VACCINATION
COVERAGE
QUALITY
INDICATORS

User's Guide

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World Health Organization

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CHAPTER 0. PRELIMINARY MATERIAL

Document Revision History

2015-12-16	Original draft
2016-03-11	Second draft
2016-06-14	Version 2.1
2016-10-11	Version 2.4: New logo on cover and replaced vcqi_halt_immediately with vcqi_cleanup
2017-02-15	Version 2.5: New ability to specify 2+ demographic stratification variables New RI data quality report New inchworm plots with two distributions per row

Acronym List

CI	Two-sided Confidence Interval
DEFF	Design effect
FVL	Forms and Variable List Document (that accompanies this User's Guide)
LCB	Lower one-sided confidence bound
HC	Health center (might sometimes be used interchangeably with "health facility")
ICC	Intracluster correlation coefficient
MCV	Measles Containing Vaccine
MOV	Missed opportunity for vaccination
UCB	Upper one-sided confidence bound
VCQI	Vaccination Coverage Quality Indicators

License Agreement

(Pending approval by WHO)

CHAPTER 1. INTRODUCTION

The Vaccination Coverage Quality Indicators (VCQI[1]) software is a set of programs to calculate standard outputs from coverage survey datasets. This document is meant to guide you in using the software.

VCQI is organized around three types of surveys:

1. Routine Immunization
2. Tetanus – typically administered to women who have had a live birth in the past 12 months
3. Post-SIA – typically administered directly following a vaccination campaign or supplemental immunization activity

In the remainder of this document we abbreviate these three surveys using the letters RI, TT and SIA.

The programs that comprise VCQI are freely available, courtesy of the World Health Organization.

1.1 How to Obtain the VCQI Programs

In the future, VCQI will be free to download from a website. For now, you need to write to Carolina Danovaro at the World Health Organization (danovaroc@who.int) and obtain permission to acquire the programs. If approved, she will direct you to contact Dale Rhoda at Biostat Global Consulting (Dale.Rhoda@biostatglobal.com) for the latest version of the files. The files are shared using GitHub (www.github.com). You will need to have a (free) GitHub account to download the VCQI programs and keep them up-to-date.

1.2 Stata Version Required

VCQI requires version 14 or later of Stata to run.

1.3 Where to put the VCQI Programs

VCQI consists of many new Stata commands, saved in text files with the extension .ado. The programs are saved in seven sub-folders. The most straightforward way to make these commands available to Stata is to save them to your local hard drive and add those folders to Stata's so-called adopath. The adopath is the group of folders that Stata searches for .ado files.

One logical place to save the VCQI programs might be in the folder that Stata calls your PERSONAL folder. Start Stata and type the command sysdir. It will produce output like this:

```
. sysdir
   STATA:  C:\Program Files (x86)\Stata14\
    BASE:  C:\Program Files (x86)\Stata14\ado\base\
    SITE:  C:\Program Files (x86)\Stata14\ado\site\
    PLUS:  c:\ado\plus\
PERSONAL:  c:\ado\personal\
OLDPLACE:  c:\ado\
```

[1] Pronounced "Vicki"

This indicates that the user's PERSONAL folder is c:\ado\personal. So this user could copy the VCQI_Stata_Programs folder into c:\ado\personal. Because the programs are saved in sub-folders, Stata will not find them automatically; the user will need run the following lines before running VCQI:

```
adopath + C:\ado\personal\VCQI_Stata_Programs\DESC
adopath + C:\ado\personal\VCQI_Stata_Programs\DIFF
adopath + C:\ado\personal\VCQI_Stata_Programs\LIBRARY
adopath + C:\ado\personal\VCQI_Stata_Programs\PLOT
adopath + C:\ado\personal\VCQI_Stata_Programs\RI
adopath + C:\ado\personal\VCQI_Stata_Programs\SIA
adopath + C:\ado\personal\VCQI_Stata_Programs\TT
```

You may either run these lines of code every time you run VCQI, or have Stata run them automatically at startup by putting them in a program named "profile.do" and saving that program in your PERSONAL folder.

1.4 Terminology

This document describes numerous analyses that can be performed on coverage survey data. The letter I in the acronym VCQI stands for *indicators* and this document often calls the analyses indicators but it also sometimes uses the word *measure* or *analysis* to mean the same thing. Any of those words mean a clearly-defined analysis that runs on coverage survey data and, if successful, produces some output. The details of the indicators appear in later sections of this document and in the accompanying specifications for the VCQI software.

CHAPTER 2. OVERVIEW

This section of the document gives an overview of a) files that comprise VCQI, b) datasets and parameter files that need to be assembled in order to run VCQI, and c) the files that are produced by VCQI.

2.1 Running VCQI

The usual practice is to copy a VCQI control program (.do file) from the examples provided, edit the file, save it and run it in Stata. Open the resulting spreadsheet and check the log sheet for errors or warnings. If VCQI ran successfully, examine the results to see if they make sense. If yes, you might copy tabulated results or automatically generated figures into a report. Save the control program and output for future reference. To run a second analysis, copy the control program to a new, empty folder; edit the new program to send its output to that new folder where the control program is saved; save the control program, and run it.

VCQI performs a series of checks to be sure you have defined the necessary inputs and that it can find the input datasets and necessary variables. When something goes wrong, it tries to provide informative error messages both to the Stata output screen and in a VCQI log file. If VCQI detects an important error, the log is copied into the output spreadsheet before the program halts. If an unanticipated error occurs, the incomplete log will be a Stata dataset saved in the VCQI output folder. If you open the spreadsheet and find only placeholder text in the Log worksheet, then close the Excel file and type the command "`vcqi_cleanup`" in the Stata command line. In most cases this will cause the log to be closed and processed and copied to the output spreadsheet file. Re-open the spreadsheet and look at the log tab. Otherwise follow the instructions found in the placeholder Log tab in the spreadsheet.

In the future we hope to establish a VCQI user's group and online forum. For now, if you have problems that you cannot debug yourself, contact Dale.Rhoda@biostatglobal.com.

2.2 The Indicators

Several types of analyses are included with VCQI; they are described in this document using short abbreviations:

- DESC: Descriptive indicators document the composition of the survey sample and summarize responses to multiple-choice questions; these indicators may be calculated for any survey.

Within each survey the indicators are organized according to vaccination program attributes that have proven useful in earlier assessments:

- COVG: Indicators related to estimated proportion served, known informally as *coverage*
- ACC: Indicators related to whether respondents have *access* to vaccination services
- CONT: Indicators related to whether respondents experience *continuity* of services
- QUAL: Indicators related to the *quality* of vaccination service

Finally, there are indicators to conduct formal hypothesis tests

- DIFF: Indicators to estimate *differences* in coverage may be calculated for many outcomes. VCQI calculates differences in coverage a) between strata, and b) between sub-groups within a single stratum.

Additional indicators will be added over time.

2.3 Files that comprise VCQI

Stata Programs

VCQI is a set of Stata programs that work together to analyze the survey data. You will need to download the programs and put them in folders where Stata can access them. No special license key is required to run the programs – if you have the VCQI programs and you have a licensed copy of Stata, you can run VCQI.

Control Program

To run VCQI, the user copies a control program, edits it, and then runs it. The control program will call all the other necessary programs – in most cases a VCQI user will not need to look inside any program except the control program. Every control program alternates between clearly marked blocks of code that the user *should edit* and blocks that they *should not edit*. Portions of the control program that you might edit include those that point to folders and datasets, lines that describe the vaccination schedule and survey, and those that list which indicators you want to calculate. Sample control programs are provided with the VCQI programs and several are annotated in this user's guide. See Chapter 7.

2.4 Files Used by VCQI

Datasets

You need to assemble a small set of files to run VCQI – precisely which files depends on whether you are analyzing data from a routine immunization (RI) survey, a post-supplemental immunization activity (SIA) survey, or a tetanus protection at birth (TT) survey. Details appear in later sections of this document. VCQI assumes that the datasets were collected using the survey questions described in the accompanying document named *Vaccination Coverage Surveys – Forms & Variable Lists (FVL) Structured for Compatibility with VCQI* (described hereafter as 'the FVL document'[2]). VCQI assumes that variables are named and coded as described there. A future annex to this guide will list the smallest set of variables required for each VCQI indicator. If the data were collected using other survey instruments, it will be necessary to recode the data to look as though it comes from questions in the FVL document.

Parameter Files

The user provides parameter files listing the names of geographic or administrative strata in the survey and the order in which they should be listed in output tables. Annex B describes how to specify names and listing orders of strata.

2.5 Files Produced by VCQI

VCQI can produce four types of files.

Analysis Datasets

For each indicator, there is usually an intermediate analysis dataset (flat file) produced that includes only the variables required for that indicator. The analysis file usually includes elements from several

[2] The variable list document is a slightly modified version of Annex H of the 2015 draft version of the WHO Vaccination Coverage Cluster Survey Reference Manual.

input datasets (e.g., from the list of households (HH), from the list of household members (HM), from the cluster metadata (CM) and from the subject matter dataset: RI, TT, or SIA). The analysis file will also include new so-called *derived variables* that VCQI calculates from the survey data and uses to calculate the indicators.

Output Databases

Most indicators produce one or more databases documenting indicator outcomes by geographic or administrative stratum in the dataset. These databases are saved as Stata datasets and are suitable for importing by other programs. They could be used for later calculations or to tabulate or graph results in a way that is not supported by VCQI. The database files have the word *_database* in their filenames. Later sections of this document list the databases saved by each indicator.

Tabulated Output

VCQI saves tabulated output in an Excel file, usually generating one tab or worksheet per indicator. The output is formatted and ready to be copied and pasted into project reports. The user controls which strata appear in the tables and in what order. (See Annex B.) Typically, a VCQI control program analyzes only one sort of survey data and produces only one Excel output file. If a survey asked questions about routine immunization, tetanus doses for pregnant women, and campaign coverage, that data would be analyzed using at least three separate control programs and the outputs for each portion of the survey would be saved in a different Excel workbook.

For RI survey analysis, there is an option to summarize the quality of the vaccination data. If the user requests this analysis, its outcomes will be put into a separate Excel spreadsheet with the words "dates_ticks" in the filename. Watch for a forthcoming tutorial on how to interpret that output.

Graphic Output

Many VCQI indicators generate figures. The control program includes options so the user can stipulate whether the program should make any figures at all, and if so, which types and which strata should appear in them. As a rule, the same strata that appear in the tabulated output also appear in the figures. Each figure is saved as a portable network graphics file (extension .png). The control program has an option to also save the figures in Stata's .gph format, which makes it possible to edit the figures later using Stata's graph editor.

At this time VCQI generates three kinds of graphical output, organ pipe plots, inchworm plots, and unweighted sample proportion plots. Annexes B & C show examples of VCQI figures. There is helpful information on organ pipe plots and inchworm plots in the 2015 Draft Update to WHO's Vaccination Coverage Cluster Survey Reference Manual – specifically in Chapter 6 and Annex M. Unweighted proportion plots simply list a sample size and show an estimated proportion for each stratum using a colored symbol.

2.6 Levels of Survey Strata

VCQI is flexible and can analyze data from a single geographic region (stratum) or from several strata. If the strata comprise all the pieces of a higher level (e.g., all the provinces in a nation) then VCQI can calculate the aggregated higher level results as well.

The examples in this user's guide assume that your survey was conducted in strata at sub-sub-national level (e.g., a separate survey in each health district). It assumes that the districts are nested within provinces, and the survey was conducted in every district in every province. It provides examples of estimating results at the district level, at the provincial level, and at the national level.

It is possible to do simpler or even more complex analyses, such as a single survey in a single stratum, or even four nested levels of hierarchy. The variations are described in Annex B.

2.7 Program Progress Log

Every VCQI session generates a log file with messages to document the user's inputs and inform the user which programs were used, what version of those programs, and whether their progress was successful or if they issued errors or warnings.

The log entries are stored in a Stata dataset while VCQI is running. The various programs append new comments onto the dataset throughout the run. When VCQI exits, the log entries are copied into the output Excel workbook in a sheet named "Log".

VCQI users should look at the log file before focusing on VCQI output. Open the Log tab in the spreadsheet and examine the output to see if there are any Priority 1 errors or Priority 2 warnings. The first column of the logfile indicates the order in which comments were written to the log. If there were errors or warnings, then the log is sorted to show them at the top of the worksheet. Errors are shaded red and warnings are yellow. Errors typically must be addressed and VCQI must be re-run. Warnings do not require you to re-run VCQI but they are messages important enough to be brought to your attention before you interpret the other VCQI output.

As far as the VCQI user is concerned, the only portion of the log that is of interest is whether or not there are errors, and if so, how to correct them. The many hundreds of other lines in the log are useful for debugging when there is a problem. You will not need to interpret them, but you may be asked to e-mail your log to the VCQI developers if you have difficulty with a VCQI analysis.

The error messages are meant to be worded in a clear enough manner to help you correct the problem. If the messages are not clear, please send feedback to Dale Rhoda.

2.8 Structure of VCQI Control Programs

Users should copy and edit the control programs that are provided with VCQI. It is good practice to use a different control program for each analysis, and save the control program and resulting output for later reference.

Regardless of whether you are analyzing an RI, TT or SIA survey, the typical VCQI control program consists of seven sections or blocks of code, alternating back and forth between blocks that the user *should not edit* and those that they *should edit*. Chapter 7 lists example control programs, line by line, and describes what they do.

Table 2-1. VCQI control programs consist of seven blocks of code

Block of Stata Code	User Edits Code in this Block?
A. Initialize Stata – clean out old data, programs, and macros	No
B. User specifies input and output folders and a name for this analysis	Yes
C. Open the log file & document which version of VCQI programs are running	No
D. User specifies datasets and metadata about survey, schedule and analysis	Yes
E. VCQI checks inputs; pre-processes analysis dataset	No
F. User specifies which indicators to calculate, and any required inputs	Yes
G. VCQI closes log, deletes temporary files, informs the user of any errors	No

CHAPTER 3. ANALYSIS OF ROUTINE IMMUNIZATION (RI) SURVEYS

Analysis of RI survey data is accomplished with a dedicated control program, copied from an example and modified to fit the user's survey and dataset. VCQI currently calculates eighteen indicators from RI surveys.

1. One regarding access to vaccination (RI_ACC_01)
2. One regarding continuity of vaccination (RI_CONT_01)
3. Five regarding vaccination coverage (RI_COVG_01 thru _05)
4. And eleven regarding the quality of the vaccination program (RI_QUAL_01 thru _09, RI_QUAL_12, and RI_QUAL_13[3])

3.1 Vaccination Schedule Metadata

The user must specify the vaccination schedule that was in place over the time being evaluated by the survey. If the target population is children 12-23 months, then the user should specify the vaccination schedule in place over the preceding 24 months. The vaccination schedule is stipulated in the control program, or in a small .do file that the control program runs. The schedule is defined using Stata scalar values, typically in Block D of the control program. These ages may vary from country to country.

For single-dose vaccines, specify the minimum age in days at which the dose should be given. E.g.,

```
vcqi_scalar[4] bcg_min_age_days =              0   // birth dose
vcqi_scalar hepb_min_age_days =                0   // birth dose
vcqi_scalar opv0_min_age_days =                0   // birth dose
vcqi_scalar ipv_min_age_days  =               98   // 14 weeks
vcqi_scalar mcv1_min_age_days =              270   // 9 months
vcqi_scalar yf_min_age_days   =              270   // 9 months
```

If there is a maximum age for valid administration, specify that. In most countries, most doses do not have a maximum age for valid administration. E.g.,

```
vcqi_scalar opv0_max_age_days =               14   // valid in 1st 2 wks
```

For multi-dose vaccines, specify the minimum age in days for the first dose, and the minimum age and interval (also in days) for later doses. E.g.,

```
vcqi_scalar penta1_min_age_days =             42   // 6 weeks
vcqi_scalar penta2_min_age_days =             70   // 10 weeks
vcqi_scalar penta2_min_interval_days =        28   // 4 weeks
vcqi_scalar penta3_min_age_days =             98   // 14 weeks
vcqi_scalar penta3_min_interval_days =        28   // 4 weeks
```

[3] RI_QUAL_10 and _11 have been defined but their implementation has been deferred for now.

[4] vcqi_scalar is a program that 1) assigns a Stata scalar the value named in the line of syntax, and 2) writes the new value of the scalar in the VCQI log. It has the same consequence as Stata's *scalar* command, with the bonus of documenting the assigned value in the log.

A Note on Dose Names

The convention in VCQI is for dose names to be expressed using lower case letters in variable names and scalar names. These are case sensitive. Before running VCQI, you will need to rename the dose-related variables from the FVL document and include the dose names in the variable names. The following lines show how the variables might be renamed for penta1. When evaluating dates, VCQI expects to find month, day, and year coded in separate variables named <dose>_date_card_m, <dose>_date_card_d, <dose>_date_card_y, and <dose>_tick_card in the RI dataset[5], and corresponding variables with the word 'register' substituted for 'card' in the RIHC dataset. The user should write a program to either rename the survey variables, or to make new variables to meet that expectation.

In the RI dataset:

```
rename RI39d penta1_date_card_d
rename RI39m penta1_date_card_m
rename RI39y penta1_date_card_y
rename RI40  penta1_tick_card
```

In the RIHC dataset:

```
rename RIHC29d penta1_date_register_d
rename RIHC29m penta1_date_register_m
rename RIHC29y penta1_date_register_y
rename RIHC30  penta1_tick_register
```

The user can name the doses anything they wish (with 6 or fewer characters in the name). For instance, it would be perfectly valid to use the name penta1, dpt1, or dtp1. The doses must be named consistently in the RI and RIHC datasets and in the scalars that define the schedule. So if the variables use penta1, then the schedule scalars should not say dpt1; they should say penta1.

Note: The only dose name that is hard-coded into VCQI is bcg. If the survey asks interviewers to record whether they saw the BCG scar on the child, then VCQI expects to find a variable named bgc_scar_history. All other doses are free to use any alternate abbreviations.

Note: Dose names should use abbreviations with 6 or fewer characters. If it is a multi-dose sequence, the letter portion of the abbreviation should use 5 or fewer characters. So 'penta' is okay and 'pneum' is okay, but 'pneumo' is too long because when the 1, 2 or 3 are appended for first, second, and third doses, the abbreviation would be 7 characters.

Again, the VCQI convention is for the scalars and these date and tick variables to use lower case names.

But in VCQI control programs we sometimes require a single dose name or a list of dose names as inputs and those may be specified in upper or lower case. (VCQI will convert the case to what it needs when it

[5] The string <dose> is a placeholder; it might be bcg or mcv1 or penta1. The FVL document contains a longer example in the section named "Breaking Dates Into Month, Day and Year Components".

runs.) If you see a dose name being listed using the `vcqi_global`[6] command, it can be either upper or lower case.

3.2 Survey Metadata

There are three categories of information that VCQI requires to describe the survey:

1. What are the earliest and latest allowable dates of vaccination for respondents and doses inquired about in this survey?
2. What are the minimum and maximum age of children eligible for the survey (in days)?
3. Did the survey protocol include seeking vaccination records at health centers, and if yes, for which respondents?

These are typically specified in Block D of the control program.

Earliest and Latest Allowable Vaccination Dates for this Survey

The user must specify the earliest and latest possible vaccination dates of respondents who are eligible for the RI survey. For surveys that include birth doses, the earliest date will be the same as the earliest possible birth date of survey respondents and the latest date will be the last day of the survey. This information will be used to assess the data quality of dates on cards and registers. If a card or register shows a date that is earlier than the earliest allowable date or later than the latest date, then the date is assumed to contain an error, and VCQI will replace the date with a tick mark.

Specify those dates with the following global macros[7] in the control program:

```
vcqi_global EARLIEST_SVY_VACC_DATE_M  1
vcqi_global EARLIEST_SVY_VACC_DATE_D  1
vcqi_global EARLIEST_SVY_VACC_DATE_Y  2013

vcqi_global LATEST_SVY_VACC_DATE_M  1
vcqi_global LATEST_SVY_VACC_DATE_D  1
vcqi_global LATEST_SVY_VACC_DATE_Y  2015
```

Note: These global macros are not dose-specific or child-specific – they apply to all doses and all children. In the survey described above, a child had to be born on or between January 1, 2013 and December 31, 2013 to be eligible for the survey. Any vaccination date that falls outside the window specified by these scalars will be considered incorrect – vaccination dates that fall outside that window will be treated as tick marks on the card, and will not be included in analyses that evaluate date of vaccination.

