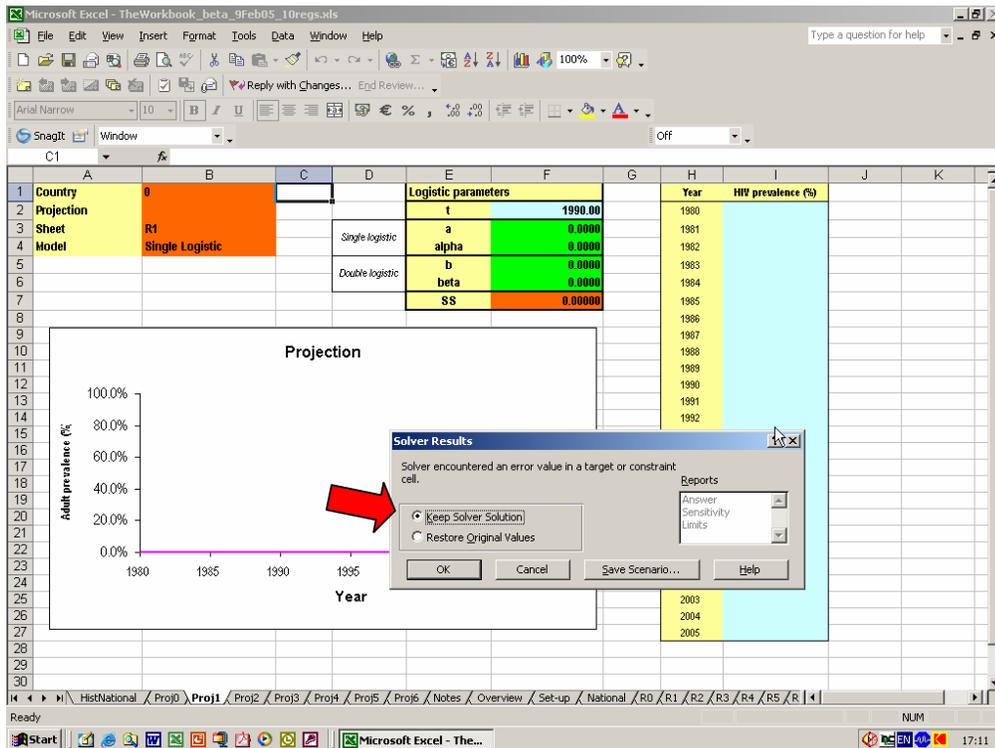


Figure 3-6. Click Keep Solver Solution Radio Button



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The results are automatically recorded on the Spectrum sheet. These values can be imported by Spectrum.

You can see the graphical output of the curve fitter as well and can evaluate how well the model fits your data (cells F2 - F6).