Eligible Ages for this Survey

The user should specify the age inclusion criteria for the survey using two global macros. If omitted, VCQI assumes that children had to be between 365 and 731 days of age. The minimum age of eligibility

[6] vcqi_global is a program that 1) assigns a Stata global macro the value named in the line of syntax, and 2) writes the new value of the global macro in the VCQI log. It has the same consequence as Stata's *global* command, with the bonus of documenting the assigned value in the log.

[7] By convention, VCQI uses upper-case for global macros and lower-case for local macros and scalars.

is used on a dose-by-dose basis to decide which children were age-eligible for which doses. This is particularly relevant in surveys that ask about doses administered in the second year of life.

```
vcqi_global VCQI_RI_MIN_AGE_OF_ELIGIBILITY 365
vcqi_global VCQI_RI_MAX_AGE_OF_ELIGIBILITY 731
```

Records Sought at Health Centers

The user must specify whether vaccination records were sought at health facilities, by setting one and only one of the following global macros to 1:

- RI_RECORDS_NOT_SOUGHT
- RI_RECORDS_SOUGHT_FOR_ALL
- RI_RECORDS_SOUGHT_IF_NO_CARD

This is accomplished in the control program with code like the following:

```
vcqi_global RI_RECORDS_NOT_SOUGHT        1
vcqi_global RI_RECORDS_SOUGHT_FOR_ALL    0
vcqi_global RI_RECORDS_SOUGHT_IF_NO_CARD 0
```

This selection affects calculations for many of the outcomes. All RI indicators interpret this data the same, except for the MOV indicators (RI_QUAL_07, RI_QUAL_08, RI_QUAL_09). The table below outlines how the data will be used.

Table 3-1. How RI_RECORDS inputs affect outcome calculation

RI_ RECORDS_ NOT_ SOUGHT	RI_ RECORDS_ SOUGHT_ FOR_ALL	RI_ RECORDS_ SOUGHT_ IF_ NO_CARD	Outcome is based on:	Notes
1	0	0	Card and History Only	Data from EPI registers is ignored, even if it is present in the dataset
0	1	0	Card or History or Register	There may be records with data from both card and register. In that case, the indicators set the final outcome to whichever record (card or register) is more favorable to the vaccination program. In other words, it gives the benefit of the doubt to the program and assumes that the source that documents a good outcome is correct
0	0	1	Card and History if card was seen; Register and History for those without Cards	Only looks at data for the register for respondents who did not furnish a card. If the survey team happens to collect register data for a respondent who also has card data, the register data will be ignored.

For example, for the indicator for valid vaccination coverage (RI_COVG_02), if the card shows that the child received the dose too early to be valid, but the register date indicates that it was valid, then the outcome variables are listed below for each RI_RECORDS_SOUGHT option:

Table 3-2. How RI_RECORDS inputs affect the main valid dose outcome (RI_COVG_02)

RI RECORDS SOUGHT	Card Seen	Valid_dose_by_card	Valid_dose_by_register	Valid_dose_to_analyze (main outcome)
FOR_ALL	Yes	Invalid dose	Valid dose	Valid dose (from register)
NOT_SOUGHT	Yes	Invalid dose	n/a	Invalid dose (from card)
IF_NO_CARD	No	n/a	Valid dose	Valid dose (from register)
IF_NO_CARD	Yes	Invalid dose	Valid dose	Invalid dose (from card)

Changing which of these three inputs is set to 1 will affect the results of the final indicator. The final indicator is sometimes recorded with a variable that uses the suffix "to analyze" and is often saved in a database with the abbreviation "_a_" in its filename. Chapter 6 contains detailed information about individual indicators.

3.3 Analysis Metadata and Options

Lists of Doses

The user must specify the names of the doses in the coverage analysis. This is accomplished in three steps in the control program.

First, specify the names of the single dose vaccines:

```
vcqi_global RI_SINGLE_DOSE_LIST  BCG HEPB OPV0 IPV MCV1 YF
```

The doses can be listed in any order and in either upper or lower case. The spelling of dose names must correspond exactly to those in the schedule scalars and the date and tick variable names in the RI and RIHC datasets.

Next, specify the name of any two-dose vaccines:

```
vcqi_global RI_MULTI_2_DOSE_LIST ROTA
```

Note: For this global macro you should not specify numbers on the end of the dose names. Do not list ROTA1 and ROTA2; simply list ROTA and VCQI will know that there is a 1 and 2. If there are no two-dose vaccines in the schedule, leave the list blank.

Next, specify the name of any three-dose vaccines:

```
vcqi_global RI_MULTI_3_DOSE_LIST PENTA PCV OPV
```

Note: For this global macro you should not specify numbers on the end of the dose names. Do not list PENTA1 PENTA2 PENTA3…simply list PENTA and VCQI will know that there is a 1, 2, and 3 dose.

Note: It is recommended to list all doses here that appear in the survey questionnaire. In some cases you might do a limited analysis of a short list of doses and you might be tempted to shorten these lists to include only the doses of interest so VCQI will run faster. But doing so may affect what you are

able to calculate in that analysis. If you exclude a dose from this list, no information about its coverage will be available in any of the indicators. And it will be important, in particular, to list all doses from the survey when calculating indicators re: missed opportunities for simultaneous vaccination (RI_COVG_07, RI_COVG_08 and RI_COVG_09).

List of Stratum Levels

The user specifies which level of strata should appear in tables and plots and datasets using syntax like this in Block D:

```
vcqi_global SHOW_LEVEL_1_ALONE         0
vcqi_global SHOW_LEVEL_2_ALONE         0
vcqi_global SHOW_LEVEL_3_ALONE         0
vcqi_global SHOW_LEVELS_2_3_TOGETHER   0

vcqi_global SHOW_LEVELS_1_4_TOGETHER   1
vcqi_global SHOW_LEVELS_2_4_TOGETHER   0
vcqi_global SHOW_LEVELS_3_4_TOGETHER   0
vcqi_global SHOW_LEVELS_2_3_4_TOGETHER 1
```

Annex B describes several common combinations of 0's and 1's for these parameters and how they affect the tables and plots.

If the user asks for output only for LEVEL 1, then VCQI will only calculate outcomes for LEVEL 1. If the user asks for output for several levels, VCQI will calculate outcomes for all levels that are requested. The selection here affects not only the tables and plots, but also the databases of results.

In these globals, the word "TOGETHER" can be interpreted to mean "NESTED". The results for the lower levels will be nested underneath results from the appropriate higher level. See Annex B.

Options for Individual Indicators

See sections on DESC_01 in Chapter 6 for how to run the analysis that describes the RI dataset.

See sections on DESC_02 and DESC_03 in Chapter 6 for how to summarize responses to multiple-choice questions.

The user specifies a title, subtitle, and as many footnotes as they like for the Excel worksheet that holds the indicator output. These are specified using global macros in the control program. For example, the following code specifies the title and two footnotes for the RI_COVG_01 indicator. It specifies an empty subtitle. (The footnotes are long and wrap onto several lines each in this document but they are each specified on a single long line of Stata code in the sample control program that comes with VCQI.)

```
vcqi_global RI_COVG_01_TO_TITLE    Crude Coverage

vcqi_global RI_COVG_01_TO_SUBTITLE

vcqi_global RI_COVG_01_TO_FOOTNOTE_1  Abbreviations:
CI=Confidence Interval; LCB=Lower Confidence Bound; UCB=Upper
Confidence Bound; DEFF=Design Effect; ICC=Intracluster
Correlation Coefficient
```

```
vcqi_global RI_COVG_01_TO_FOOTNOTE_2  Note: This measure is a
population estimate that incorporates survey weights.  The CI,
LCB and UCB are calculated with software that take the complex
survey design into account.
```

Footnotes are numbered sequentially and you may specify as many footnotes for a single measure as you wish. It is important not to skip any numbers. Begin with 1 and increase by 1 up to the number that you wish to list.

Note: If you skip a number when specifying footnotes (i.e., 1..2..4..5) then VCQI will only list the footnotes from before the break (i.e., 1 and 2).

Several indicators include some automatic footnotes, based on user inputs. The logic that produces these is laid out in Chapter 7.

There are no special inputs or metadata required to calculate RI_COVG_01-02 or RI_QUAL_01-02. Use the default titles and footnotes in the example control program, or specify new ones if you wish.

The remaining indicators each require the user to specify one or more global macros to define precisely what to analyze and how. See the individual descriptions of the indicators in later sections of this document.

See sections on COVG_DIFF_01 and COVG_DIFF_02 for how to test hypotheses about whether population levels of RI coverage differ a) between strata, or b) between sub-groups within a stratum, respectively.

See Annex B for details on how to control which strata appear in the Excel output and the graphic figures.

CHAPTER 4. ANALYSIS OF TETANUS PROTECTION AT BIRTH (TT) SURVEYS

Analysis of TT survey data is accomplished with a dedicated control program, copied from an example and modified to fit the user's survey and dataset. VCQI currently calculates a single measure from tetanus surveys *TT_COVG_01: Proportion of the children born in the last 12 months protected at birth from tetanus*. VCQI assumes that the survey datasets are consistent with the FVL document, so you will need to rename and recode all applicable variables accordingly before running VCQI.

4.1 Schedule Metadata

This indicator does not require any vaccination schedule information.

4.2 Survey Metadata

Records Sought at Health Centers

The user must specify whether vaccination records were sought at health centers, by setting one and only one of the following global macros to 1:

- TT_RECORDS_NOT_SOUGHT
- TT_RECORDS_SOUGHT_FOR_ALL
- TT_RECORDS_SOUGHT_IF_NO_CARD

This selection affects how the main outcome of TT_COVG_01 is calculated.

Table 4-1. How TT_RECORDS inputs affect indicator calculations

TT_ RECORDS_ NOT_ SOUGHT	TT_ RECORDS_ SOUGHT_ FOR_ALL	TT_ RECORDS_ SOUGHT_ IF_ NO_CARD	Outcome is based on…	Notes
1	0	0	Card and History Only	Data from the TTHC dataset is ignored even if the control program names a TTHC file – evidence for protection at birth comes only from the card & respondent's recall.
0	1	0	Card or History or Register	The dataset may contain records with data from both card and register. In that case, the indicator considers evidence from respondent recall, from the vaccination card, and from the health facility register. If data from any source indicates that the child was protected at birth, then the main outcome will indicate that the child was protected at birth.
0	0	1	Card and History if card was seen; Register and History for those without cards	Only looks at data from the health facility for respondents who did not furnish a card. If the survey team happens to have collected register data for a respondent who also has card data, the register data will be ignored.

4.3 Analysis Metadata and Options

See sections on DESC_01 in Chapter 6 for how to run the analysis that describes the TT dataset.

See sections on DESC_02 and DESC_03 in Chapter 6 for how to summarize responses to multiple-choice questions.

See section on TT_COVG_01 in Chapter 6 for how to generate the protected at birth indicator.

See sections on COVG_DIFF_01 and COVG_DIFF_02 for how to test hypotheses about whether population levels of protection at birth differ a) between strata, or b) between sub-groups within a stratum, respectively.

See Annex B for details on how to control which strata appear in the Excel output and the graphic figures.

CHAPTER 5. ANALYSIS OF POST-CAMPAIGN (SIA) SURVEYS

Analysis of SIA survey data is accomplished with a dedicated control program, copied from an example and modified to fit the user's survey and dataset. One important limitation at this time is that VCQI assumes that the SIA consisted of a single dose. If your vaccination campaign included more than one dose, each will need to be saved in separate datasets and analyzed with separate VCQI control programs.

VCQI currently calculates four indicators for SIA surveys.

- Proportion of target population who received the campaign dose (SIA_COVG_01)
- Proportion of target population whose campaign dose was their first-ever dose (SIA_COVG_02)
- Estimated proportion of each single-year birth cohort in the target population who have had 0, 1, or 2+ lifetime doses of measles vaccine (SIA_COVG_03)
- Proportion of vaccinated respondents who received a campaign card (SIA_QUAL_01)

VCQI assumes that the survey datasets are consistent with the FVL document, so you will need to rename and recode all applicable variables accordingly before running VCQI.

5.1 Vaccination Schedule Metadata

The SIA module does not use schedule metadata.

5.2 Survey Metadata

Block D also specifies whether the coverage survey documented coverage using fingermarks or not. If not, then the fingermark outcome is not summarized in the Excel spreadsheet. The value 1 means yes, and the value 0 means no.

```
vcqi_global SIA_FINGERMARKS_SOUGHT 1
```

Note: VCQI currently assumes that the coverage survey checks for coverage using either a campaign card or caregiver's recall. Code the variables SIA20 and SIA22 in accordance with FVL document. If the campaign did not use cards, then there will be some extra card-related columns in the output table that may be safely ignored or deleted.

5.3 Analysis Metadata and Options

See sections on DESC_01 in Chapter 6 for how to run the analysis that describes the SIA dataset. See sections on DESC_02 & DESC_03 in Chapter 6 for how to summarize responses to multiple-choice questions.

There are no special inputs or metadata required to calculate the SIA indicators. You may use the titles, subtitles, and footnotes from the example control program, or specify new ones in your control program.

See sections on COVG_DIFF_01 and COVG_DIFF_02 in Chapter 6 for how to test hypotheses about whether population levels of campaign coverage differ a) between strata, or b) between sub-groups within a stratum, respectively.

See Annex B for details on how to control which strata appear in the Excel output and graphic figures.

CHAPTER 6. DESCRIPTION OF THE VACCINATION COVERAGE QUALITY INDICATORS

The following pages list the individual indicators that are available in VCQI. Each contains an overview, a list and description of required global macro inputs (if any) and a short list of outputs that the software generates. The VCQI files you download include examples of control programs to run each of these indicators and include examples of output from each.

6.1 Weighted and unweighted analyses

Many of the analyses listed here are described as "Weighted: Yes". Those analyses are always weighted even if there are some respondents for whom we do not have sufficient data to be able to put them in the numerator. Valid coverage is a good example. If we do not have vaccination dates from the card or register then we cannot say that a respondent got a valid dose, but the convention for these indicators is to put all respondents in the denominator so the measure is interpreted as "% of the population represented by the respondents for whom we a) had data elements required and b) found evidence of valid coverage".

Some of the analyses listed below are described as "Weighted: No". These are usually analyses where only a subset of respondents will be in the denominator, so it could be confusing to draw conclusions about the overall population.[8]

Note: VCQI does not currently provide estimates of sampling error for the unweighted analysis. The estimate is a description of a proportion observed in the sample, and is reported without an estimate of its uncertainty. (This would be a good topic for discussion in a user's group whether it would be helpful to report the precision of the estimates, due to sampling variability, for these indicators.)

6.2 Analysis Counter

Block F of the control program sets a global macro named ANALYSIS_COUNTER. It is required, and usually set to 1. In most control programs it will only be set once and never changed.

In the remainder of this chapter, you will note that the analysis counter appears in the names of many VCQI output files and worksheets.

In advanced analyses, the user can conduct sensitivity analyses by running an initial analysis and then changing some of the analysis parameters, changing the analysis counter and re-running the indicator. In the first run, the output files and tabs would list the value 1 for ANALYSIS_COUNTER and in the

[8] In the current software, these analyses will always be unweighted. In a future revision it might be advisable to add a capability to recognize when more than (some user-specified proportion, like 90%) of the sample is in the denominator and more than (some user-specified count, like 2) respondents in every cluster are in the denominator, in which case maybe the weighted proportion is meaningful and the user could be informed, in a footnote of the unweighted analysis, that a weighted analysis is available. The user could obtain the weighted analysis by going back and including an option to FORCE calculation of the weighted measure. This is an idea that should be discussed with a user group, perhaps. For now, if this document says it is unweighted, it is unweighted.

second run they would be named with the value 2 and would therefore not overwrite the first set of output. This can be accomplished in a single control program.

For example, one could explore how valid coverage changes if we allow a four-day "grace period" whereby we count a dose as valid if the child receives it up to four days before they were scheduled to do so. This can be done with code like the following:

```
* Initial run uses the usual schedule established in Block D

vcqi_scalar penta1_min_age_days =            42   // 6 weeks
vcqi_scalar penta2_min_age_days =            70   // 10 weeks
vcqi_scalar penta2_min_interval_days =       28   // 4 weeks
vcqi_scalar penta3_min_age_days =            98   // 14 weeks
vcqi_scalar penta3_min_interval_days =       28   // 4 weeks

* intervening code from Block E goes here
* intervening code from Block E goes here
* intervening code from Block E goes here

* This code in block F accomplishes the original analysis
* Tabular output goes to tab named "RI_COVG_02 1"
* Databases and plots have the ANALYSIS_COUNTER value 1 in filenames

vcqi_global ANALYSIS_COUNTER 1
RI_COVG_02

* Now re-run using a schedule with a grace period
* Tabular output goes to tab named "RI_COVG_02 2"
* Databases and plots have the ANALYSIS_COUNTER value 2 in filenames

vcqi_global ANALYSIS_COUNTER 2
vcqi_scalar penta1_min_age_days =       38   // 6 weeks minus 4 days
vcqi_scalar penta2_min_age_days =       66   // 10 weeks minus 4 days
vcqi_scalar penta2_min_interval_days = 24   // 4 weeks minus 4 days
vcqi_scalar penta3_min_age_days =       94   // 14 weeks minus 4 days
vcqi_scalar penta3_min_interval_days = 24   // 4 weeks minus 4 days

RI_COVG_02
```

This same sensitivity analysis could be accomplished using two CONTROL programs that send output to two different Excel files altogether. In that case, there is no need to change the value of ANALYSIS_COUNTER.

Note: Some indicators use the ANALYSIS_COUNTER to open datasets from indicators that were run earlier, so it is best to experiment carefully with changing the ANALYSIS COUNTER. Note that the indicators in Table 6-1 rely on datasets constructed earlier. The value of ANALYSIS_COUNTER must be the same when the later indicator is run that it was when the earlier indicator was run. So in some cases, to do the sensitivity analysis, it will be necessary to change ANALYSIS_COUNTER and re-run several indicators or to use a Stata command to rename copies of earlier datasets. (e.g., To do a

sensitivity analysis on RI_QUAL_07 with different inputs, it will be necessary to re-run RI_COVG_02 using the new value of ANALYSIS_COUNTER as well or to copy the dataset named RI_COVG_02_1 to a new dataset named RI_COVG_02_2. Watch for a tutorial with additional examples of how to use the analysis counter in several kinds of "what-if" analyses.)

Table 6-1 lists the indicators that rely on output from RI_COVG_01, RI_COVG_02 and RI_COVG_03.

Table 6-1. VCQI indicators that rely on others being run first

Indicators that use output from RI_COVG_01 (crude coverage)	Indicators that use output from RI_COVG_02 (valid coverage)	Indicators that use output from RI_COVG_03 (fully vaccinated)
RI_ACC_01 RI_CONT_01 RI_COVG_02 RI_COVG_03 RI_COVG_04 RI_COVG_05	RI_COVG_03 RI_COVG_04 RI_QUAL_06 RI_QUAL_07	RI_COVG_04

6.3 DESC: All Surveys: Describing the Survey Sample

DESC_01: Expected vs observed sample: clusters, households, & respondents

Description: This indicator generates a table that describes the expected number of clusters, households, and respondents, based on records from the survey design phase, and will document the actual numbers observed in the survey. It documents the number of households visited, the number of households where no one was home and the number of respondents who refused. It also describes the number of selected respondents (by gender) and interview disposition as well as the number of respondents for whom records were found in health facility registers.

Weighted: No

Denominator: All households selected to be visited (first portion of the table)
All eligible respondents (second portion of the table)

Numerator: Counts from survey design and from survey dataset

User inputs: The user must specify what sort of survey dataset is being summarized:

```
vcqi_global DESC_01_DATASET <TT, RI or SIA>
```

Control Program Command:

```
DESC_01
```

Outputs: This indicator generates three databases that describe the households visited, the eligible respondents, and the RI dataset. They are named

DESC_01_HH_<RI, TT, or SIA>_*<analysis counter>*_database.dta
DESC_01_EL_<RI,TT,SIA>_*<analysis counter>*_database.dta
DESC_01_RI_*<analysis counter>*_database.dta

The Excel worksheet is named DESC_01.

This indicator does not generate any plots.

In the Excel worksheet, VCQI reports the following quantities for each stratum. These items are listed in rows here, because of space consideration, but in the VCQI spreadsheet, they are columns. In the VCQI output, each row in the output table represents a different stratum.