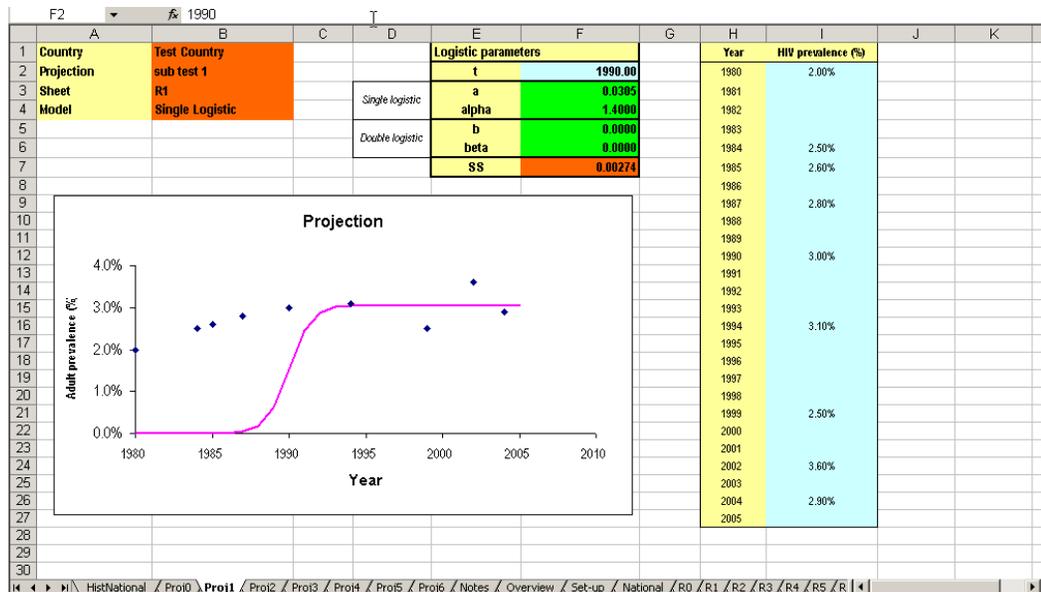
Thinking about your results

‘Reasonableness’ is arbitrary. If you only have three points in this mathematical model, the model is weaker. The graph may not be a good representation of your epidemic. If you feel that the curve it is not fitting the data well, you can adjust the parameters to see if the result from Solver is closer to what you really think is happening.

How to refit the curve

The curve-fitting algorithm does not always produce the best fit on the first try, as shown in Figure 3-7.

Figure 3-7. Curve Does Not Show a Good View of the Epidemic



If the curve produced does not fit the data points for the yearly estimates, you can reset the logistic parameters to different values and try refitting the curve. Here is how to do that.

The three parameters used in the single logistic curve and shown in Figure 3-8:

- Year (t), in cell F2, is calculated by the Solver program. It represents the year in which the epidemic reached ½ of its peak.
- Exponential (α), cell F3, is a measure of how fast the epidemic grew (rate of increase).

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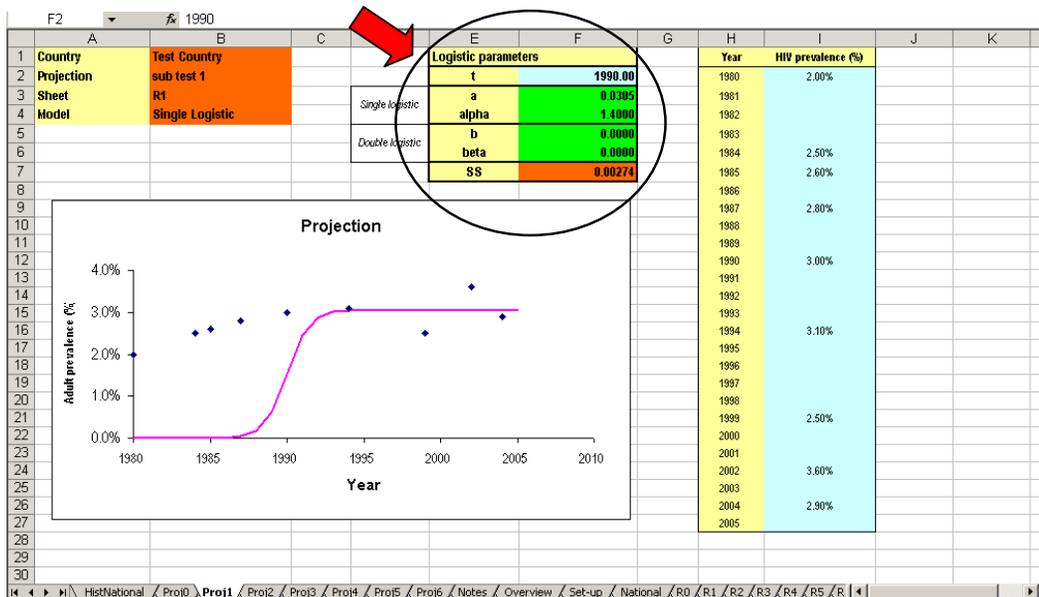
- Asymptote (alpha), cell F4, indicates the point the epidemic is likely to level off.

The Sum of Squares (SS) is shown in cell F7. SS is an additional logistic parameter and is used as a diagnostic. SS provides a measure for determining how efficient the three parameters are estimating a reasonable curve.

The closer SS is to 0.00, the better.

You can also use the parameter estimates from this analysis to solve for Doubling Time of the epidemic. The natural log of 2, $\ln(2)$, divided by Exponential provides you doubling time at the beginning of the epidemic.

Figure 3-8. Logistic Parameters and SS



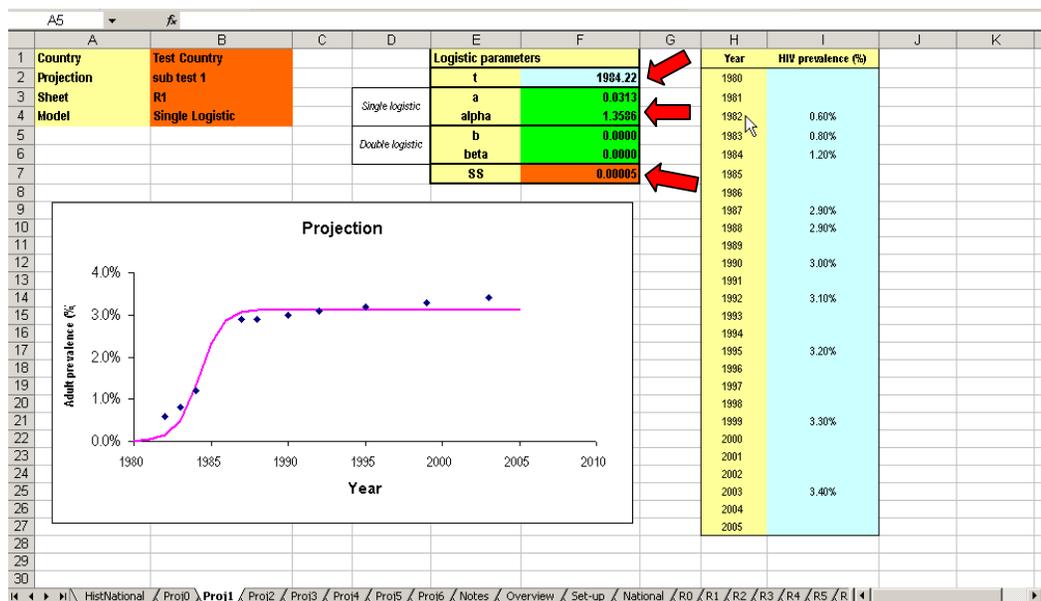
Sometimes, by varying the three (for single logistic) or five (for double logistic) parameters in Solver, we can further minimize the SS. Starting next page, follow Procedure 3-4 and Figures 3-9 through 3-11 to refit your epidemic curve.

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Procedure 3-4. Refit the Curve, Three Parameter (Single Logistic) Model

Step	Do this:
1	Run Solver.
2	Record the initial values of: <ul style="list-style-type: none"> ▪ cells F2 - F4 ▪ SS, found in cell F7 as shown in Figure 3-9.
3	Alter the values in F2 - F4 for single logistic as shown in Figure 3-10.
4	Check your SS results: <ul style="list-style-type: none"> ▪ if SS is higher, return to your original results. ▪ if SS is smaller, keep the new values.
5	Document in the Notes sheet: <ul style="list-style-type: none"> ▪ your initial SS ▪ the changes you made to F2 - F4 ▪ the final SS
6	Save your work.

Figure 3-9. Record Initial Values



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Figure 3-10. Alter the Values of Cells F2 – F4, then Check SS