Table 6-2. Fields reported in DESC_01

Worksheet Column	Summary of:	Category	Sub-category	What is reported
B	HH Visited	Expected	Total	N
C		Observed	Total	N
D	Info From	Occupant	Total	N
E				%
F			Eligible	N
G				%
H		Neighbor	Total	N
I				%
J			Eligible	N
K				%
L		No Info	Total	N
M				%
N	Info From Occupant	Eligible	Total	N
O		Selected	Total	N
P		Completed	Total	N
Q				%
R			Male	N
S				%
T			Female	N
U				%
V			Found Register Records	N
W				%
X		Did Not Complete	Caretaker Unavailable	N
Y				%
Z			Refused	N
AA				%
AB			Other	N
AC				%

Within a stratum, there are some relationships that should hold among columns:

1. D + H + L = C
2. P + X + Z + AB = O
3. R + T = P
4. E + I + M = 100%
5. Q + Y + AA + AC = 100%
6. S + U = 100%

DESC_02: Response to multiple-choice question (e.g., education, occupation, etc.)

Description: Most surveys will include some multiple-choice questions to be summarized in the survey report. These often describe the respondents' demographics, opinions, sources of info and reasons for not vaccinating.

DESC_02 summarizes responses to questions where the respondent must select only one response, and the responses are saved in a single outcome variable., The variable is usually saved as an integer with a value label to describe the response option.

Note: To summarize responses to questions where the respondent can select more than one response, see DESC_03.

Weighted: Yes or No – the user decides

Denominator: Depends on user selections:

Table 6-3. Denominator definitions for DESC_02

DESC_02_WEIGHTED	DESC_02_DENOMINATOR	Denominator Description
No	Responded	Number of respondents who answered the question
No	All	Number of all respondents
Yes	All	Sum of weights for all respondents

Numerator: Depends on user selections:

Table 6-4. Numerator definitions for DESC_02

DESC_02_WEIGHTED	Numerator Description
No	Number of respondents who selected a particular choice
Yes	Sum of weights for respondents who selected that choice

User inputs: For each requested table, the user specifies

Required:

```
DESC_02_DATASET <RI, SIA or TT>
DESC_02_VARIABLES <name of variable(s) that holds the
response[9]>
DESC_02_WEIGHTED <YES or NO>[10]
DESC_02_DENOMINATOR <ALL or RESPONDED>[11]
```

[9] If more than one variable is listed, a table will be made for each variable and all the currently defined DESC_02 global variables will be applied to all of those tables; if you wish to make tables using different options (e.g., some weighted and some not) then run DESC_02 once with the WEIGHTED option and then turn that option off and run DESC_02 again.

[10] Many VCQI globals are set to 1 to indicate YES and 0 to indicate NO. This global is an exception; use the words YES or NO.

[11] If WEIGHTED is YES then DENOMINATOR must be ALL.

Note: If the user asks for weighted output then the denominator must be ALL. The estimated proportion for each response will be weighted and will be accompanied by a confidence interval. If the user asks for unweighted output, the user can stipulate that the denominator should be ALL respondents, or only those who RESPONDED to the question (response is not missing).

Optional:

Several inputs are optional. If you wish to over-ride the label for one of the response options, you may do so using the "MISSING" options. And if you want to report sub-totals of response options, you may do so using the "SUBTOTAL" options. To work correctly, the items indicated in <angle brackets> in Table 6-5 should be replaced with integers.

Table 6-5. Optional inputs for DESC_02

Optional Globals	Description	Values
DESC_02_N_MISSING_LEVELS	Number of replacement labels	Integer
DESC_02_MISSING_LEVEL_<1 up to the N_MISSING_LEVELS>	Response value that new label will apply to	Integer
DESC_02_MISSING_LABEL_<1 up to the N_MISSING_LEVELS>	New value label	Text
DESC_02_N_SUBTOTALS	Number of response groups user would like to create for variable	Integer
DESC_02_SUBTOTAL_LEVELS_<1 up to the N_SUBTOTALS>	Response values that will be grouped together	List of Integers
DESC_02_SUBTOTAL_LABEL_<1 up to the N_SUBTOTALS> Text label for table	New value label for grouped responses	Text

The options in Table 6-5 accomplish two different goals. In Stata, missing values are not allowed value labels, so the first set of optional inputs lets the user assign labels to missing values (or lets the user over-ride the value label and specify what label they would like to see in the output table). If the user wishes to specify a label for one level, set N_MISSING_LEVELS to 1 and identify which level. A common option will be to specify the missing level denoted in Stata with a single period. (See example below.) If the user wishes to specify revised labels for other levels, then supply those as well.[12]

In the example below, the level 3 has a value label that says "Other, please specify". The user wished to override this label and instead say "3: Other". The user also wanted to label the column of missing values with the word "Missing".

```
vcqi_global DESC_02_N_MISSING_LEVELS        2
vcqi_global DESC_02_MISSING_LEVEL_1         3
vcqi_global DESC_02_MISSING_LABEL_1         3: Other
```

[12] Although the key word in the global names is "MISSING", they key functionality is to re-label those responses.

```
vcqi_global DESC_02_MISSING_LEVEL_2         .
vcqi_global DESC_02_MISSING_LABEL_2         Missing
```

Note: When the DENOMINATOR is set to RESPONDED, VCQI will not list missing as a level in the output table – it assumes that you are not interested in tabulating missing responses. But the so-called MISSING options may still be used to re-label non-missing responses.

Note: When the DENOMINATOR is set to ALL, it will be a good idea to specify a LABEL for missing values (.). Otherwise the output table may include a column header that says " . (%) ", which may be confusing to some readers who do not know that a dot is Stata's way of representing a missing value.

The second goal accomplished by the optional inputs to specify a sub-total. Tell Stata how many sub-totals there will be, and then for each, specify the list of response categories that should be grouped together and stipulate what label to put at the top of the column.

Note: There is currently no option for suppressing the individual responses and showing sub-totals only.

```
vcqi_global DESC_02_N_SUBTOTALS  1
vcqi_global DESC_02_SUBTOTAL_LEVELS_1  1 2
vcqi_global DESC_02_SUBTOTAL_LABEL_1 Subtotal: 1 or 2
```

Control Program Command: `DESC_02`

Outputs: This indicator makes one database per variable summarized. The file will be named DESC_02_<*analysis counter*>_<DESC 02 counter>.dta. The DESC 02 counter starts at 1 and increases by 1 every additional time DESC_02 is called. The database lists the % for each option along with total N for every stratum at every level. If the user requests weighted results, it reports weighted N and reports 95% CI for each option if the calculation.

This indicator makes one Excel worksheet per variable summarized. The worksheet will be named DESC_02_<*analysis counter*>_<*DESC_02 counter*>_<*name of variable being summarized*>_database.dta.

This indicator does not generate any plots.

Interpretation: Depends on the user's selections:

Table 6-6. Interpretation of DESC_02

DESC_02_WEIGHTED	DESC_02_DENOMINATOR	Interpretation
Unweighted	All	"Among the N respondents, X% selected this response option."
Unweighted	Responded	"Among the N respondents who answered the question, X% selected this response option."
Weighted	All	"X% of eligible respondents in the population are estimated to be in the category of person who would select this response option."

More Notes: **One important limitation of this indicator is that it only lists responses that respondents actually selected. If there was a valid response option that no one selected, it will not appear in the resulting table.**

It is possible to summarize the responses to numerous questions. After setting the input global macros and calling DESC_02, simply change the DESC_02 global macros and call DESC_02 again. The output for each call is summarized in a new tab in the Excel worksheet. See the example control programs that you downloaded with VCQI for examples.

It is allowable to specify more than one variable for DESC_02_VARIABLES. If you specify two variables, they will each be summarized in their own worksheets. They will use the same options for the required and optional inputs. It may be rare to have two variables where you wish to use all the same options, but it is allowed.

DESC_03: Response to multiple-choice question (e.g., education, occupation, etc.)

Description: Most surveys will include some multiple-choice questions to be summarized in the survey report. This indicator summarizes responses to questions where the respondent may select more than one response option.

Note: To summarize responses to questions where the respondent can select only one response, see DESC_02.

Weighted: Yes or No – the user decides

Denominator: Depends on user selection:

Table 6-7. Denominator definitions for DESC_03

DESC_02_WEIGHTED	DESC_02_DENOMINATOR	Denominator Description
No	Responded	Number of respondents who answered the question
No	All	Number of all respondents
Yes	All	Sum of weights for all respondents

Numerator: Depends on user selection:

Table 6-8. Numerator definitions for DESC_03

DESC_02_WEIGHTED	Numerator Description
No	Number of Respondents who selected a particular choice
Yes	Sum of weights for respondent who selected that choice

User inputs: For each requested table, the user specifies

Required:

```
DESC_03_DATASET <RI, SIA or TT>
DESC_03_SHORT_TITLE <title for worksheet tab>
DESC_03_VARIABLES <name of variables that hold responses>
DESC_03_SELECTED_VALUE <number that indicates the user
                        selected the response – often 1>
DESC_03_WEIGHTED <YES or NO>[13]
DESC_03_DENOMINATOR <ALL or RESPONDED>[14]
```

Example:

```
global DESC_03_DATASET     RI
global DESC_03_SHORT_TITLE whynot
global DESC_03_VARIABLES   RI89 RI90 RI91 RI92 RI93 RI94
          RI95 RI96 RI97 RI98 RI99 RI100
```

[13] Many VCQI globals are set to 1 to indicate YES and 0 to indicate NO. This global is an exception; use the words YES or NO.

[14] If WEIGHTED is YES then DENOMINATOR must be ALL.

```
global DESC_03_SELECTED_VALUE    1
global DESC_03_WEIGHTED          NO
global DESC_03_DENOMINATOR       RESPONDED
```

Note: If the user asks for weighted output then the denominator must be ALL. The estimated proportion for each response will be weighted and will be accompanied by a confidence interval. If the user asks for unweighted output, they can stipulate that the denominator should be ALL respondents, or only those who RESPONDED to the question (response is not missing).

Optional:

Note: The user will need to complete the Global Names below with the correct integer value in place of < > text if they wish to utilize the MISSING_LEVELS or SUBTOTAL functions.

Table 6-9. Optional inputs for DESC_03

Optional Globals	Description	Values
DESC_03_TO_TITLE	Title for cell A1 in Excel summary worksheet	String
DESC_03_N_MISSING_LEVELS	Number of replacement labels	Integer
DESC_03_MISSING_LEVEL_<1 up to the N_MISSING_LEVELS> <integer>	Response value(s) that new label will apply to	Integer
DESC_03_MISSING_LABEL_<1 up to the N_MISSING_LEVELS> Text label for table	New value label	Text
DESC_03_N_SUBTOTALS	Number of response groups user would like to create for variable	Integer
DESC_03_SUBTOTAL_LEVELS_<1 up to the N_SUBTOTALS> <list of integers>	Response values that will be grouped together	List of Integers
DESC_03_SUBTOTAL_LABEL_<1 up to the N_SUBTOTALS> Text label for table	New value label for grouped responses	Text

The _TITLE option is unique to DESC_03. Note that DESC_02 uses the Stata variable label to populate cell A1 of the summary Excel worksheet, but for DESC_03 it is not clear which variable might hold the appropriate label, so the user is asked to specify the title for the DESC_03 worksheet.

```
global DESC_03_TO_TITLE Why is the child under vaccinated?
```

The “MISSING” options accomplish the same goals described above in DESC_02: allow the user to over-ride the variable labels and specify what label they would like to see in the output table. If the user wishes to specify a label for one level, set

N_MISSING_LEVELS to 1 and identify which level. A common option will be to override the label for "Other, Please specify" and make it simply "Other". E.g.:

```
vcqi_global DESC_03_N_MISSING_LEVELS  1
vcqi_global DESC_03_MISSING_LEVEL_1   RI100
vcqi_global DESC_03_MISSING_LABEL_1   12. Other
```

The second goal for optional inputs is to allow the user to identify several response options that should be lumped together into a sub-total. The resulting table will list each individual response and the sub-total. To specify a sub-total, tell Stata how many sub-totals there will be, and then for each, specify the list of response categories that should be grouped together and tell it what label to put at the top of the column. **Note: There is currently no option for suppressing the individual responses and showing sub-totals only.**

```
vcqi_global DESC_03_N_SUBTOTALS  3
vcqi_global DESC_03_SUBTOTAL_LEVELS_1 RI89 RI90 RI91 RI92
RI93 RI94 RI95
vcqi_global DESC_03_SUBTOTAL_LABEL_1  Troubles
vcqi_global DESC_03_SUBTOTAL_LEVELS_2 RI96 RI97 RI98
vcqi_global DESC_03_SUBTOTAL_LABEL_2  Beliefs
vcqi_global DESC_03_SUBTOTAL_LEVELS_3 RI99 RI100
vcqi_global DESC_03_SUBTOTAL_LABEL_3  Knowledge
```

Control Program Command: `DESC_03`

Outputs: This indicator makes one database per variable summarized. The file will be named DESC_03_<*analysis counter*>_<*DESC 03 counter*>.dta. The DESC 03 counter starts at 1 and increases by 1 every additional time DESC_03 is called. The database lists the % for each option along with total N for every stratum at every level. It reports weighted N if the user requests weighted results and reports 95% CI for each option if the calculation is weighted.

This indicator makes one Excel worksheet per variable summarized. The worksheet will be named DESC_03_<*DESC_03 counter*>_<*DESC_03_SHORT_TITLE*>_database.dta.

This indicator does not generate any plots.

Interpretation: Depends on the user's selections:

Table 6-10. Interpretations for DESC_03

DESC_02_WEIGHTED	DESC_02_DENOMINATOR	Interpretation
Unweighted	All	"Among the N respondents, X% selected this response option."
Unweighted	Responded	"Among the N respondents who answered the question, X% selected this response option."
Weighted	All	"X% of eligible respondents in the population are estimated to be in the category of person who would select this response option."

Notes: **This indicator, unlike DESC_02, does summarize responses even if no one selected them.**

It is possible to summarize the responses to numerous sets of questions. After setting the input global macros and calling DESC_03, simply change the DESC_03 global macros and call DESC_03 again. The output for each call is summarized in a new tab in the Excel worksheet.

For each response option, DESC_03 uses the variable label as the title of the column to summarize those responses. So if the variables being summarized are XY14 and its label is "Apples" and XY15 and its label is "Oranges", then those will form the labels. The variable labels can be over-ridden by the user, using the DESC_03_MISSING options.

6.4 RI_COVG: RI Survey – Measures Related to Coverage

RI_COVG_01: Crude coverage

Weighted: Yes

Denominator: Sum of weights for all respondents

Numerator: Sum of weights for respondents who received the vaccine dose according to card, register, history

Vaccines: Calculated for each dose

Time options: By the time of survey

Variations: By card
By history
By register
By card or history (for purpose of comparison with older surveys)
By card or register (i.e., by documented source)
By card or history or register
To analyze (depends on whether RI records were sought at health facilities, and for whom; see Chapter 3.)

User inputs: The dose list (See Chapter 3).

Whether RI records were sought at health facilities. See section 3.2 for a description of the three global macros that describe what was done at health facilities.

Control Program Command: `RI_COVG_01`

Output: This indicator generates databases that summarize valid coverage:

Table 6-11. Naming convention for RI_COVG_01 databases

According to evidence from…	Database Name
Card	RI_COVG_01_<dose>_<*analysis counter*>_c_database.dta
Caretaker's Verbal History	RI_COVG_01_<dose>_<*analysis counter*>_h_database.dta
Card or History	RI_COVG_01_<dose>_<*analysis counter*>_ch_database.dta
Register	RI_COVG_01_<dose>_<*analysis counter*>_r_database.dta
Card or Register	RI_COVG_01_<dose>_<*analysis counter*>_cr_database.dta
Card or History or Register	RI_COVG_01_<dose>_<*analysis counter*>_chr_database.dta
Main Outcome to Analyze	RI_COVG_01_<dose>_<*analysis counter*>_a_database.dta

How the main outcome for crude coverage is calculated for each respondent depends on whether RI records were sought at health centers, and if so, for whom. This is indicated in the control program by setting one (and only one) of the RECORDS_SOUGHT global macros to 1. See section 3.2 for details on RECORDS_SOUGHT global macros in RI Analysis.

The databases include the following output fields for every dose in the dose list and every outcome listed above and every stratum requested via the SHOW_LEVEL globals (described in section 3.3 and Annex B): estimated %, 2-sided 95% CI, 1-sided 95% lower confidence bound (LCB), 1-sided 95% upper confidence bound (UCB), Design Effect (DEFF), Intracluster correlation coefficient (ICC), N (unweighted), N (weighted), and ICC2[15].

The Excel worksheet for this indicator is named: RI_COVG_01 <*analysis counter*>. For the outcomes by card, history, and register it simply lists estimated % and 95% CI. For the main outcome it lists estimated %, 95% CI, LCB, UCB, DEFF, ICC, N (unweighted), N (weighted).

The plots generated by the indicator include one organ pipe plot of the main outcome per dose per stratum and one inchworm plot per dose summarizing the main crude coverage outcome.

The organ pipe plots are named RI_COVG_01_<*analysis counter*>_opplot_<*dose*>_ <*stratum id*>_<*stratum name*>.png

The inchworm plots are named RI_COVG_01_<analysis counter>_iwplot_<*dose*>_<*four 0/1 flags to show which levels are plotted*>.png.

Interpretation: "X% of the population who were eligible for the survey are estimated to have received <*dose*>, as documented by <*source(s)*>."

Notes: **For BCG there is an additional outcome for coverage by scar stored in a database named RI_COVG_01_<*analysis_counter*>_BCG_s_database.dta. And for BCG, evidence from the scar is counted in the card or history outcome, the card or history or register outcome and the 'to analyze' outcome.**

If the survey did not ask for BCG evidence by scar then the RI_COVG_01 table will include scar columns that could be ignored or deleted and will include the words "or scar" in several column labels. In the future, it would be possible to add a user input to tell VCQI that the survey did not include a scar question and then the output could appear without alluding to scars. Discuss this enhancement with WHO & a VCQI User's Group.

[15] The variable that we name ICC is estimated using the design effect and the average respondents per cluster.

$$ICC = \frac{(DEFF - 1)}{\left(\frac{\#\ of\ respondents\ in\ stratum}{\#\ of\ clusters\ in\ stratum} - 1\right)}$$

The variable named ICC2 is estimated with one-way ANOVA using the 0/1 outcome and using clusterID as the only factor. Differences between these two methods of estimation may be interesting to researchers. The first estimate (ICC) is the one listed in the VCQI spreadsheet output.

RI_COVG_02: Valid coverage

Weighted: Yes

Denominator: Sum of weights for all respondents

Numerator: Sum of weights for respondents who received a valid dose according to card or register

Vaccines: Calculated for each dose

Time options: By the time of survey, or
By 12 months of age

Variations: By card
By register
By card or register
To analyze

The main motivation is to assess valid coverage when using dates from both cards and registers. One reason for reporting card and register data alone, in addition to card or register, is to show how much coverage estimates increase when the survey team goes to the effort and expense of collecting data from health centers.

User inputs: The dose list (See Chapter 3).

Whether RI records were sought at health facilities. See description above for RI_COVG_01.

The RI dose schedule (See Chapter 3).

Control Program Command: `RI_COVG_02`

Output: This indicator generates databases that summarize valid coverage:

Table 6-12. Naming convention for RI_COVG_03 databases

According to evidence from…	Dataset name
Card	RI_COVG_02_<dose>_<*analysis counter*>_c_database.dta
Register	RI_COVG_02_<dose>_<*analysis counter*>_r_database.dta
Card or Register	RI_COVG_02_<dose>_<*analysis counter*>_cr_database.dta
Main Outcome to Analyze	RI_COVG_02_<dose>_<*analysis counter*>_a_database.dta
By age 1, according to card	RI_COVG_02_<dose>_<*analysis counter*>_ca1_database.dta
By age 1, according to register	RI_COVG_02_<dose>_<*analysis counter*>_ra1_database.dta
By age 1, according to card or register	RI_COVG_02_<dose>_<*analysis counter*>_cra1_database.dta
Main outcome for valid coverage by age 1	RI_COVG_02_<dose>_<*analysis counter*>_aa1_database.dta

How the main outcomes for valid coverage and valid coverage by age 1 are calculated for each respondent depends on whether RI records were sought at health centers, and if so, for whom. This is indicated in the control program by setting one (and only one) of the RECORDS_SOUGHT global macros to 1. See section 3.2 for details on RECORDS_SOUGHT global macros in RI Analysis.

The databases include the following output fields for every dose in the dose list and every outcome listed above and every stratum requested via the SHOW_LEVEL globals (described in section 3.3 and Annex B): estimated %, 95% CI, LCB, UCB, DEFF, ICC, N (unweighted), N (weighted), and ICC2.

The Excel worksheet for this indicator is named: RI_COVG_02 <*analysis counter*>. For the outcomes by card, by register, and by card or register it simply lists estimated % and 95% CI. For the main outcomes it lists estimated %, 95% CI, LCB, UCB, DEFF, ICC, N (unweighted), N (weighted).