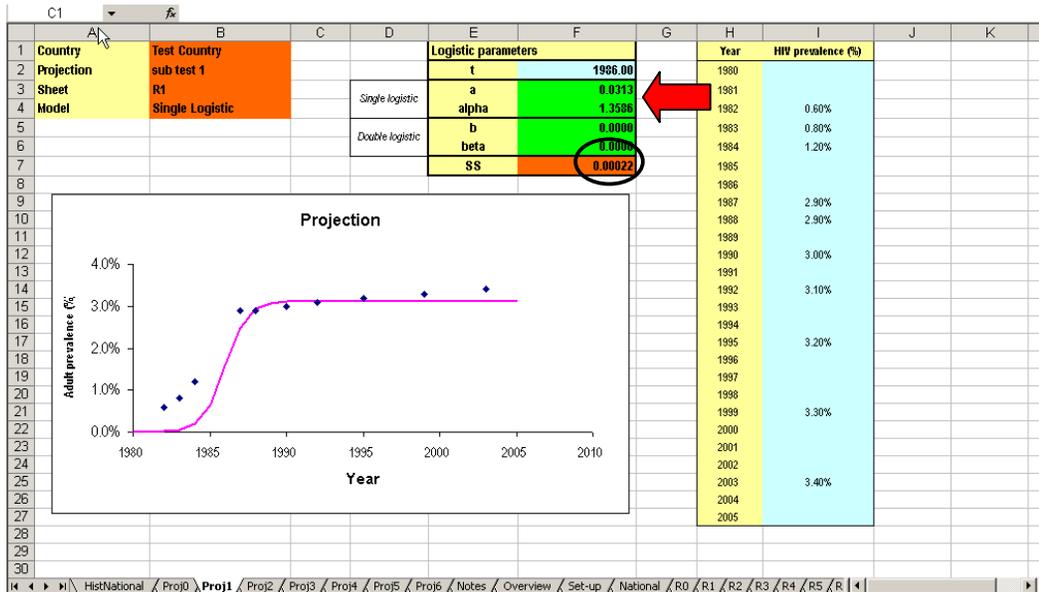
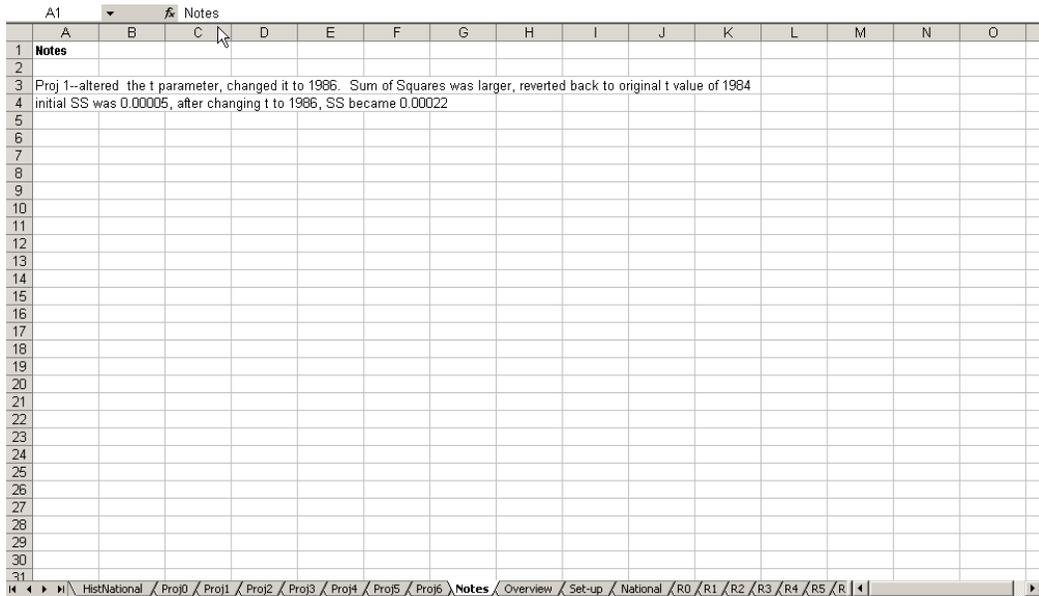


Figure 3-11. Document Your Actions on the Notes Sheet



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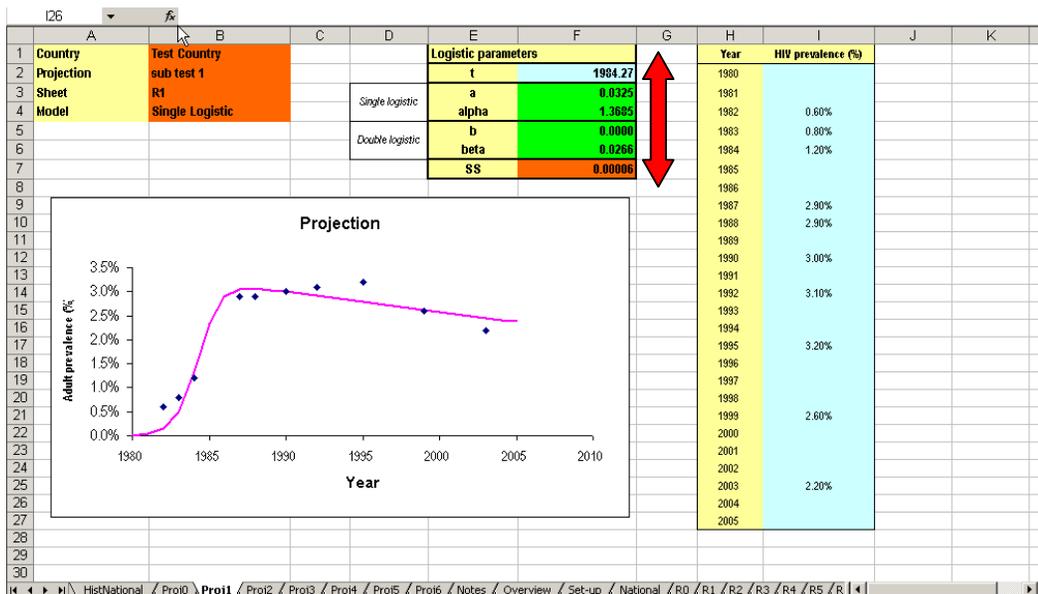
Epidemic in decline

If you have data that suggests that the epidemic is in decline, you may decide to use the double logistic curve. If you need to refit the curve, follow Procedure 3-5 below and Figures 3-12 and 3-13.