The plots generated by the indicator include one organ pipe plot of the main outcome per dose per stratum and three inchworm plots per dose: one showing results for the main outcome for valid coverage and the other for the main outcome of valid coverage by age 1 and a third showing valid and crude coverage on the same figure. The valid coverage appears in color and crude coverage appears as a hollow gray outline. The indicator does not currently make organ pipe plots of any outcomes by age 1.

The organ pipe plots are named RI_COVG_02_<*analysis counter*>_opplot_<*dose*>_ <*stratum id*>_<*stratum name*>.png

The inchworm plots are named RI_COVG_02_<analysis counter>_iwplot_<*dose*>_<*a or age1 or a_double*>_<*four 0/1 flags to show which levels are plotted*>.png.

The inchworm plots that show both valid and crude coverage on the same plot also have the word "double" in the filenames.

Interpretation: "X% of the population who were eligible for the survey are estimated to have a documented record of vaccinations (<*source(s)*>) and to have received a valid dose of <*dose*>."

Note: **The survey report should describe what is meant by a "valid dose".**

a) The child had reached the minimum age of eligibility for this dose.

b) If the schedule specifies a maximum age of eligibility, then the child was within the allowable age range when they received the dose.

c) If the dose is number 2 or 3 (or higher) in a sequence, then the minimum interval had passed since receiving the earlier dose, so the child was eligible to receive the next dose.

RI_COVG_03: Fully vaccinated

Weighted: Yes

Denominator: Sum of weights for all respondents

Numerator: Sum of weights for respondents who received all doses in the list that makes up "fully vaccinated" in that country at that time

Time options: By the time of survey (crude or valid), or
By 12 months of age (valid)

Variations: By any source (crude)
By card or register (valid)

User inputs: You must provide a list of doses that define "fully vaccinated". This is accomplished in the control program with a line like this (the text is wrapped here in the user's guide but should appear on a single line in the VCQI control program):

```
vcqi_global RI_DOSES_TO_BE_FULLY_VACCINATED BCG MCV1 YF
PENTA1 PENTA2 PENTA3 OPV1 OPV2 OPV3
```

Note: In this global macro, the user must specify dose numbers on the multi-dose vaccines: PENTA1 PENTA2 PENTA3, etc. It does not matter what order the doses are listed in, but their names must match the dose names of the date and tick variables in the RI dataset and in the schedule scalars described in Chapter 3.

The control program must also provide the vaccination schedule described in Chapter 3 (which affects which doses were valid).

Note: This measure calculates both crude and valid outcomes and fully vaccinated by age 1. It uses the output from RI_COVG_01 and RI_COVG_02, so those measures must be calculated before asking for this one.

Control Program Command: `RI_COVG_03`

Output: This indicator generates databases that summarize results for:

- Those who received crude doses of all the vaccines in the full vaccination list.
  This file is named RI_COVG_03_<*analysis counter*>_fvc_database.dta.
- Those who received valid doses of all those vaccines.
  This file is named RI_COVG_03_<*analysis counter*>_fvv_database.dta.
- Those who received a dose by the age of one year.
  This file is named RI_COVG_03_<*analysis counter*>_fva1_database.dta.

The databases include the following output fields for every stratum requested via the SHOW_LEVEL globals (described in section 3.3 and Annex B): estimated %, 95% CI, LCB, UCB, DEFF, ICC, N (unweighted), N (weighted), and ICC2.

The Excel worksheet for this indicator is named: RI_COVG_03 <*analysis counter*>. It lists estimated %, 95% CI, LCB, UCB, DEFF, ICC, N (unweighted), N (weighted).

The plots generated by the indicator include three organ pipe plots per stratum and four overall inchworm plots both showing results for crude, valid, and by age 1, and one showing both crude and valid outcomes on the same figure.

The organ pipe plots are named RI_COVG_03_<*analysis counter*>_opplot_<*fvc, fvv, or fva1*>_<*stratum id*>_<*stratum name*>.png

The inchworm plots are named RI_COVG_03_<analysis counter>_iwplot_<*fvc, fvv, or fva1 or fvv_double*>_<*four 0/1 flags to show which levels are plotted*>.*png*

Interpretation: "X% of the population who were eligible for the survey are estimated to be fully vaccinated, with <*either crude or valid doses*> having received <*list of doses to be fully vaccinated*>."

RI_COVG_04: Not vaccinated

Weighted: Yes

Denominator: Sum of weights for all respondents

Numerator: Sum of weights for respondents who received none of the doses in the list that makes up "vaccinated" in that country at that time

Time options: By the time of survey (crude or valid), or
By 12 months of age (valid)

Variations: By any source (crude)
By card or register (valid)

User inputs: The RI_DOSES_TO_BE_FULLY_VACCINATED list described in Chapter 3.

The vaccination schedule described in Chapter 3 (which affects which doses were valid).

Note: This measure calculates both crude and valid outcomes and not vaccinated by age 1. It uses the output from RI_COVG_01 and RI_COVG_02 and RI_COVG_03, so those measures must be calculated before asking for this one.

Control Program Command: `RI_COVG_04`

Output: This indicator generates databases that summarize results for:

- Those who did not receive any crude doses of the vaccines in the full vaccination list. This file is named RI_COVG_04_<*analysis counter*>_nvc_database.dta.
- Those who did not receive any valid doses of those vaccines. This file is named RI_COVG_04_<*analysis counter*>_nvv_database.dta.
- Those who did not receive a dose by the age of one year. This file is named RI_COVG_04_<*analysis counter*>_nva1_database.dta.

The databases include the following output fields for every stratum requested via the SHOW_LEVEL globals (described in section 3.3 and Annex B): estimated %, 95% CI, LCB, UCB, DEFF, ICC, N (unweighted), N (weighted), and ICC2.

The Excel worksheet for this indicator is named: RI_COVG_04 <*analysis counter*>. It lists estimated %, 95% CI, LCB, UCB, DEFF, ICC, N (unweighted), N (weighted).

The plots generated by the indicator include three organ pipe plots per stratum and four overall inchworm plots showing results both for crude, valid, and by age 1 and one showing crude and valid outcomes on the same figure.

The organ pipe plots are named RI_COVG_04_<*analysis counter*>_opplot_<*nvc, nvv, or nva1*>_<*stratum id*>_<stratum name>.png

The inchworm plots are named RI_COVG_04_<analysis counter>_iwplot_<*nvc, nvv, or nva1 or nvv_double*>_<*four 0/1 flags to show which levels are plotted*>.png

Interpretation: "X% of the population who were eligible for the survey are estimated to be un-vaccinated, having no evidence of received any <*crude or valid*> doses of <*list of doses to be fully vaccinated*> by the sources of information examined in this survey."

RI_COVG_05: Clusters with alarmingly low crude coverage

Weighted: User-specifies, yes or no

Denominator: Count (or sum of weights) for all respondents in the cluster

Numerator: Count (or sum of weights) for respondents who received the dose

Vaccines: Calculate for select doses

User inputs:

```
vcqi_global RI_COVG_05_DOSE_LIST <e.g., MCV1 PENTA1>

vcqi_global RI_COVG_05_TABLES <ALL_CLUSTERS or
                               ONLY_LOW_CLUSTERS>
vcqi_global RI_COVG_05_THRESHOLD_TYPE <COUNT or PERCENT>
vcqi_global RI_COVG_05_THRESHOLD <threshold number>
```

Note: The doses in the dose list must have already had crude coverage calculated by RI_COVG_01.

The user can specify a single dose or several doses to check. The output table will list the count of persons in the cluster, the count of persons vaccinated, and the percent of persons vaccinated in the cluster for each dose in the RI_COVG_05_DOSE_LIST.

If the user wants to only see the list of clusters with alarmingly low coverage, specify ONLY_LOW_CLUSTERS. If the user wishes to see the counts for all clusters in all strata and have the tables highlight those whose coverage is low, then specify ALL_CLUSTERS. (If you specify ALL_CLUSTERS then the rows that list clusters with alarmingly low coverage will be shaded.)

The THRESHOLD_TYPE dictates whether the threshold is a COUNT (i.e., any cluster with ≤ 2 children vaccinated is flagged alarmingly low) or a PERCENT (i.e., any cluster with ≤ 10% of children vaccinated is flagged as alarmingly low).

The THRESHOLD itself is either a COUNT (0, 1, 2, etc.) or a PERCENT (0, 1, 2, … 98, 99, 100). Clusters whose coverage is less than or equal to the threshold will be flagged as having alarmingly low coverage.

Control Program Command: `RI_COVG_05`

Output: This indicator makes a single database named RI_COVG_05 <*analysis counter*>_database.dta.

If making a single table that lists ONLY_LOW_CLUSTERS, then the Excel worksheet is named RI_COVG_05 <*analysis counter*>. If making tables for each stratum (ALL_CLUSTERS) then the table name (and Excel tab name) will also list the stratum ID; in either case, the database and table will list:

- Cluster ID & name,
- count of respondents in the cluster,

- count of respondents with got_crude_<dose>_to_analyze == 1,
- % covered (sum of weights for vaccinated respondents divided by sum of weights for all respondents in the cluster)

This indicator does not make a graph at this time. It complements the organ pipe plots of RI_COVG_01.

Interpretation: "Low coverage is defined here as being a cluster where fewer than <threshold> <percent or individuals> showed evidence of vaccination. The clusters highlighted in this list show evidence of low coverage for at least one of <list of doses considered>."

6.5 RI_ACC: RI Survey – Measures Related to Access

RI_ACC_01: Crude coverage for one dose

Weighted: Yes

Denominator: Sum of weights for all respondents

Numerator: Sum of weights for all respondents who received <dose>

Vaccines: May be calculated for any dose.

User inputs `vcqi_global RI_ACC_01_DOSE_NAME <often PENTA1 or DPT1>`

Note: This indicator uses output from RI_COVG_01, so that must be calculated first.

Control Program Command: `RI_ACC_01`

Output: This indicator produces a single database named:

RI_ACC_01_*<analysis counter>*_*<dose >*_database.dta

The database includes the following output fields for every stratum requested via the SHOW_LEVEL globals (described in section 3.3 and Annex B): estimated %, 95% CI, LCB, UCB, DEFF, ICC, N (unweighted), N (weighted), and ICC2.

The Excel worksheet for this indicator is named: RI_ACC_01 <*analysis counter*>. It lists estimated %, 95% CI, LCB, UCB, DEFF, ICC, N (unweighted), N (weighted).

This indicator does not produce graphic figures. RI_COVG_01 produces organ pipe and inchworm plots which may be used to describe the results of this indicator.

Note: This indicator produces exactly the same output as RI_COVG_01, but it does not list coverage by card, history, register, etc. It only lists the final coverage outcome (to_analyze).

Interpretation: "X% of the population who were eligible for the survey are estimated to have access to vaccination services because they show evidence of having received <DPT1 / PENTA1>, as documented by <*source(s)*>."

6.6 RI_CONT: RI Survey – Measures Related to Continuity of Services

RI_CONT_01: Dropout between two crude doses

Weighted: No

Denominator: Number of respondents who received the first dose

Numerator: Number of respondents who received the first dose and who were eligible but did not receive the second dose

Vaccines: Any pair due to be administered at different ages

Time options: By the time of the survey

User inputs: `vcqi_global RI_CONT_01_DROPOUT_LIST PENTA1 PENTA3 OPV1 OPV3`

This global macro can contain several pairs of doses. The indicator calculates dropout for each pair. In this case, it would calculate dropout from Penta1 to Penta3 and dropout from OPV1 to OPV3. There is no limit to the number of doses you can list, but they must be in pairs.

Note: This indicator uses output from RI_COVG_01, so that must be calculated first.

Control Program Command: `RI_CONT_01`

Output This indicator produces a single database per dose pair named:

RI_CONT_01_*<analysis counter>*_*<dose1>*_*<dose2>*_database.dta

The database fields listed include sample % and N (unweighted). N is the number of respondents whose RI_COVG_01 records indicate that they received dose1. And % is the fraction who did not receive dose2.

The output depends on whether RI records were sought at health centers, and if so, for whom. This is indicated in the control program by setting one (and only one) of the RECORDS_SOUGHT global macros to 1.

- If records were not sought (RI_RECORDS_NOT_SOUGHT is 1) then the RI_COVG_01 result is calculated from data on the card.
- If records were sought for all respondents (RI_RECORDS_SOUGHT_FOR_ALL is 1) then the respondent will be considered to have not dropped out if any source of info indicates that they received dose1 and dose2. The evidence for dose1 does not need to be the same as that for dose2. (This is consistent with the idea of documenting the best possible outcome, as described in Section 3.2.)
- If records were sought only for those who did not present a vaccination card (RI_RECORDS_SOUGHT_IF_NO_CARD is 1) then the result will be based on cards for those who show cards, and on register data for those who do not have cards, but do have register data.

The Excel worksheet for this indicator is named: RI_CONT_01 <*analysis counter*>. The fields listed include sample % and N (unweighted).

The indicator generates one plot showing the unweighted sample % from each stratum. The file is named RI_CONT_01_<analysis counter>_uwplot_*<dose1 >_<dose2>_<four 0/1 flags to show which levels are plotted>.png*

Interpretation: "Among the <N> children who showed evidence of having received <earlier dose>, (per card or recall <or register>), <dropout>% did not show evidence of receiving <later dose>."

Notes: A weighted dropout figure is straightforward to calculate from the tables made by RI_COVG_01 and RI_COVG_02. But the weights may muddle the meaning of the indicator, so we show the unweighted results here.

6.7 RI_QUAL: RI Survey – Measures Related to quality of Services

RI_QUAL_01: Card availability

Weighted: Yes

Denominator: Sum of weights for all respondents

Numerator: Sum of weights for respondents who show a card with 1+ vaccination dates on it

Control Program Command: `RI_QUAL_01`

Output: This indicator produces a single database named:

RI_QUAL_01_<*analysis counter*>_ca_database.dta

The database includes the following output fields for every stratum requested via the SHOW_LEVEL globals (described in section 3.3 and Annex B): estimated %, 95% CI, LCB, UCB, DEFF, ICC, N (unweighted), N (weighted), and ICC2.

The Excel worksheet for this indicator is named: RI_QUAL_01 <*analysis counter*>. It lists estimated %, 95% CI, LCB, UCB, DEFF, ICC, N (unweighted), N (weighted).

Plots include:

- One organ pipe plot for each stratum
- One inchworm plot

The organ pipe plots are named RI_QUAL_01_<analysis counter>_opplot_<stratum id>_<stratum name>.png

The inchworm plot is named RI_QUAL_01_<analysis counter>_iwplot_<four 0/1 flags to show which levels are plotted>.png.

Interpretation: "X% of the population who were eligible for the survey are estimated to have home-based record (card) with one or more vaccination dates on it."

RI_QUAL_02: Ever had a card

Weighted: Yes

Denominator: Sum of weights for all respondents

Numerator: Sum of weights for respondents who say that they ever received a card for the child

Control Program Command: `RI_QUAL_02`

Output: This indicator produces a single database named:

RI_QUAL_02_<*analysis counter*>_1_database.dta

The database includes the following output fields for every stratum requested via the SHOW_LEVEL globals (described in section 3.3 and Annex B): estimated %, 95% CI, LCB, UCB, DEFF, ICC, N (unweighted), N (weighted), and ICC2.

The Excel worksheet for this indicator is named: RI_QUAL_02 <*analysis counter*>. It lists estimated %, 95% CI, LCB, UCB, DEFF, ICC, N (unweighted), N (weighted).

Plots include:

- One organ pipe plot for each stratum
- One inchworm plot

The organ pipe plots are named RI_QUAL_02_<analysis counter>_opplot_<stratum id>_<stratum name>.png

The inchworm plot is named RI_QUAL_02_<analysis counter>_iwplot_<four 0/1 flags to show which levels are plotted>.png.

Interpretation: "X% of the population who were eligible for the survey are estimated to have received at least one home-based record (vaccination card), even if they no longer have it."

RI_QUAL_03: Percent of doses with dates that were invalid

Weighted: No

Denominator: Number of respondents who had DOB data and <dose> with a date, by card or register

Numerator: Number of respondents whose <dose> was invalid (given too early)

Vaccines: May be calculated for any single dose or the first dose in a two- or three-dose series.

User inputs `vcqi_global RI_QUAL_03_DOSE_NAME <often PENTA1 or DPT1>`

Control Program Command: `RI_QUAL_03`

Note: This indicator uses output from RI_COVG_02, so that must be calculated first.

Output: This indicator produces a single database named:

RI_QUAL_03_<*analysis counter*>_<*dose*>_database.dta

The database lists number of respondents N (unweighted) whose record includes the DOB and date when they received DPT1, and the percent of those respondents who received it before they were age-eligible.

The calculation is based on the results of RI_COVG_02, so that indicator must be run before this one, and the results of this indicator will be affected by RECORDS_SOUGHT global macros via that indicator. See section 3.2 for details about RECORDS_SOUGHT global macros in RI Analysis.

The Excel worksheet for this indicator is named: RI_QUAL_03 <*analysis counter*>. The fields listed include sample % and N (unweighted). N is the number of respondents whose records indicate their age when they received DPT1.

The indicator generates one plot showing the unweighted sample % from each stratum.

The files is named RI_QUAL_03_<*analysis counter*>_uwplot_<*dose* >_<*four 0/1 flags to show which levels are plotted*>*.png.*

Interpretation: "Of N respondents in the sample for whom age-at-vaccination could be calculated for <dose>, X% received it before they were eligible to do so."

RI_QUAL_04: Percent of doses administered before a certain age

Weighted: No

Denominator: Number of respondents who had DOB data and <dose> with a date, by card or register

Numerator: Number of respondents whose <dose> was given before <threshold> age

Vaccines: Any dose (often MCV1 before 39 weeks or Penta1 before 6 weeks)

User inputs
```
vcqi_global RI_QUAL_04_DOSE_NAME <often MCV1 or MEASLES>
vcqi_global RI_QUAL_04_AGE_THRESHOLD `=39*7'
```

Note: The indicator uses logic to see if vaccination happened at an age < the threshold rather than ≤ the threshold. If the interpretation is 'before' then the threshold can be `=39*7'; if the interpretation is 'by the age of' then it might be prudent to specify something like `=39*7+1' so that vaccination on day 39*7 would count.

Note: RI_QUAL_04_AGE_THRESHOLD must be populated with the age in days.

Control Program Command:
```
RI_QUAL_04
```

Note: This indicator uses output from RI_COVG_02, so that must be calculated first.

Output: This indicator produces a single database named:

RI_QUAL_04_*<analysis counter>*_*<dose>*_*<threshold>*_database.dta

The database lists N (unweighted) of respondents whose record includes the age at which they received <dose>, and the percent of those respondents who received it before <threshold> age.

The output depends on whether RI records were sought at health centers, and if so, for whom. This is indicated in the control program by setting one (and only one) of the RECORDS_SOUGHT global macros to 1. See section 3.2 for details about RECORDS_SOUGHT global macros in RI Analysis.

The Excel worksheet for this indicator is named: RI_QUAL_04 <*analysis counter*>. The fields listed include sample % and N (unweighted). N is the number of respondents whose records indicate their age when they received <dose>.

The indicator generates one plot showing the unweighted sample % from each stratum. The files are named RI_QUAL_04_<analysis counter>_uwplot_*<dose >_<threshold>_<four 0/1 flags to show which levels are plotted>.png*

Notes: **This indicator flags records where the dose was administered at an age strictly less than the user-defined threshold.**

Interpretation: "Of N respondents in the sample for whom age-at-vaccination could be calculated for <dose>, X% received it before the age of <threshold> days."

RI_QUAL_05: Percent of later doses in a series administered before <threshold> days passed

Weighted: No

Denominator: Number of <dose>2 & 3 doses administered where the date was known for that dose and for the preceding dose

Numerator: Number of times the <dose>2 or 3 dose was administered before <threshold> days had passed from the date of the earlier dose

Vaccines: Any two- or three-dose series; often DPT.

User inputs: `vcqi_global RI_QUAL_05_DOSE_NAME <Usually PENTA or DTP or DPT>`

Note: RI_QUAL_05_DOSE_NAME should only contain the dose base name and not the dose number.

`vcqi_global RI_QUAL_05_INTERVAL_THRESHOLD <number…often 28>`

Note: RI_QUAL_05_INTERVAL_THRESHOLD must be populated with age in days and the calculation flags records where the interval is strictly less than (<) the user-defined threshold. So if the threshold is 28, the outcome will be 1 if the interval was 0-27 days, and it will be 0 if the interval was 28+ days.