Procedure 3-5. Refit the Curve, Five Parameter (Double Logistic) Model

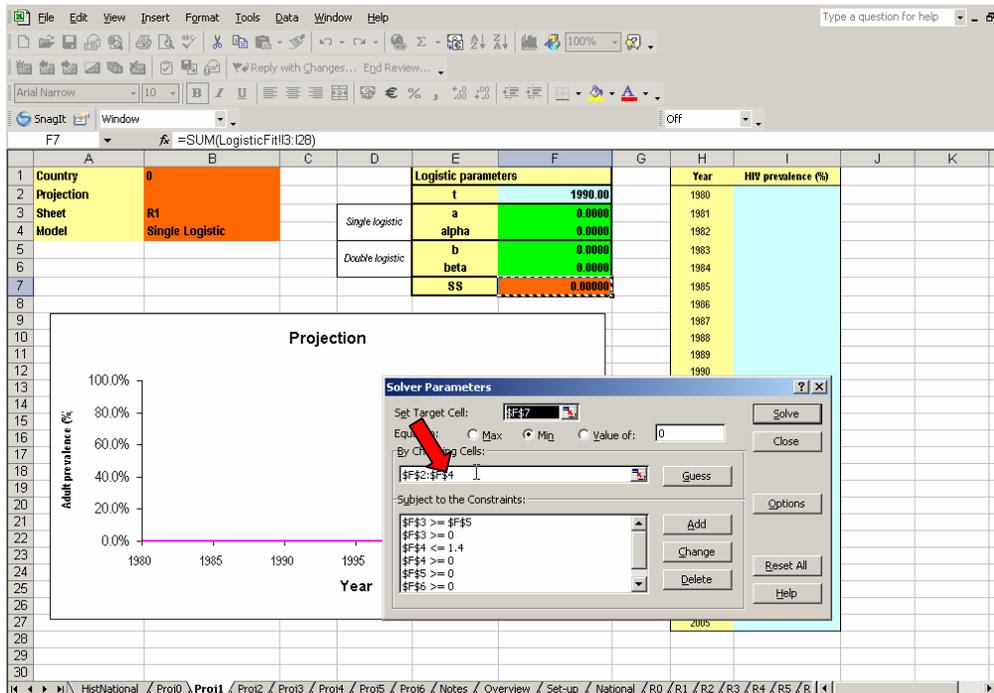
Step	Do this:
1	Run Solver.
2	Record the original value for SS, shown in Figure 3-12.
3	Alter the region called By Changing Cells within Solver shown in Figure 3-13. Change \$F\$2:\$F\$4 to \$F\$2:\$F\$6.
4	Use the additional two parameters in the double logistic curve: <ul style="list-style-type: none"> ▪ B, cell E5, the prevalence level at which the epidemic is going to stabilize ▪ β (Beta), cell E6, the rate at which the epidemic is in decline. Solver calculates these values for you.
5	If you alter any of the five parameters: <ul style="list-style-type: none"> ▪ As with the logistic instructions (Procedure 3-4), record and report which parameter(s) you changed and why ▪ Record the new value for the Sum of Squares
6	Save your work.

Figure 3-12. Record the Original Values



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Figure 3-13. Altering the Solver Function to Solve for Five Parameters



Your Results and Output

You do not need to export data to a special file to send it to Spectrum.

Workbook generates data that is written to a file. Spectrum is able to recognize the Workbook file and will retrieve it as part of its own programming.

This data is available to you if you use the unhide option as you have in the past.

Appendix A, References and Further Reading

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Appendix B, Glossary and Acronyms

Appendix C, Useful Links

Appendix D, Handout for Planning Workbook Structure

Directions

Most of the work of preparing a national estimate is the initial data collection and planning. We will use this handout to develop a structure for your Workbook. Then we will apply the structure to the Workbook software.

We will just do the set-up and detailed information for one region on the handout to give you an idea of what is needed.

You will fill in the handout with these details:

- your geographical ‘regions’
- the groups in your country who are at higher risk of HIV infection
- the groups in your country who are at lower risk of HIV infection
- how you have decided to handle ‘missing’ data

Tables for planning

Table 1. Your Regions

These entries go in Set-up

Region	Regions (or Districts, Provinces, Counties, Departments, etc)
R1	
R2	
R3	
R4	
R5	
R6	
R7	
R8	
R9	
R10	

Table 2. Your High and Low-Risk Groups

These entries go in Set-up

Higher-Risk Behaviour Groups	Lower-Risk Behaviour Groups

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Table 3. Data Sources

Data	Check	Comments (years, regions, groups covered, etc)
DHS or DHS+ survey results		
ANC surveys		
Behavioural surveys		
Case reports		

Table 4. Your Regional Data

These entries go in Set-up and Regional tabs or help with estimates

Category	Entry or estimate	Source of Your Data
Region 1 name (tab R1)		
Population (age 15-49)		
% Urban		
Is epidemic early or long-standing?		
List missing data	Missing population data: Missing prevalence data:	

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High-Risk Estimates		
IDU	Size: HIV Prev Range:	
MSM	Size: HIV Prev Range:	
FSW	Size: HIV Prev Range:	
Clients of FSWs	Size: HIV Prev Range:	
Other	Size: HIV Prev Range:	
Other	Size: HIV Prev Range:	
List missing data	Missing population data: Missing prevalence data:	
Other	Size: HIV Prev Range:	

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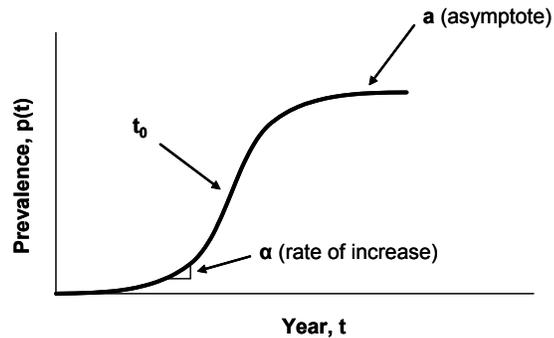
Low-Risk Estimates		
IDU partner	Size: HIV Prev Range:	
MSM female partner	Size: HIV Prev Range:	
FSW client partner	Size: HIV Prev Range:	
Other	Size: HIV Prev Range:	
Other	Size: HIV Prev Range:	
Other	Size: HIV Prev Range:	

Appendix E, Description of Model for Fitting Curves in Workbook

1. When the prevalence is still increasing or showing signs of leveling off:

Fit a logistic curve of the form

$$p(t) = \frac{ae^{\alpha(t-t_0)}}{1 + e^{\alpha(t-t_0)}}$$



Where a = asymptote (i.e., the level at which the epidemic is expected to level off)

α = the rate of increase at the start of the epidemic

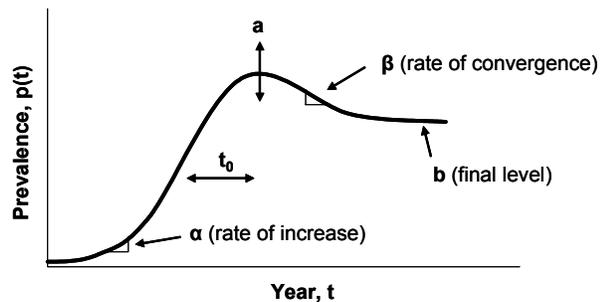
t_0 = the time at which the epidemic reaches half its asymptotic value

The doubling time at the beginning of the epidemic can be determined from α , i.e., doubling time = $\ln(2) / \alpha$

2. When the prevalence shows evidence of a decline:

Fit a double logistic curve of the form

$$p(t) = \left[\frac{e^{\alpha(t-t_0)}}{1 + e^{\alpha(t-t_0)}} \right] \left[\frac{ae^{-\beta(t-t_0)}}{1 + e^{-\beta(t-t_0)}} + b \right]$$



Where α = the rate of increase at the start of the epidemic

a = determines the peak value

β = the rate of convergence

b = final prevalence level

t_0 = shifts the whole curve backward or forward