Control Program Command: `RI_QUAL_05`

Output: This indicator produces a single database named:

RI_QUAL_05_*<analysis counter>*_*<dose>*_database.dta

The database lists N (unweighted) of intervals where respondents had documented vaccination dates for both the first and second dose, and the % of those intervals that were shorter than the interval defined in the user inputs.

The output depends on whether RI records were sought at health centers, and if so, for whom. This is indicated in the control program by setting one (and only one) of the RECORDS_SOUGHT global macros to 1. See Section 3.2 for details on RECORDS_SOUGHT global macros in RI Analysis.

The Excel worksheet for this indicator is named: RI_QUAL_05 <*analysis counter*>. The fields listed include sample % and N (unweighted). N is the number of Dose 1 to Dose 2 intervals plus the number of Dose 2 to Dose 3 intervals for which the data include dates for both doses. Some respondents will have dates for zero intervals, some for one interval, and some for two intervals.

The indicator generates one plot showing the unweighted sample % from each stratum. The files are named RI_QUAL_05_<analysis counter>_uwplot_*<dose >_<four 0/1 flags to show which levels are plotted>.png*

Interpretation: “Of N intervals in the sample where the data include dates for both the earlier and later dose of <vaccine>, X% of the intervals were shorter than <threshold> days.”

RI_QUAL_06: Percent of valid <dose> doses that were administered before the age of 12 months

Weighted: No

Denominator: Number of children who had valid <dose>

Numerator: Number of children whose valid <dose>was received before the age of 12 months

Vaccines: Can be any dose; often MCV1

User inputs: `vcqi_global RI_QUAL_06_DOSE_NAME <dose name, often MCV1>`

Note:The threshold for RI_QUAL_06 is always age 1 year.

Control Program Command: `RI_QUAL_06`

Note: This indicator uses output from RI_COVG_02, so that must be calculated first.

Output: This indicator produces a single database named:

RI_QUAL_06_<*analysis counter*>_<*dose*>_database.dta

The database lists N (unweighted) of respondents who had a valid dose of measles and the % of those who had that dose before the age of 1, for every stratum requested via the SHOW_LEVEL globals (described in section 3.3 and Annex B). The calculation is based on the results of RI_COVG_02, so that indicator must be run before this one, and the results of this indicator will be affected by RECORDS_SOUGHT global macros via that indicator. See section 3.2 for details on RECORDS_SOUGHT global macros in RI Analysis.

The Excel worksheet for this indicator is named: RI_QUAL_06 <*analysis counter*>. The fields listed include sample % and N (unweighted).

The indicator generates one plot showing the unweighted sample % from each stratum. The files are named
RI_QUAL_06_<analysis counter>_uwplot_<*dose* >_<*four 0/1 flags to show which levels are plotted*>.*png*

Interpretation: "Of N respondents in the sample who received a valid dose of <dose>, X% were administered before the age of 1 year."

A note regarding three indicators that summarize missed opportunities for simultaneous vaccination (MOVs)

RI_QUAL_07 and _08 and _09 all summarize MOVs in the survey dataset.

When interpreting the MOV indicators it is very important to be clear whether the analysis was done with the CRUDE option (invalid doses count) or the VALID option (early doses are ignored).

Consider a country where DPT is scheduled to be given at 6, 10 and 14 weeks. Consider a child who received DPT at 5, 9 and 13 weeks and who received measles at 9 months of age. The child did not receive 3 valid doses of DPT…only the doses at 9 weeks and 13 weeks were valid…and they were valid for DPT1 and DPT2. The dose received at 5 weeks was an invalid dose, so the child did not receive a 3rd valid dose. So if the MOV analysis does not give credit for invalid doses (specify VALID option when running VCQI) then when the child returns for the measles vaccine at age 9 months, they are considered to be eligible for a 3rd valid dose of DPT. And if they do not receive it along with measles, it is counted as a missed opportunity.

If, instead, the user gives credit for invalid doses (specifies the CRUDE option), then the child is still counted as having two valid doses of DPT, but they are not considered eligible for a 3rd dose at the measles visit, and that visit is not considered to be a missed opportunity for DPT.

Specifying the VALID option will result in higher results for the MOV indicators. If the parameter is set to VALID then the child described above would be considered to have an MOV for DPT3 when they receive measles but not DPT at 9 months. If instead, the parameter is set to CRUDE then they would not.

It is my (Dale Rhoda) understanding that at this time (February 2017) WHO does not formally advise countries to give additional doses in a series if the child has received the full target number of doses, but some were invalid. (The practice may vary from country to country and even within countries.) So to summarize performance of the vaccination program as it is administered, it is probably appropriate to use the CRUDE option in the analysis. But biologically, children who receive a full complement of valid doses are probably more likely to develop immunity than those who receive some or all invalid doses. So it may be informative to do the MOV analysis twice…once with the parameter set to CRUDE and again with the parameter set to VALID, and to compare the output.

RI_QUAL_07: Valid coverage if there had been no missed opportunities for simultaneous vaccination (MOV)

Weighted: Yes

Denominator: Sum of weights for all respondents

Numerator: Sum of weights for all respondents who had valid dose plus the sum of weights for those who did not have a valid dose, but did have an uncorrected MOV

Vaccines: Calculate for each vaccine and dose

User inputs: `vcqi_global RI_QUAL_07_VALID_OR_CRUDE <VALID or CRUDE>`

Control Program Command: `RI_QUAL_07`

Note: This indicator uses output from RI_COVG_02, so that must be calculated first.

Output: Databases for this indicator are Stata datasets named:

RI_QUAL_07_<*analysis counter*>_<*dose*>_<*valid or crude*>_database.dta

Each database includes the following output fields for every stratum requested via the SHOW_LEVEL globals (described in section 3.3 and Annex B): estimated %, 95% CI, LCB, UCB, DEFF, ICC, N (unweighted), N (weighted), ICC2 and the number of clusters in the stratum.

The Excel worksheet for this indicator is named: RI_QUAL_07 <*analysis counter*>. Coverage is estimated for each dose in RI_DOSE_LIST. Each dose is summarized in two columns listing: estimated % and 95% CI. The final (right-most) column in the worksheet lists N (unweighted) and N (weighted).

How the outcome is calculated for each respondent depends on whether RI records were sought at health centers, and if so, for whom. This is indicated in the control program by setting one (and only one) of the RECORDS_SOUGHT global macros to 1.

Table 6-13. How RI_QUAL_07 uses RI_RECORDS inputs

RI_RECORDS_NOT_SOUGHT	RI_RECORDS_SOUGHT_FOR_ALL	RI_RECORDS_SOUGHT_IF_NO_CARD	Outcome is based on…	Notes
1	0	0	Card Only	Outcome is calculated using the vaccination date on the card
0	1	0	Card; if missing Card, then Register	For single-dose vaccines: Dates from register records are used to fill in missing dates on cards; if there is a date on the card, the date from the register is ignored, even if it yields a more favorable outcome than the date on the card. [This could be the topic of a future change.]
				For multi-dose vaccines: Dates from register records are used if the card does not contain any dates, or if the register records more doses for that vaccine series than the card does. [This also could be the topic of a future change to the software.]
0	0	1	Card if card was seen Register for those without cards	Outcome is calculated using the card for respondents who show vaccination cards, and using the register for those without cards, but whose documented vaccination records are collected from health centers

Plots include two inchworm plots per dose. The first shows what valid coverage would have been if there had been no MOVs and the second also overlays the valid coverage results from RI_COVG_02 with a gray hollow outline. The plot files are named RI_COVG_07_<*analysis counter*>_iwplot_<*dose or dose_double*>_<*four 0/1 flags to show which levels are plotted*>.png.

Interpretation: "X% of the population who were eligible for the survey would have been estimated to have a documented record of vaccinations (<*source(s)*>) and to have received a valid dose of <*dose*> if there had been no missed opportunities for simultaneous vaccination."

Notes: **To see the difference between the CRUDE and VALID analysis, simply run the indicator twice. This can be accomplished with the following syntax in the control program:**

```
vcqi_global ANALYSIS_COUNTER 1
vcqi_global RI_QUAL_07_VALID_OR_CRUDE VALID
RI_QUAL_07
```

```
vcqi_global ANALYSIS_COUNTER 2
vcqi_global RI_QUAL_07_VALID_OR_CRUDE CRUDE
RI_QUAL_07
```

This will result in two sets of databases and figures, one with the ANALYSIS_COUNTER value of 1 in the filenames and the other with the ANALYSIS_COUNTER value of 2 in the filenames. The tabular output will be summarized in two worksheets named RI_QUAL_07 1 and RI_QUAL_07 2. The crude and valid worksheets will have different footnotes.

RI_QUAL_08: Percent of visits with missed opportunity for simultaneous vaccination

Weighted: No

Denominator: Number of vaccination dates where a respondent was eligible to receive 1+ vaccinations

Numerator: Number of vaccination dates where a respondent did not receive all vaccinations for which they were eligible

Vaccines: Calculate for each vaccine and dose
Calculate over all vaccines and doses
(rate of MOV per visit, i.e., # of vaccines missed per visit)

User inputs:

```
vcqi_global RI_QUAL_08_VALID_OR_CRUDE <CRUDE or VALID>
```

See notes section in RI_QUAL_07 regarding CRUDE and VALID.

Control Program Command:

```
RI_QUAL_08
```

Output: This indicator produces a database for each dose in the RI_DOSE_LIST. The database is named: RI_QUAL_08_<*analysis counter*>_<*dose*>_database.dta. It lists the number of visits where children were eligible for the dose in question, and the % of those visits where the child had a MOV for every stratum requested via the SHOW_LEVEL globals (described in section 3.3 and Annex B).

The indicator also produces a database that is not dose-specific, named RI_QUAL_08_<*analysis counter*>_any_database.dta. It lists the total number of visits where a child was eligible for 1+ doses and the percent of those visits where the child had 1+ MOVs.

The indicator also produces a database that is not dose-specific, named RI_QUAL_08_<*analysis counter*>_rate_database.dta. It lists the total number of visits where a child was eligible for 1+ doses and average number of MOVs per visit.

How the outcome is calculated for each respondent depends on whether RI records were sought at health centers, and if so, for whom. This is indicated in the control program by setting one (and only one) of the RECORDS_SOUGHT global macros to 1. See section RI_QUAL_07 for details on how the RECORDS_SOUGHT global macros differ on MOV calculations.

The Excel worksheet for this indicator is named: RI_QUAL_08 <*analysis counter*>. It holds outcomes for all doses in a single very wide table, where each dose has two columns: unweighted number of eligible visits, and % of those visits with MOV. The aggregate data over all doses show those two columns plus three additional columns which are the sum of total_movs, the sum of all eligible visits, and the rate of total_movs / total eligible visits.

The indicator generates one plot per dose showing the unweighted % of eligible visits that yielded an MOV from each stratum. The plot files are named

RI_COVG_08_<*analysis counter*>_uwplot_<*dose*>_<*four 0/1 flags to show which levels are plotted*>.png.

The indicator also generates an overall plot showing the % of visits that had 1+ MOVs for any dose. That plot is named RI_QUAL_08_<analysis counter>_uwplot_any_<*four 0/1 flags to show which levels are plotted*>.png.

Interpretation: To interpret columns labeled "Visits with MOV for <dose>": "Respondents did not receive <dose> in X% of the N visits where they were eligible for it."

To interpret the column labeled "Visits with MOV for any dose": "Respondents did not receive all doses for which they were eligible in X% of the N visits where they were eligible for one or more doses."

To interpret the column labeled "MOVs per Visit": "On average, respondents were not given R doses for which they were eligible in each vaccination visit."

If MOVs per visit is a number smaller than 1, it may be helpful to interpret thus:

"On average, there was a missed opportunity for simultaneous vaccination in one out of every 1/R visits in the survey dataset." (i.e., If the average MOVs per visit is 0.2, we might say "On average there was a missed opportunity for simultaneous vaccination in one out of every 5 visits represented in the survey dataset."

Notes: **To see the difference between the CRUDE and VALID analysis, simply run the indicator twice. This can be accomplished with the following syntax in the control program:**

```
vcqi_global ANALYSIS_COUNTER 1
vcqi_global RI_QUAL_08_VALID_OR_CRUDE VALID
RI_QUAL_08
vcqi_global ANALYSIS_COUNTER 2
vcqi_global RI_QUAL_08_VALID_OR_CRUDE CRUDE
RI_QUAL_08
```

This will result in two sets of databases and figures, one with the ANALYSIS_COUNTER value of 1 in the filenames and the other with the ANALYSIS_COUNTER value of 2 in the filenames. The tabular output will be summarized in two worksheets named RI_QUAL_08 1 and RI_QUAL_08 2. The crude and valid worksheets will have different footnotes.

RI_QUAL_09: Percent of children with missed opportunity for simultaneous vaccination

Weighted: No

Denominator: Number of children with date of birth data and date of vaccination data indicating that they had 1+ visits for vaccination on days when they were eligible to receive the dose in question

Numerator: Number of children who experienced 1+ missed opportunities to be vaccinated for the dose in question

Vaccines: Calculate for each vaccine and dose
Calculate over all vaccines and doses (# of children with 1+ MOV / # of children with 1+ eligible visit date in the dataset)

User inputs:

```
vcqi_global RI_QUAL_09_VALID_OR_CRUDE <CRUDE or VALID>
```

See notes section in RI_QUAL_07 regarding CRUDE and VALID.

Control Program Command:

```
RI_QUAL_09
```

Output: This indicator produces a database for each dose in the RI dose list. Each is named:

RI_QUAL_09_<*analysis counter*>_<*dose* >_database.dta

The database lists output for every stratum requested via the SHOW_LEVEL globals (described in section 3.3 and Annex B), documenting the number of children who had a recorded date of birth who had 1+ documented vaccinations at an age when they were eligible to receive the dose in question, the number of children who experienced 1+ missed opportunities for the dose, the number of children whose missed opportunities were corrected, and the number of children whose missed opportunity was uncorrected at the time of the survey.

It also produces a database describing the proportion of respondents who experienced 1+ MOVs for any dose. That database is named:

RI_QUAL_09_<*analysis counter*>_anydose_database.dta

How the outcome is calculated for each respondent depends on whether RI records were sought at health centers, and if so, for whom. This is indicated in the control program by setting one (and only one) of the RECORDS_SOUGHT global macros to 1. See section RI_QUAL_07 for details on how the RECORDS_SOUGHT global macros differ on MOV calculations.

The Excel worksheet for this indicator is named: RI_QUAL_09 <*analysis counter*>.

Report outcomes for all doses in a single very wide table, where each dose has four columns:

1. The number of children who had at least one visit where they were eligible to receive the dose (this is the number of children for which the indicator is either 0 or 1)
2. The % of those children who had 1+ MOVs for that dose (this measure)
3. The percent of children with eligible visits who had uncorrected MOVs
4. The percent of children with eligible visits who had corrected MOVs.

Note: The latter two figures add up to the percent calculated in this measure.

The data for all doses combined consist of five columns:

1. A total number of children who had dob data and 1+ eligible visits;
2. The percent who had 1+ MOVs for 1+ doses;
3. The percent for whom all MOVs were corrected;
4. The percent for whom none of the MOVs were corrected, and
5. The percent for whom some, but not all of the MOVs were corrected.

Note: Column 5 is equal to 2 minus 3 minus 4.

The indicator generates two plots for each dose: one that shows the unweighted proportion of respondents who had eligible visits that experienced 1+ MOVs, and another that shows the proportion of children whose MOVs were eventually corrected.

The indicator generates two additional plots: One that shows the % of respondents who were eligible for any dose, who experienced 1+ MOVs, and one that shows the % of respondents who had 1+ MOVs and later had all of their MOVs corrected.

The plot files are named RI_QUAL_09_*<analysis counter>*_uwplot_*<dose or anydose>*_*<four 0/1 flags to show which levels are plotted>.png and*

RI_QUAL_09_*<analysis counter>*_uwplot_*<dose or anydose>*_cor_*<four 0/1 flags to show which levels are plotted>.png*

Interpretation: To interpret columns labeled "Had MOV for <dose> %": "Among the N children in the survey dataset who received some vaccinations on days when they were age-eligible to receive <dose>, X% of them experienced 1+ occasions where they were eligible to receive <dose> but did not receive it."

To interpret the column labeled "MOV uncorrected for <dose> %": "Among the N children in the survey dataset who visited vaccination services on days when they were eligible to receive <dose>, X% of them experienced uncorrected missed opportunities for vaccination with <dose>, that is, there were 1+ occasions where they were eligible to receive <dose> but did not receive it, and as of the date of the survey they still had not received it."

To interpret the column labeled "MOV corrected for <dose> %": "Among the N children in the survey dataset who visited vaccination services on days when they were eligible to receive <dose>, X% of them experienced corrected missed opportunities for vaccination with <dose>, that is, there were 1+ occasions where they were eligible to receive <dose> but did not receive it, but they did receive it at a later date."

To interpret column labeled “Had MOV for any dose (%)”: “Among the N children in the survey dataset who visited vaccination services on days when they were eligible to receive any dose, X% of them experienced 1+ occasions where they did not receive all doses for which they were eligible.”

To interpret column labeld “All MOVs were uncorrected (%)”: “Among the N children in the survey dataset who experienced 1+ MOVs for any doses, X% had all of their MOVs still uncorrected at the time of the survey.”

To interpret column labeled “All MOVs were corrected (%)”: “Among the N children in the survey dataset who experienced 1+ MOVs for any doses, X% had all of their MOVs corrected by the time of the survey.”

To interpret column labeled “Some (not all) MOVs were corrected (%)”: “Among the N children in the survey dataset who experienced 1+ MOVs for any doses, X% had some but not all of their MOVs corrected by the time of the survey.”

Notes: **To see the difference between the CRUDE and VALID analysis, simply run the indicator twice. This can be accomplished with the following syntax in the control program:**

```
vcqi_global ANALYSIS_COUNTER 1
vcqi_global RI_QUAL_09_VALID_OR_CRUDE VALID
RI_QUAL_09
vcqi_global ANALYSIS_COUNTER 2
vcqi_global RI_QUAL_09_VALID_OR_CRUDE CRUDE
RI_QUAL_09
```

This will result in two sets of databases and figures, one with the ANALYSIS_COUNTER value of 1 in the filenames and the other with the ANALYSIS_COUNTER value of 2 in the filenames. The tabular output will be summarized in two worksheets named RI_QUAL_09 1 and RI_QUAL_09 2. The crude and valid worksheets will have different footnotes.

RI_QUAL_12: Percent of later doses in a sequence administered after a particular interval

Weighted: No

Denominator: Number of times the two doses were administered and there was a recorded date for each

Numerator: Number of times the later dose was administered after the interval (in days) in question

Vaccines: Calculate separately for different dose pairs

Variations: DPT1 to 2
DPT2 to 3
Others

User inputs:

```
vcqi_global RI_QUAL_12_DOSE_PAIR_LIST <list of dose pairs,
             e.g.,PENTA1 PENTA2 PENTA2 PENTA3 Penta1 mcv1>
vcqi_global RI_QUAL_12_THRESHOLD_LIST <list of thresholds,
             e.g., 56 56 100>
```

Note: RI_QUAL_12_THRESHOLD_LIST must be populated with age in days

Note: The user may specify any number of dose pairs in RI_QUAL_12_DOSE_PAIR_LIST. The number of thresholds in RI_QUAL_12_THRESHOLD_LIST must correspond to the number of dose pairs.

Control Program Command: `RI_QUAL_12`

Output: This indicator produces a database for each dose pair and threshold combination. The database is named:

RI_QUAL_12_*<analysis counter>*_*<dose1>*_*<dose2>*_*<threshold>*_database.dta

The database lists sample % and N (unweighted) for every stratum requested via the SHOW_LEVEL globals (described in section 3.3 and Annex B).

How the outcome is calculated for each respondent depends on whether RI records were sought at health centers, and if so, for whom. This is indicated in the control program by setting one (and only one) of the RECORDS_SOUGHT global macros to 1. See section 3.2 for details on how the RECORDS_SOUGHT global macros in RI Analysis.

The Excel worksheet for this indicator is named: RI_QUAL_12 *<analysis counter>*. The fields listed include sample % and N (unweighted). When the indicator performs calculations for more than one dose pair, the results for second and later pairs appear in columns to the right of those for the first pair.

The indicator generates one plot per dose pair and threshold showing the unweighted sample % from each stratum. The plot files are named

RI_QUAL_12_<analysis counter>_uwplot_*<dose1 >_<dose2>_<threshold>_<four 0/1 flags to show which levels are plotted>.png*

Interpretation: "Of N intervals in the sample where the data include dates for both the earlier and later dose of <vaccine>, X% of the intervals were longer than <threshold> days."

Notes: **The indicator uses a calculation to determine whether the vaccination interval is greater than (>) the specified interval. (Not greater than or equal to (≥).)**

Depending on what the user specifies for a threshold, it might be a good thing for the interval to exceed the threshold (i.e., that might mean it's a valid interval) or it might be a bad thing (i.e., the interval is 365 days). In coding the variable for analysis, we assume that it is a bad thing for the interval to exceed the threshold; so if RI_RECORDS_SOUGHT_FOR_ALL is 1 then we record a 0 if either the card or register indicates that the interval was shorter than the threshold.

Hence this indicator should NOT be used to establish whether the second dose in the interval is valid; it should rather be used to estimate the proportion of times the interval is unacceptably long.

RI_QUAL_13: Percent of children who receive <dose> by a certain age

Weighted: No

Denominator: Number of children who have a date recorded for <dose> and have DOB data

Numerator: Number of children whose age at <dose> occurs before they are <threshold> days old

Vaccines: Any vaccine; often DPT3

User inputs

```
vcqi_global RI_QUAL_13_DOSE_NAME <often PENTA3 or DTP3>
vcqi_global RI_QUAL_13_AGE_THRESHOLD `=(26*7)+1'
```

Note: RI_QUAL_13_AGE_THRESHOLD must be populated with age in days

Note: The +1 is included in the threshold calculation because the indicator uses logic to see if vaccination happened at an age < the threshold rather than ≤ the threshold.

Note: This indicator uses output from RI_COVG_02, so that must be calculated first.

Control Program Command:

```
RI_QUAL_13
```

Output: This indicator produces a single database named:

RI_QUAL_13_*<analysis counter>*_*<dose_abbreviation>*_*<threshold>*_database.dta

The database lists sample % and N (unweighted) for every stratum requested via the SHOW_LEVEL globals (described in section 3.3 and Annex B).

How the outcome is calculated for each respondent depends on whether RI records were sought at health centers, and if so, for whom. This is indicated in the control program by setting one (and only one) of the RECORDS_SOUGHT global macros to 1. See section 3.2 for details on how the RECORDS_SOUGHT global macros in RI Analysis.

The Excel worksheet for this indicator is named: RI_QUAL_13 <*analysis counter*>. The fields listed include sample % and N (unweighted).

The indicator generates a single plot showing the unweighted sample % from each stratum. The plot files are named RI_QUAL_13_*<analysis counter>*_uwplot_*<dose_abbrev>*_*<threshold>*_*<four 0/1 flags to show which levels are plotted>.png*

Interpretation: "Of N respondents in the sample for whom age-at-vaccination could be calculated for <dose>, X% received it before the age of <threshold> days."

Note: **At this time, this indicator is not eligible to be included in hypothesis tests using COVG_DIFF01 or COVG_DIFF02. It is reported as an unweighted sample proportion and VCQI does not do any calculations regarding its sampling variability.**

6.8 TT_COVG: Tetanus Survey – Measures Related to Coverage

TT_COVG_01: Children born protected from neonatal tetanus

Weighted: Yes

Denominator: Sum of weights for all respondents

Numerator: Sum of weights for women who are protected

Variations: By card
By history
By card or history
By register
By card or history or register
To analyze

Control Program Command: `TT_COVG_01`

Inputs defined via global macros: None for this indicator

Output: Databases for this indicator are Stata datasets named:

TT_COVG_01_<*analysis counter*>_<*abbreviation*>_database.dta

Abbreviations can include:

- by card (c)
- by history (h)
- by card or history (ch)
- by register (r) (if records were sought)
- by card, history or register (chr) (if records were sought)
- to analyze (a)

Each database includes the following output fields for every stratum requested via the SHOW_LEVEL globals (described in section 4.3 and Annex B): estimated %, 95% CI, LCB, UCB, DEFF, ICC, N (unweighted), N (weighted), and ICC2.

The output labeled "to analyze" is the main outcome and how its value is calculated for each respondent depends on whether TT records were sought at health centers, and if so, for whom. This is indicated in the control program by setting one (and only one) of the RECORDS_SOUGHT global macros to 1. See section 4.2 for details on RECORDS_SOUGHT global macros for TT analysis.

The Excel worksheet for this indicator is named: TT_COVG_01 <*analysis counter*>. Each of the databases is summarized in the worksheet. The fields in the worksheet include estimated %, 95% CI, LCB, UCB, DEFF, ICC, N (unweighted), N (weighted).

Plots include one organ pipe plot per stratum, named TT_COVG_01_<*analysis counter*>_opplot_<*stratum id*>_<*stratum name*>.png and one inchworm plot is named TT_COVG_01_<analysis counter>_iwplot_*<four 0/1 flags to show which levels are plotted*>.png.

Interpretation: "X% of babies born in the 12 months preceding the survey are estimated to have been protected at birth from neonatal tetanus, according to evidence given from [maternal vaccination card and/or maternal recall of their vaccination history and/or health center records of maternal vaccinations]."

6.9 SIA_COVG: Post-SIA Survey – Measures Related to Coverage

SIA_COVG_01 Crude SIA coverage

Weighted: Yes

Denominator: Sum of weights for all respondents

Numerator: Sum of weights for respondents who received the vaccine dose according to [card, history, or finger mark]

Vaccines: Calculated for each dose

Time options: During the campaign

Variations: By card
By history
By finger mark
By card or history or finger mark (this is the main coverage outcome)

Control Program Command: `SIA_COVG_01`

Output: This indicator generates databases that summarize SIA coverage:

Table 6-14. Naming convention for SIA_COVG_01 databases

Summarize SIA coverage according to evidence from…	Database Name
Campaign card	SIA_COVG_01_<*analysis counter*>_c_database.dta
Caretaker's verbal history	SIA_COVG_01_<*analysis counter*>_h_database.dta
Fingermark	SIA_COVG_01_<*analysis counter*>_f_database.dta
Main outcome to analyze	SIA_COVG_01_<*analysis counter*>_a_database.dta

The databases include the following output fields for the campaign dose and every outcome listed above and every stratum requested via the SHOW_LEVEL globals (described in section 5.3 and Annex B): estimated %, 95% CI, LCB, UCB, DEFF, ICC, N (unweighted), N (weighted), and ICC2.

The Excel worksheet for this indicator is named: SIA_COVG_01 <*analysis counter*>. For the outcomes by card, history, and register it simply lists estimated % and 95% CI. For the main outcome it lists estimated %, 95% CI, LCB, UCB, DEFF, ICC, N (unweighted), N (weighted).

The plots generated by the indicator include one organ pipe plot of the main outcome per stratum and one inchworm plot summarizing the main crude coverage outcome for the campaign dose.

The organ pipe plots are named SIA_COVG_01_<*analysis counter*>_opplot_ <*stratum id*>_<*stratum name*>.png

The inchworm plots are named SIA_COVG_01_<analysis counter>_iwplot_*<four 0/1 flags to show which levels are plotted>*.png.

Interpretation: "X% of eligible children who were living here during the campaign are estimated to have been vaccinated against [measles] during the recent campaign per information obtained [by card, by caregiver history, by finger mark]."

Notes **This indicator assumes that every respondent in the SIA dataset was in the country at the time of the campaign and meets any other inclusion criteria for the campaign. Respondents who do not meet the criteria should either be removed from the dataset in an upstream step or should have their weights set to zero.**

SIA_COVG_02: Crude SIA coverage where SIA dose was the first dose

Weighted: Yes

Denominator: Sum of weights for all respondents

Numerator: Sum of weights for respondents who received the SIA dose and had never received a dose before

Vaccines: Calculated for each dose

Time options: During the campaign

Control Program Command: `SIA_COVG_02`

Output: This indicator generates one database that summarizes the outcome; the file is named SIA_COVG_02_<*analysis counter*>_a_database.dta.

The database includes the following output fields for every stratum requested via the SHOW_LEVEL globals (described in section 5.3 and Annex B): estimated %, 95% CI, LCB, UCB, DEFF, ICC, N (unweighted), N (weighted), and ICC2.

The Excel worksheet for this indicator is named: SIA_COVG_02 <*analysis counter*>. It lists estimated %, 95% CI, LCB, UCB, DEFF, ICC, N (unweighted), N (weighted).

The plots generated by the indicator include one organ pipe plot per stratum and one inchworm plot.

The organ pipe plots are named SIA_COVG_02_<*analysis counter*>_opplot_ <*stratum id*>_<*stratum name*>.png

The inchworm plot is named SIA_COVG_02_<analysis counter>_iwplot_<*four 0/1 flags to show which levels are plotted*>.png.

Interpretation: "X% of eligible children who were living here during the campaign received their first-ever dose of [measles] vaccine in the recent campaign."

Notes **This indicator assumes that every respondent in the SIA dataset was in the country at the time of the campaign and meets any other inclusion criteria for the campaign. Respondents who do not meet the criteria should either be removed from the dataset in an upstream step or should have their weights set to zero.**

SIA_COVG_03: Lifetime measles doses, by birth cohort

Weighted: Yes

Description: Most SIAs will be targeted at a population of children who span several years of age. Each year of age is considered to be a so-called one-year "birth cohort". In this measure, we report how each cohort is divided across three categories: those for whom we do not find evidence (by card or history or registry) that they ever received a dose of the campaign dose (e.g., MCV) (0 doses); those for whom we find evidence of a single lifetime dose (1 dose); and those for whom we find evidence of 2+ doses (2+ doses). The three categories will sum to 100% for each cohort. ("Do not know" is not evidence and is treated as a zero.)

Denominator: Sum of weights for all respondents

Numerator: There are three numerators:

1. Sum of weights for respondents who report never having received the campaign dose
2. Sum of weights for respondents who show evidence of one lifetime dose
3. Sum of weights for respondents who show evidence of 2+ lifetime doses

User inputs: This indicator uses the SIA_MIN_AGE and SIA_MAX_AGE global macros to identify the youngest and oldest birth cohort targeted in the campaign.

```
vcqi_global SIA_MIN_AGE `=9*30'
vcqi_global SIA_MAX_AGE `=int(15*365.25)'
```

Note: SIA_MIN_AGE and SIA_MAX_AGE must be populated with age in days

Control Program Command: `SIA_COVG_03`

Output: This indicator produces three databases for each year of age eligibility in the survey – one for each of the three numerators. The datasets are named SIA_COVG_03_*<analysis counter>*_<db counter>_database.dta, where the db counter is a number starting with 0 for the youngest cohort, 0 doses, then increasing by 1 with each additional database. The table below illustrates the pattern in filenames and numbers.

Table 6-15. Naming convention for SIA_COVG_03 databases

VCQI output database filename	Outcome summarized
SIA_COVG_03_1_1_database.dta	9m-12m; % with 0 lifetime doses
SIA_COVG_03_1_2_database.dta	9m-12m; % with 1 lifetime doses
SIA_COVG_03_1_3_database.dta	9m-12m; % with 2+ lifetime doses
SIA_COVG_03_1_4_database.dta	1 year old; % with 0 lifetime doses
SIA_COVG_03_1_5_database.dta	1 year old; % with 1 lifetime doses
SIA_COVG_03_1_6_database.dta	1 year old; % with 2+ lifetime doses
SIA_COVG_03_1_7_database.dta	2 years old; % with 0 lifetime doses
SIA_COVG_03_1_8_database.dta	2 years old; % with 1 lifetime doses
SIA_COVG_03_1_9_database.dta	2 years old; % with 2+ lifetime doses
And so on…	

The database includes the following output fields for every stratum requested via the SHOW_LEVEL globals (described in section 5.3 and Annex B): estimated %, 95% CI, LCB, UCB, DEFF, ICC, N (unweighted), N (weighted), and ICC2.

The Excel worksheet for this indicator is named: SIA_COVG_03 <*analysis counter*>. It lists estimated %, 95% CI, LCB, UCB, DEFF, ICC, N (unweighted), N (weighted).

This indicator does not produce any plots.

Interpretation: "X% of children in the age cohort who had completed Y years gave verbal or documented indication of having received [0, 1, or 2+] lifetime doses of [the campaign vaccine]."

6.10 SIA_QUAL: Post-SIA Survey – Measures Related to Quality of Services

SIA_QUAL_01: Received a campaign card

Weighted: No

Denominator: Number of respondents who were vaccinated in the campaign

Numerator: There are three numerators:
Number of vaccinated respondents whose card was seen by survey data collectors
Number of vaccinated respondents who reported having a card, but it was not seen
Number of vaccinated respondents who either showed a card or reported receiving one

Time options: During the campaign

Control Program Command: `SIA_QUAL_01`

Output: This indicator generates three databases that summarizes the outcomes – one for each numerator:

Table 6-16. Naming convention for SIA_QUAL_01 databases

Numerator	Database Name
Card Seen	SIA_QUAL_01_<*analysis counter*>_s_database.dta
Card Unseen	SIA_QUAL_01_<*analysis counter*>_u_database.
Main Outcome (Card seen or unseen)	SIA_QUAL_01_<*analysis counter*>_a_database.dta

The databases include the number of respondents vaccinated and the unweighted % who received a card in every stratum requested via the SHOW_LEVEL globals (described in section 5.3 and Annex B).

The Excel worksheet for this indicator is named: SIA_QUAL_01 <*analysis counter*>.

The plots generated by the indicator include one organ pipe plot of the main outcome per stratum and one inchworm plot summarizing the main outcome.

The organ pipe plots are named SIA_QUAL_01_<*analysis counter*>_opplot_ <*stratum id*>_<*stratum name*>.png

The inchworm plots are named SIA_QUAL_01_<analysis counter>_iwplot_*<four 0/1 flags to show which levels are plotted>*.png.

Interpretation: "Among the N children who were vaccinated in the campaign, X% demonstrated that they received a card."

"Among the N children who were vaccinated in the campaign, X% reported having received a campaign card, but did not show it."

"Among the N children who were vaccinated in the campaign, X% either demonstrated that they received, or reported having received a campaign card."

6.11 Hypothesis Tests for Differences in Coverage

COVG_DIFF_01: Differences between strata

Description: This indicator allows the user to test the hypothesis that coverage is the same between two strata, i.e., two provinces or two districts. The user specifies the strata of interest and the variable being tested and then runs the test. Results are written to a database and optionally to a spreadsheet.

Weighted: Yes

Null hypothesis: Underlying population level coverage is the same in the two strata being tested

Alternative hypothesis: Coverage in the first stratum is not equal to coverage in the second.

Variables: Any variable used for weighted coverage analyses. Table 6-5 at the end of this section lists the variables that are appropriate for testing.

User inputs: The inputs are a set of global macros which are defined before the first test and then re-defined for subsequent tests.

Table 6-17. User inputs for COVG_DIFF_01

Global Macro	Acceptable Values	Description	Notes
COVG_DIFF_01_STRATUM_LEVEL	2 or 3		
COVG_DIFF_01_ANALYSIS_COUNTER	Number	Set to whatever value was used in the analysis that generated the dataset	Usually 1
COVG_DIFF_01_ID_OR_NAME	ID or NAME	Specifies whether the user will identify the two strata using their IDs or their names.	Both ID and NAME must match those in the appropriate name dataset. So if the hypothesis is between strata at level 2, then the IDs or NAMEs specified below must match the IDs and NAMEs in the LEVEL2_NAME_DATASET
COVG_DIFF_01_STRATUM_ID1	ID of stratum 1 to test or BLANK		Can only be populated if COVG_DIFF_01_ID_OR_NAME is set to ID

Global Macro	Acceptable Values	Description	Notes
COVG_DIFF_01_STRATUM_ID2	ID of stratum 2 to test or BLANK		Can only be populated if COVG_DIFF_01_ID_OR_NAME is set to ID
COVG_DIFF_01_STRATUM_NAME1	NAME of stratum 1 to test or BLANK		Can only be populated if COVG_DIFF_01_ID_OR_NAME is set to NAME
COVG_DIFF_01_STRATUM_NAME2	NAME of stratum 2 to test or BLANK		Can only be populated if COVG_DIFF_01_ID_OR_NAME is set to NAME
COVG_DIFF_01_INDICATOR	Name of the indicator that generated the variable to test.		Examples: TT_COVG_01, RI_QUAL_01, or SIA_COVG_01
COVG_DIFF_01_VARIABLE	Name of the coverage variable to be tested.		Examples: got_crude_penta3_by_card or protected_at_birth_to_analyze Table 6-5 lists indicators and analyzes that are reasonable to include in hypothesis tests.

Control Program Command: `COVG_DIFF_01`

Output: This indicator does not make a database and it does not make any plots.

The Excel worksheet is named COVG_DIFF_01 *<analysis counter>*. Each hypothesis test adds an additional row to the worksheet. It lists stratum level, stratum 1 ID & name, stratum 2 ID & name, variable tested, unweighted N and weighted N, coverage and 95% CI in stratum 1 & stratum 2, difference in coverage, degrees of freedom for the test, 95% CI for the difference, and Rao-Scott p-value for the test.

Interpretation: "The probability of observing two strata of this size with sample proportions that differ by this much or more if the underlying coverage were the same is equal to the p-value."

Example:

```
vcqi_global COVG_DIFF_01_STRATUM_LEVEL 2

vcqi_global COVG_DIFF_01_ANALYSIS_COUNTER 1

vcqi_global COVG_DIFF_01_ID_OR_NAME NAME

vcqi_global COVG_DIFF_01_STRATUM_NAME1 UPPER PROVINCE
vcqi_global COVG_DIFF_01_STRATUM_NAME2 LOWER PROVINCE

vcqi_global COVG_DIFF_01_INDICATOR SIA_COVG_01
vcqi_global COVG_DIFF_01_VARIABLE got_sia_dose

COVG_DIFF_01
```

Notes: **This indicator does not generate a database or a figure. Each hypothesis test adds an additional row to the COVG_DIFF_01 worksheet.**

Table 6-18. Weighted coverage variables that are eligible for hypothesis testing

Indicator	Coverage Variable
TT_COVG_01	protected_at_birth_by_card protected_at_birth_by_history protected_at_birth_c_or_h protected_at_birth_by_register protected_at_birth_c_or_h_or_r protected_at_birth_to_analyze
SIA_COV_01	got_sia_dose_by_card got_sia_dose_by_history got_sia_dose got_sia_dose_by_fingermark
SIA_COV_02	sia_is_first_measles_dose
SIA_QUAL_01	campaign_card_seen campaign_card_unseen got_campaign_card
RI_ACC_01	got_crude_<*dose*>_to_analyze
RI_COVG_01	got_crude_<*dose*>_by_card got_crude_<*dose*>_by_history got_crude_<*dose*>_by_register got_crude_<*dose*>_c_or_h got_crude_<dose>_c_or_r got_crude_<*dose*>_c_or_h_or_r got_crude_<*dose*>_to_analyze
RI_COVG_02	got_valid_<*dose*>_by_card got_valid_<*dose*>_by_register got_valid_<*dose*>_c_or_r got_valid_<*dose*>_to_analyze
RI_COVG_03	fully_vaccinated_ fully_vaccinated_by_age1
RI_COVG_04	not_vaccinated_crude not_vacinated_valid not_vaccinated_by_age1
RI_QUAL_01	showed_card_with_dates
RI_QUAL_02	ever_had_an_ri_card
RI_QUAL_07	valid_<*dose*>_if_no_movs

Note: The string <dose> is a placeholder for a real dose name like bcg, penta1, mcv1, etc. The dose names in these variables use lower-case letters and should be the same names used in the RI dose List and scalars.

COVG_DIFF_02: Differences between subpopulations within a stratum

Description: This indicator allows the user to test the hypothesis that coverage is the same between two subpopulations, i.e., urban vs. rural, male vs. female, literate caregiver vs. illiterate, received ante-natal care vs. did not. The user specifies the stratum of interest and the two subpopulations and the variable being tested and then runs the test. Results are written to a database and optionally to a spreadsheet.

Weighted: Yes

Null hypothesis: Underlying population coverage is the same in the two subpopulations being tested

Alternative hypothesis: Coverage in the first subpopulation is not equal to coverage in the second.

Variables: Any variable used for weighted coverage analyses. Table 6-5 at the end of the previous section lists the variables that are appropriate for this sort of testing.

Inputs: The inputs are a set of global macros which are defined before the first test and then re-defined for subsequent tests.

Table 6-19. User inputs for COVG_DIFF_02

Global Macro	Acceptable Values	Description	Notes
COVG_DIFF_02_STRATUM_LEVEL	1 or 2 or 3		
COVG_DIFF_02_ANALYSIS_COUNTER	Number	Set to whatever value was used in the analysis that generated the dataset	Usually 1
COVG_DIFF_02_ID_OR_NAME	ID or NAME	Specifies whether the user will identify the two strata using their IDs or their names.	Both ID and NAME must match those in the appropriate name dataset. So if the hypothesis is between strata at level 2, then the IDs or the NAMEs specified below must match the IDs and NAMES in the LEVEL2_NAME_DATASET
COVG_DIFF_02_STRATUM_ID	ID of stratum 2 to test or BLANK		Can only be populated if COVG_DIFF_02_ID_OR_NAME is set to ID
COVG_DIFF_02_STRATUM_NAME	NAME of stratum 2 to test or BLANK		Can only be populated if COVG_DIFF_02_ID_OR_NAME is set to NAME

Global Macro	Acceptable Values	Description	Notes
COVG_DIFF_02_INDICATOR	Name of the indicator that generated the variable to test		Examples: RI_COVG_01 or TT_COVG_01
COVG_DIFF_02_SUBPOP_VARIABLE	Variable that holds the levels of the subpopulation		Examples: urban_cluster, sex, caregiver_literate, etc.
COVG_DIFF_02_SUBPOP_ID1	Level of first population		Must be an integer
COVG_DIFF_02_SUBPOP_ID1	Level of second population		Must be an integer
COVG_DIFF_02_VARIABLE	Name of the coverage variable to be tested.		Examples: got_crude_penta3_by_card or protected_at_birth_to_analyze Table 6-5 lists indicators and analyzes that are reasonable to include in hypothesis tests.

Control Program Command: `COVG_DIFF_02`

Table Output: This indicator does not make a database and it does not make any plots.

The Excel worksheet is named COVG_DIFF_02 *<analysis counter>*. Each hypothesis test adds an additional row to the worksheet. It lists stratum level, stratum ID & name, subpopulation variable, subpopulation id & name for subpopulations 1 & 2; unweighted and weighted N, variable tested, coverage and 95% CI in stratum 1 & stratum 2, difference in coverage, degrees of freedom for the test, 95% CI for the difference, and Rao-Scott p-value for the test.

Interpretation: "The probability of observing two subpopulations this size with sample proportions that differ by this much or more if the underlying coverage were the same is equal to the p-value."

Example:

```
* Got campaign card coverage is equal between urban
* and rural sub-groups within Province 1

vcqi_global COVG_DIFF_02_ID_OR_NAME ID
vcqi_global COVG_DIFF_02_STRATUM_LEVEL 2
```

```
vcqi_global COVG_DIFF_02_STRATUM_ID 1

vcqi_global COVG_DIFF_02_INDICATOR SIA_QUAL_01
vcqi_global COVG_DIFF_02_ANALYSIS_COUNTER 1

vcqi_global COVG_DIFF_02_VARIABLE got_campaign_card

vcqi_global COVG_DIFF_02_SUBPOP_VARIABLE urban_cluster
vcqi_global COVG_DIFF_02_SUBPOP_LEVEL1 0
vcqi_global COVG_DIFF_02_SUBPOP_LEVEL2 1

COVG_DIFF_02
```

Notes: **Each hypothesis test adds an additional row to the COVG_DIFF_02 worksheet.**

CHAPTER 7. EXAMPLES OF CONTROL PROGRAMS

As described at the end of Chapter 2, VCQI control programs usually consist of seven blocks of code. Three blocks are edited and customized by the user and four blocks are usually not edited but are necessary for the program to run correctly.

This chapter shows examples of each of the seven blocks for an RI control program, a TT control program, and an SIA control program.

7.1 Block A – Start with clear memory

The first block of a VCQI control program is the same, whether TT, RI, or SIA. Three lines of code clear out old data, programs, and macros and ensure that the output that goes to the screen will not pause during the run. The code below shows the top of a TT program. RI and SIA programs would look the same, with the acronyms RI or SIA being substituted for TT.

```
*******************************************************************************
* Vaccination Coverage Quality Indicators (VCQI) control program to analyze
* data from a tetanus survey
*
*
* Program example and template for the VCQI User's Guide
*
* Written by Biostat Global Consulting
*
* Updated 2017-02-15
*
* The user might customize this program by changing items below in the
* code blocks marked TT-B, TT-D, and TT-F below.  Those blocks are
* marked "(User may change)".
*
*
*******************************************************************************
* Code Block: TT-A                                                (Do not change)
*------------------------------------------------------------------------------
*                  Start with clear memory
*------------------------------------------------------------------------------

set more off

clear all

macro drop _all
```

7.2 Block B – Specify input/output folders & analysis name

Block B is the first of three sections that the user edits. It consists of three lines of code, two name folders where VCQI will find the survey datasets, where she will put the output files, and the third line gives a name to the analysis. The analysis name will appear in the name of the output spreadsheet. This page shows Block B from a TT control program and it looks exactly like one from an RI or SIA program.

```
*************************************************************************
* Code Block: TT-B                                          (User may change)
*------------------------------------------------------------------------
*                  Specify input/output folders & analysis name
*------------------------------------------------------------------------

* Where should the programs look for datasets?
global VCQI_DATA_FOLDER    Q:/Test datasets/2016-02-24

* Where should the programs put output?
global VCQI_OUTPUT_FOLDER  Q:/VCQI test output/TT test

* Establish analysis name
* (used in log file name and Excel file name)

global VCQI_ANALYSIS_NAME TT_Test
```

7.3 Block C – CD to output folder & open VCQI log

Block C has Stata change the working directory to be the output folder specified in Block B. Then it deletes any old copies of the Excel output file so this new run will be putting output into a new file. Next it opens the VCQI log, putting some initial messages in there to document the user-inputs that have been specified up to this point. Lastly it runs a program that puts more than 200 lines of output in the log file, documenting precisely which versions of the VCQI Stata programs will be used in this analysis. The log file lists the version number and date that each program was last changed in a substantial way. This may be helpful for troubleshooting problems later.

```
*******************************************************************************
* Code Block: TT-C                                                 (Do not change)
*------------------------------------------------------------------------------
*                  CD to output folder & open VCQI log
*------------------------------------------------------------------------------

cd "${VCQI_OUTPUT_FOLDER}"

* Start with a clean, empty Excel file for tabulated output (TO)
capture erase "${VCQI_OUTPUT_FOLDER}/${VCQI_ANALYSIS_NAME}_TO.xlsx"

* Give the current program a name, for logging purposes
global VCP TT_Control_Program

* Open the VCQI log and put a comment in it
vcqi_log_comment $VCP 3 Comment "Run begins...log opened..."

* Document the global macros that were defined before the log opened
vcqi_log_global VCQI_DATA_FOLDER
vcqi_log_global VCQI_OUTPUT_FOLDER
vcqi_log_global VCQI_ANALYSIS_NAME

* Write an entry in the log file for each program, noting its version number

vcqi_log_all_program_versions
```

The global macro VCP stands for VCQI Current Program; it holds the name of the program that is currently running. When a message is posted to the log file, the message lists the name of the program that made the message. This is accomplished by passing $VCP to the program that writes the log.

The program vcqi_log_global writes a message into the log, documenting the value of a global macro.

7.4 Block D – Specify dataset names & important metadata

Block D holds the second set of lines that a user typically edits. The user specifies the names of the Stata datasets that hold the coverage survey data. Variable names and coding conventions for those datasets are in VCQI's Forms and Variable List (FVL) document. The user also specifies some parameters or metadata to describe the vaccination schedule, the coverage survey, and some parameters to control what VCQI generates and how it looks. Many of the lines in Block D are common across TT, RI, and SIA surveys. After the common code, three sections follow listing lines of code that are specific to TT, RI and SIA control programs.

Block D – Code common to RI, TT and SIA analyses

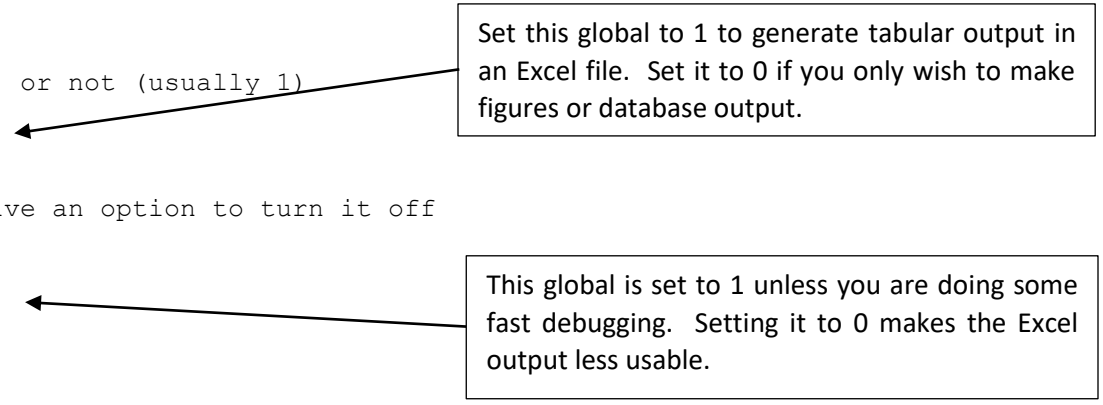
```
*******************************************************************************
* Code Block: TT-D                                                (User may change)
*------------------------------------------------------------------------------
*                  Specify dataset names and parameters/metadata
*------------------------------------------------------------------------------

vcqi_global VCQI_CM_DATASET     CM_faux_dataset

* If you will describe the dataset using DESC_01 then you need to also specify
* the HH and HM datasets

vcqi_global VCQI_HH_DATASET     HH_faux_dataset
vcqi_global VCQI_HM_DATASET     HM_faux_dataset
* ----------------------------------------------------------------------------
* Parameters to describe the analysis being requested
* ----------------------------------------------------------------------------

* Name the datasets that give geographic names of the various strata
* and list the order in which strata should appear in tabular output.
* See Annex B of the VCQI User's Guide

vcqi_global LEVEL2_ORDER_DATASET ${VCQI_DATA_FOLDER}/level2order
vcqi_global LEVEL3_ORDER_DATASET ${VCQI_DATA_FOLDER}/level3order

vcqi_global LEVEL1_NAME_DATASET ${VCQI_DATA_FOLDER}/level1name
vcqi_global LEVEL2_NAME_DATASET ${VCQI_DATA_FOLDER}/level2names
vcqi_global LEVEL3_NAME_DATASET ${VCQI_DATA_FOLDER}/level3names
```

See Annex B for a description and of these _ORDER_ and _NAME_ datasets.

```
* The user can ask for results to be broken out by levels of
* a) a single demographic stratifier (like urban/rural), or
* b) a set of several stratifiers (like urban/rural and sex and household wealth)
*
* If the user requests a single stratifier
* then the stratifier will appear in inchworm and unweighted proportion
* plots as well as VCQI tables.

* But if the user requests two or more stratifiers
* then inchworm plots and unweighted proportion plots are not generated for
* this run.  The stratifiers will appear only in VCQI tables, but not plots.

* List of demographic variables for stratified tables (can be left blank)
vcqi_global VCQI_LEVEL4_SET_VARLIST urban_cluster

* Name of dataset that documents the user's preferred order and
* row labels for LEVEL4 strata(can be left blank)
* (VCQI will generate a layout file if one is not specified; you may
*  copy VCQI's file, edit it, move it to the input dataset folder and
*  then point to it here during later VCQI runs.)

vcqi_global VCQI_LEVEL4_SET_LAYOUT ${VCQI_DATA_FOLDER}/VCQI_LEVEL4_SET_LAYOUT_urban_cluster
```

See Annex B for a description and of the SET_LAYOUT dataset

```
* These globals control how the output looks in the tabulated dataset
* from the 05TO programs; see Annex B in the VCQI User's Guide.

vcqi_global SHOW_LEVEL_1_ALONE         0
vcqi_global SHOW_LEVEL_2_ALONE         0
vcqi_global SHOW_LEVEL_3_ALONE         0
vcqi_global SHOW_LEVELS_2_3_TOGETHER   0

vcqi_global SHOW_LEVELS_1_4_TOGETHER   1
vcqi_global SHOW_LEVELS_2_4_TOGETHER   0
vcqi_global SHOW_LEVELS_3_4_TOGETHER   0
vcqi_global SHOW_LEVELS_2_3_4_TOGETHER 1

vcqi_global SHOW_BLANKS_BETWEEN_LEVELS 1


* User specifies the method for calculating confidence intervals
* Valid choices are LOGIT, WILSON, JEFFREYS or CLOPPER; our default
* recommendation is WILSON.

vcqi_global VCQI_CI_METHOD WILSON

* Specify whether the code should export to excel, or not (usually 1)

vcqi_global EXPORT_TO_EXCEL                    1

* The code to format excel is a little slow, so give an option to turn it off
* when debugging (usually 1)

vcqi_global FORMAT_EXCEL                       1
```



```
* Specify whether the code should make plots, or not (usually 1)

* MAKE_PLOTS must be 1 for any plots to be made
vcqi_global MAKE_PLOTS                              1

* Make inchworm plots? Set to 1 for yes.
vcqi_global VCQI_MAKE_IW_PLOTS                      1

* Make unweighted sample proportion plots? Set to 1 for yes.
vcqi_global VCQI_MAKE_UW_PLOTS                      1

* Make organ pipe plots? Set to 1 for yes.
vcqi_global VCQI_MAKE_OP_PLOTS                      1

* Save the data underlying each organ pipe plot?  Set to 1 for yes.
*
* Recall that organ pipe plots are very spare, and do not list the cluster id
* for any of the bars
*
* If this option is turned on, (set to 1) then the organ pipe plot program
* will save a dataset in the Plots_OP folder for each plot.  The dataset will
* list the cluster id for each bar in the plot along with its height and
* width.  This makes it possible to identify precisely which cluster id goes
* with which bar in the plot.

vcqi_global VCQI_SAVE_OP_PLOT_DATA                  1

* Specify whether the code should save Stata .gph files when making plots.
* Usually 0.  These files are only made if MAKE_PLOTS is 1.
* Set to 1 if you want to be able to edit plots in the Stata Graph Editor
* or re-export them in a different size or graphic file format.

vcqi_global SAVE_VCQI_GPH_FILES                     1
```

Set this global to 1 to make plots. Set it 0 if you only want database or tabular output.

Furthermore, you can suppress individual types of plots…sometimes you may want to make only inchworm plots…so turn off the organ pipe and unweighted sample proportion plots

```
* Specify whether the code should save VCQI output databases
*
* WARNING!! If this macro is set to 1, VCQI will delete ALL files that
* end in _database.dta in the VCQI_OUTPUT_FOLDER at the end of the run
* If you want to save the databased, change the value to 0.
* (Usually 1)

vcqi_global DELETE_VCQI_DATABASES_AT_END        1

* Specify whether the code should delete intermediate datasets
* at the end of the analysis (Usually 1)
* If you wish to keep them for additional analysis or debugging,
* set the option to 0.

vcqi_global DELETE_TEMP_VCQI_DATASETS           1

* Set this global to 1 to test all metadata and code that makes
* datasets and calculates derived variables...without running the
* indicators or generating output

vcqi_global VCQI_CHECK_INSTEAD_OF_RUN           0
```

VCQI generates datasets (flat files) of analysis results that it calls *databases*. They are deleted by default when VCQI is finished because we assume that most users want to look at tabular output in Excel rather than unformatted flat files. In order to keep the database, set this global to 0.

This global is usually set to 1 so VCQI will delete its temporary datasets when it is finished running. A user might set this global to 0 to keep those datasets for the purpose of debugging a program or following along to understand some of VCQI's intermediate work products.

Some users may wish to do additional analyses using some of VCQI's derived variables; if so, set this option to 0.

If you set this global to 1 then VCQI will do a quick check of your inputs to see if there is anything obviously missing or mis-specified, hopefully allowing you to catch mistakes at the start rather than 20 or 30+ minutes into a long VCQI run.

Block D – Code specific to TT analyses

```
* Names of datasets that hold TT data
vcqi_global VCQI_TT_DATASET     TT_faux_dataset
vcqi_global VCQI_TTHC_DATASET   TTHC_faux_dataset

* ------------------------------------------------------------------------
* Parameters to describe the TT survey
* ------------------------------------------------------------------------

* These following parameters help describe the survey protocol
* with regard to whether they:
* a) skipped going to health centers to find TT records
*    (TT_RECORDS_NOT_SOUGHT 1)
* b) looked for records for all respondents
*    (TT_RECORDS_SOUGHT_FOR_ALL 1)
* c) looked for records for women who didn't present vaccination cards
*    during the household interview
*    (TT_RECORDS_SOUGHT_IF_NO_CARD 1)
*
* These are mutually exclusive, so only one of them should be set to 1.
* (the code checks that condition later)

vcqi_global TT_RECORDS_NOT_SOUGHT        0
vcqi_global TT_RECORDS_SOUGHT_FOR_ALL    0
vcqi_global TT_RECORDS_SOUGHT_IF_NO_CARD 1
```

Block D for an RI survey analysis

```
* Name of datasets that hold RI data
vcqi_global VCQI_RI_DATASET         RI_mdy
vcqi_global VCQI_RIHC_DATASET       RIHC_mdy

* ------------------------------------------------------------------------
* Parameters to describe RI schedule
* ------------------------------------------------------------------------
* These parameters may change from survey to survey
*
* http://www.who.int/immunization/policy/Immunization_routine_table2.pdf?ua=1
* Note: Not including maximums (e.g., ms & yf are to be given b/t 9-12 months;
* series are to be given b/t 4-8 weeks of previous dose)

scalar bcg_min_age_days =           0  // birth dose
scalar hepb_min_age_days =          0  // birth dose
scalar opv0_min_age_days =          0  // birth dose

* opv0 only given in the first two weeks of life
scalar opv0_max_age_days =          14  // birth dose

scalar penta1_min_age_days =        42  // 6 weeks
scalar pcv1_min_age_days =          42  // 6 weeks
scalar opv1_min_age_days =          42  // 6 weeks
scalar rota1_min_age_days =         42  // 6 weeks

scalar penta2_min_age_days =        70  // 10 weeks
scalar penta2_min_interval_days =   28  // 4 weeks
scalar pcv2_min_age_days =          70  // 10 weeks
scalar pcv2_min_interval_days =     28  // 4 weeks
scalar opv2_min_age_days =          70  // 10 weeks
scalar opv2_min_interval_days =     28  // 4 weeks
scalar rota2_min_age_days =         70  // 10 weeks
scalar rota2_min_interval_days =    28  // 4 weeks
```

```
scalar penta3_min_age_days =        98  // 14 weeks
scalar penta3_min_interval_days =   28  // 4 weeks
scalar pcv3_min_age_days =          98  // 14 weeks
scalar pcv3_min_interval_days =     28  // 4 weeks
scalar opv3_min_age_days =          98  // 14 weeks
scalar opv3_min_interval_days =     28  // 4 weeks
scalar rota3_min_age_days =         98  // 14 weeks
scalar rota3_min_interval_days =    28  // 4 weeks

scalar ipv_min_age_days =           98  // 14 weeks

scalar mcv_min_age_days =           270  // 9 months
scalar mcv1_min_age_days =          270  // 9 months
scalar yf_min_age_days =            270  // 9 months

* ------------------------------------------------------------------------
* Parameters to describe survey
* ------------------------------------------------------------------------
* Specify the earliest and latest possible vaccination date for this survey.
*
* (The software assumes this survey includes birth doses, so the earliest date
* is the first possible birthdate for RI survey respondents and the latest
* date is the last possible vaccination date for this dataset - the latest
* date might be the date that the survey ended.

vcqi_global EARLIEST_SVY_VACC_DATE_M     1
vcqi_global EARLIEST_SVY_VACC_DATE_D     1
vcqi_global EARLIEST_SVY_VACC_DATE_Y     2013

vcqi_global LATEST_SVY_VACC_DATE_M       1
vcqi_global LATEST_SVY_VACC_DATE_D       1
vcqi_global LATEST_SVY_VACC_DATE_Y       2015
```

```
* These parameters indicate the eligible age range for survey respondents
* (age expressed in days)

vcqi_global VCQI_RI_MIN_AGE_OF_ELIGIBILITY 365
vcqi_global VCQI_RI_MAX_AGE_OF_ELIGIBILITY 729

* These following parameters help describe the survey protocol
* with regard to whether they:
* a) skipped going to health centers to find RI records (RI_RECORDS_NOT_SOUGHT 1)
* b) looked for records for all respondents (RI_RECORDS_SOUGHT_FOR_ALL 1)
* c) looked for records for women who didn't present vaccination cards
*    during the household interview (RI_RECORDS_SOUGHT_IF_NO_CARD 1)
*
* These are mutually exclusive, so only one of them should be set to 1.
*
vcqi_global RI_RECORDS_NOT_SOUGHT        0
vcqi_global RI_RECORDS_SOUGHT_FOR_ALL    0
vcqi_global RI_RECORDS_SOUGHT_IF_NO_CARD 1

* ------------------------------------------------------------------------
* Which doses should be included in the analysis
* ------------------------------------------------------------------------

* Note that these abbreviations must correspond to those used in the
* names of the dose date and dose tick variables.  The variables are
* named using lower-case acronyms.  The globals here may be upper or
* mixed case...they will be converted to lower case in the software.
*
vcqi_global RI_SINGLE_DOSE_LIST  BCG HEPB OPV0 IPV MCV1 YF
vcqi_global RI_MULTI_2_DOSE_LIST
vcqi_global RI_MULTI_3_DOSE_LIST PENTA PCV OPV ROTA


* For RI analysis, there is an optional report on data quality
* Set this global to 1 to generate that report
* It appears in its own separate Excel spreadsheet

vcqi_global VCQI_REPORT_DATA_QUALITY           0
```

These are the VCQI default values: children are eligible for the survey if they are at least 12 months old and not yet 24 months old.

If you do not specify these parameters, VCQI will set them to 365 and 729 by default; you may specify other values here.

If you ask for a report on data quality, VCQI will generate a separate spreadsheet to describe how many dates are provided by card and by register and how many dates of birth are provided by history.

It summarizes how many of the dates have obvious problems and it summarizes whether the evidence of vaccination across sources is concordant or discordant.

The report only needs to be generated once; after the initial run, this option can be set to 0 to skip this step.

Block D for an SIA survey analysis

```
* Names of datasets that hold SIA data

vcqi_global VCQI_SIA_DATASET    SIA_faux_dataset

* ----------------------------------------------------
* Parameters to describe SIA schedule
* Minimum and maximum age to participate
* in the SIA - expressed in days (9m to 15 years)

vcqi_global SIA_MIN_AGE `=9*30'
vcqi_global SIA_MAX_AGE `=int(15*365.25)'

* ----------------------------------------------------
* Parameters to describe survey
* This survey coded a variable for whether the fingermark was
* seen and so we can report results by fingermark as well as
* card and history

vcqi_global SIA_FINGERMARKS_SOUGHT 1
```

Set this to 0 if the survey did not record whether children had fingermarks

7.5 Block E – Pre-process survey data

Block E should not be changed by the user. The code varies across RI, TT and SIA surveys. We have pasted Block E from each kind of survey here.

```
*------------------------------------------------------------------------------
* Code Block: TT-E                                                (Do not change)
*------------------------------------------------------------------------------
*                  Pre-process survey data
*------------------------------------------------------------------------------

establish_unique_TT_ids


if "$VCQI_CHECK_INSTEAD_OF_RUN" == "1" {
      vcqi_log_comment $VCP 3 Comment "The user has requested a check instead of a run."
      vcqi_global VCQI_PREPROCESS_DATA          0
      vcqi_global VCQI_GENERATE_DVS             0
      vcqi_global VCQI_GENERATE_DATABASES       0
      vcqi_global EXPORT_TO_EXCEL               0
      vcqi_global MAKE_PLOTS                    0
}

check_TT_schedule_metadata
check_TT_survey_metadata
check_TT_analysis_metadata
```

```
*******************************************************************************
* Code Block: SIA-E                                                (Do not change)
*------------------------------------------------------------------------------
*                  Pre-process survey data
*------------------------------------------------------------------------------

* Prepare to do SIA analysis

check_SIA_schedule_metadata
check_SIA_survey_metadata
check_SIA_analysis_metadata
establish_unique_SIA_ids

if "$VCQI_CHECK_INSTEAD_OF_RUN" == "1" {
      vcqi_log_comment $VCP 3 Comment "The user has requested a check instead of a run."
      vcqi_global VCQI_PREPROCESS_DATA    0
      vcqi_global VCQI_GENERATE_DVS       0
      vcqi_global VCQI_GENERATE_DATABASES 0
      vcqi_global EXPORT_TO_EXCEL               0
      vcqi_global MAKE_PLOTS                    0
}
```

```
*******************************************************************************
* Code Block: RI-E                                                (Do not change)
*------------------------------------------------------------------------------
*                  Format the VCQI dose list and pre-process survey data
*------------------------------------------------------------------------------

* Construct the global RI_DOSE_LIST from what the user specified above
* VCQI currently handles single-dose and three-dose vaccines.

* First, list single dose vaccines
global RI_DOSE_LIST `=lower("$RI_SINGLE_DOSE_LIST")'

* Finally, list each dose for three-dose vaccines
foreach i in $RI_MULTI_3_DOSE_LIST {
      global RI_DOSE_LIST "$RI_DOSE_LIST `=lower("`i'")'1 `=lower("`i'")'2 `=lower("`i'")'3"
}

* Put a copy of the dose list in the log
vcqi_log_global RI_DOSE_LIST

* ----------------------------------------------------------------------------
* Check the user's metadata for completeness and correctness
* ----------------------------------------------------------------------------

check_RI_schedule_metadata
check_RI_survey_metadata
check_RI_analysis_metadata

* Run the program to look at date of birth (from history, card, and register)
* and look at dates of vaccination from cards and register.  This program
* evaluates each date and checks to see that it occurred in the period
* allowed for respondents eligible for this survey.  It also checks to see
* that doses in a sequence were given in order.  If any vaccination date
* seems to be outside the right range or recorded out of sequence, the date
* is stripped off and replaced with a simple yes/no tick mark.  This step
* means less date-checking is necessary in subsequent programs.

cleanup_RI_dates_and_ticks
```

```
* The name of the datasets coming out of these cleanup steps are:
* "${VCQI_OUTPUT_FOLDER}/${VCQI_DATASET}_clean" &
* "${VCQI_OUTPUT_FOLDER}/${VCQI_RIHC_DATASET}_clean"

* ------------------------------------------------------------------------
* Establish unique IDs
* ------------------------------------------------------------------------

* The name of the dataset coming out of the ID step is RI_with_ids
establish_unique_RI_ids

* If the user requests a check instead of a run, then turn off
* flags that result in databases, excel output, and plots

if "$VCQI_CHECK_INSTEAD_OF_RUN" == "1" {
      vcqi_log_comment $VCP 3 Comment "The user has requested a check instead of a run."
      vcqi_global VCQI_PREPROCESS_DATA          0
      vcqi_global VCQI_GENERATE_DVS             0
      vcqi_global VCQI_GENERATE_DATABASES       0
      vcqi_global EXPORT_TO_EXCEL               0
      vcqi_global MAKE_PLOTS                    0
}
```

7.6 Block F – Calculate VCQI indicators requested by the user

Block F is the third and final section that the user edits.

It is common to run the DESC indicators first to describe the dataset, and then run the specific RI, TT or SIA indicators of interest. Finally run the COVG_DIFF indicators if you need formal hypothesis tests to decide whether coverage is likely to differ by an amount that is statistically significant. VCQI can test for differences

a) between strata themselves, or
b) between sub-groups within a stratum (e.g., males vs. females, urban vs. rural, education of caretaker, etc.)

Broadly speaking, there are four steps to run an indicator:

1. Specify required (and optional) inputs via vcqi_global statements.
2. Specify the title, subtitle, and footnotes for the Excel worksheet that will hold tabular results.
3. Call the program that calculates the indicator and generates output.
4. If you will calculate this indicator again later in the program, clear out the input global macros so they are not mistakenly used again.

These steps are quite similar across indicators, but the details of the code in Block F differs substantially across TT, RI and SIA surveys. We have pasted some example code here. See the control programs that accompany this guide for full examples of how to run the VCQI indicators.

```
* Describe the RI survey dataset
vcqi_global DESC_01_DATASET           RI
vcqi_global DESC_01_TO_TITLE          RI Survey Sample Summary
vcqi_global DESC_01_TO_FOOTNOTE_1     Abbreviations: HH = Households
DESC_01
```

```
* ------------------------------------------------------------------------
* Summarize responses to some multiple-choice questions using DESC_02
* ------------------------------------------------------------------------

* Is the card an original or replacement?  (simple unweighted sample proportion)

vcqi_global DESC_02_DATASET      RI
vcqi_global DESC_02_VARIABLES    RI30
vcqi_global DESC_02_WEIGHTED     NO
vcqi_global DESC_02_DENOMINATOR  RESPONDED

vcqi_global DESC_02_TO_TITLE Is the card an original or replacement?
* Clear out the SUBTITLE in case it was previously used.
vcqi_global DESC_02_TO_SUBTITLE
* Remember that DESC_02 automatically assigns two footnotes, so if you
* want to include another, start with the number 3.
* We are not using it here, but clear it out in case it was used earlier.
vcqi_global DESC_02_TO_FOOTNOTE_3
DESC_02

* Did you have to pay for replacement?
vcqi_global DESC_02_VARIABLES    RI31
vcqi_global DESC_02_TO_TITLE Did you have to pay for replacement?
DESC_02
```

```
* ------------------------------------------------------------------------
* Now demonstrate using DESC_03 on a multiple-choice question
* where the respondent can select all answers that apply
* ------------------------------------------------------------------------

vcqi_global DESC_03_DATASET           RI
vcqi_global DESC_03_SHORT_TITLE       Vx_Msgs
vcqi_global DESC_03_VARIABLES         RI127 RI128 RI129 RI130 RI131 RI132 RI133
vcqi_global DESC_03_WEIGHTED          YES
vcqi_global DESC_03_DENOMINATOR       ALL
vcqi_global DESC_03_SELECTED_VALUE    1

* The label on RI133 is "7. Other, please specify"; use the so-called
* MISSING options to re-label it simply "7. Other"
vcqi_global DESC_03_TO_TITLE          What messages have you heard about vaccination?
vcqi_global DESC_03_N_MISSING_LEVELS  1
vcqi_global DESC_03_MISSING_LEVEL_1   RI133
vcqi_global DESC_03_MISSING_LABEL_1   7. Other

* Clear out the SUBTITLE in case it was previously used.
vcqi_global DESC_03_TO_SUBTITLE
* We are not using any footnotes here; clear out the first one so none are printed.
vcqi_global DESC_03_TO_FOOTNOTE_1
DESC_03
```

Note: Shaded lines below are wrapped onto multiple lines in this document, but appear on a single line of code (each) in Stata.

```
* Estimate crude dose coverage for all the doses in the RI_DOSE_LIST

vcqi_global RI_COVG_01_TO_TITLE    Crude Coverage

vcqi_global RI_COVG_01_TO_FOOTNOTE_1  Abbreviations: CI=Confidence Interval; LCB=Lower Confidence Bound; UCB=Upper Confidence Bound; DEFF=Design Effect; ICC=Intracluster Correlation Coefficient

vcqi_global RI_COVG_01_TO_FOOTNOTE_2  Note: This measure is a population estimate that incorporates survey weights.  The CI, LCB and UCB are calculated with software that take the complex survey design into account.

RI_COVG_01
```

```
* ------------------------------------------------------------------------
* Identify clusters with alarmingly low coverage of BCG MCV1 OPV1 or PENTA1

vcqi_global RI_COVG_05_DOSE_LIST BCG MCV1 OPV1 PENTA1

* Specify whether to make one table listing only the clusters with low
* coverage (ONLY_LOW_CLUSTERS)
* or to make one table per stratum, listing all clusters and highlighting
* those with low coverage (ALL_CLUSTERS)
vcqi_global RI_COVG_05_TABLES ONLY_LOW_CLUSTERS

* Specify whether alarmingly low coverage is defined by an absolute
* number of respondents vaccinated (COUNT) or by percent of respondents
* in the cluster (PERCENT)
vcqi_global RI_COVG_05_THRESHOLD_TYPE COUNT

* Specify the threshold that defines alarmingly low
* A count, like 0, 1, 2 if the THRESHOLD_TYPE is COUNT
* A percent 0 up to 100 if the THRESHOLD_TYPE is PERCENT

* Clusters whose coverage is <= the threshold will be flagged
* as having alarmingly low coverage.
vcqi_global RI_COVG_05_THRESHOLD 2

* Note that the worksheet title is built by the indicator and not specified
* by the user.
* Note also the indicator builds footnotes 1 and 2, so the first
* user-specified footnote would be #3.
vcqi_global RI_COVG_05_TO_FOOTNOTE_3

RI_COVG_05
```

Note: Shaded lines below are wrapped onto multiple line in this document, but appear on a single line of code (each) in Stata.

```
* Estimate the proportion of children who experienced 1+ MOVs
vcqi_global RI_QUAL_09_VALID_OR_CRUDE VALID

vcqi_global RI_QUAL_09_TO_TITLE       Percent of Respondents with MOVs

vcqi_global RI_QUAL_09_TO_FOOTNOTE_1  Percent of respondents who had date of birth and visit date data who failed to receive a vaccination for which they were eligible on an occasion when they received another vaccination.

vcqi_global RI_QUAL_09_TO_FOOTNOTE_2  An uncorrected MOV means that the respondent had still not received a valid dose at the time of the survey.

vcqi_global RI_QUAL_09_TO_FOOTNOTE_3  A corrected MOV means that the respondent had received a valid dose by the time of the survey.

vcqi_global RI_QUAL_09_TO_FOOTNOTE_4  The denominator for Had MOV (%) is the number of respondents who had visits eligible.

vcqi_global RI_QUAL_09_TO_FOOTNOTE_5  The denominator for MOV uncorrected and corrected (%) is the number of MOVs.

vcqi_global RI_QUAL_09_TO_FOOTNOTE_6  Note that for individual doses, the % MOV uncorrected + % MOV corrected adds up to 100%.

if "`=upper("$RI_QUAL_09_VALID_OR_CRUDE")" == "VALID" vcqi_global RI_QUAL_09_TO_FOOTNOTE_7 Note: Early doses are ignored in this analysis; the respondent is considered to have not received them.

if "`=upper("$RI_QUAL_09_VALID_OR_CRUDE")" == "CRUDE" vcqi_global RI_QUAL_09_TO_FOOTNOTE_7 Note: Early doses are accepted in this analysis; all doses are considered valid doses.

RI_QUAL_09
```

```
* Estimate the proportion of intervals that are longer
* than the specified thresholds
* 1. Penta1 to Penta2 longer than 56 days
* 2. Penta2 to Penta3 longer than 56 days
* 3. BGC to MCV1 longer than 273 days

vcqi_global RI_QUAL_12_DOSE_PAIR_LIST PENTA1 PENTA2 PENTA2 PENTA3 BCG MCV1
vcqi_global RI_QUAL_12_THRESHOLD_LIST 56 56 273

vcqi_global RI_QUAL_12_TO_TITLE       Dose Intervals Exceed Thresholds
vcqi_global RI_QUAL_12_TO_SUBTITLE
vcqi_global RI_QUAL_12_TO_FOOTNOTE_1  Note: This measure is an unweighted summary of a proportion
from the survey sample.

RI_QUAL_12

*-------------------------------------------------------------------------
* Does crude (RI_COVG_01) penta3 by card differ between
* the Upper vs Lower province?

vcqi_global COVG_DIFF_01_STRATUM_LEVEL 2
vcqi_global COVG_DIFF_01_ANALYSIS_COUNTER $ANALYSIS_COUNTER

vcqi_global COVG_DIFF_01_ID_OR_NAME NAME

vcqi_global COVG_DIFF_01_STRATUM_NAME1 UPPER PROVINCE
vcqi_global COVG_DIFF_01_STRATUM_NAME2 LOWER PROVINCE

vcqi_global COVG_DIFF_01_INDICATOR RI_COVG_01
vcqi_global COVG_DIFF_01_VARIABLE got_crude_penta3_by_card

vcqi_global COVG_DIFF_01_TO_FOOTNOTE_1 Abbreviations: CI = Confidence Interval

COVG_DIFF_01
```

You may specify more than one dose pair and interval at a time. In this case we are asking for three analyses. The dose pairs are all listed on the DOSE_PAIR line and the thresholds on the THRESHOLD_LIST line.

Note: Be sure to put the RI_QUAL_12_THRESHOLD_LIST in the same order as the corresponding dose pair in RI_QUAL_12_DOSE_PAIR_LIST

```
* ------------------------------------------------------------------------
* Does crude Penta 1, 2, and 3 differ between urban and rural clusters
* in province 1?

vcqi_global COVG_DIFF_02_INDICATOR RI_COVG_01
vcqi_global COVG_DIFF_02_ANALYSIS_COUNTER  $ANALYSIS_COUNTER

vcqi_global COVG_DIFF_02_SUBPOP_VARIABLE urban_cluster
vcqi_global COVG_DIFF_02_SUBPOP_LEVEL1 0
vcqi_global COVG_DIFF_02_SUBPOP_LEVEL2 1

vcqi_global COVG_DIFF_02_ID_OR_NAME ID
vcqi_global COVG_DIFF_02_STRATUM_LEVEL 2

vcqi_global COVG_DIFF_02_STRATUM_ID 1

vcqi_global COVG_DIFF_02_VARIABLE got_crude_penta1_by_card

vcqi_global COVG_DIFF_02_TO_FOOTNOTE_1 Abbreviations: CI = Confidence Interval

COVG_DIFF_02

vcqi_global COVG_DIFF_02_VARIABLE got_crude_penta2_by_card
COVG_DIFF_02

vcqi_global COVG_DIFF_02_VARIABLE got_crude_penta3_by_card
COVG_DIFF_02
```

Establish all the global macros needed to run the test, and run it once.

Change the variable, and re-run the test; the 2nd and 3rd calls to COVG_DIFF_02 here use all the same global options as the first call. The only difference is the variable being tested.

7.7 Block G – Exit gracefully

Block G is the same across all three kinds of control programs. It calls a program that cleans up after VCQI, moving the log file into Excel and, if the user wishes, deleting temporary files. The VCQI log is moved into a worksheet of the Excel output file; errors are shaded red and warnings are shaded yellow; the log is sorted so errors and warnings appear at the top of the log worksheet.

```
*******************************************************************************
* Code Block: RI-G                                                (Do not change)
*------------------------------------------------------------------------------
*                  Exit gracefully
*------------------------------------------------------------------------------
*
* Close the datasets that hold the results of
* hypothesis tests, and put them into the output spreadsheet
*
* Close the log file and put it into the output spreadsheet
*
* Clean up extra files
*
* Send a message to the screen if there are warnings or errors in the log

vcqi_cleanup
```

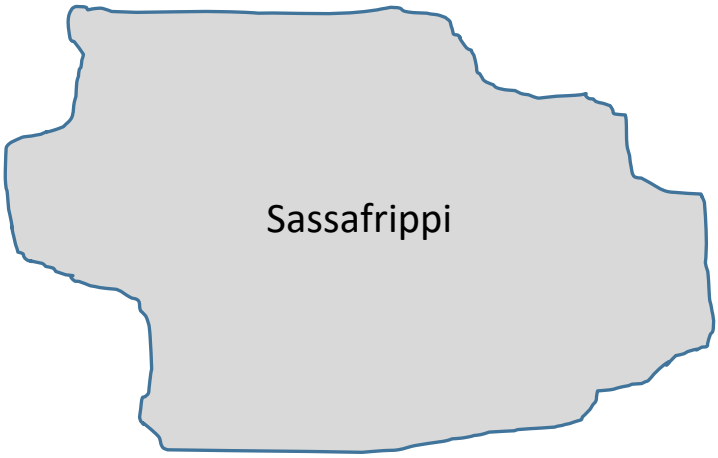
ANNEX A. UNDERSTANDING NESTED STRATA IN VCQI

Table A-1 lists the vocabulary associated with the three nested levels of strata in our example.

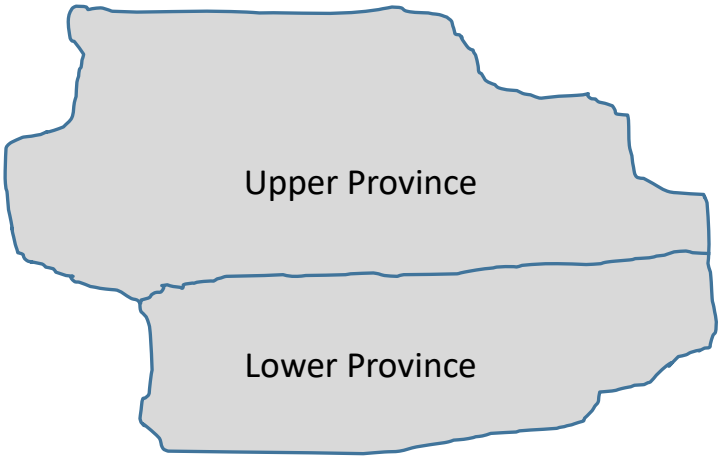
Table A-1. Overview of Three Nested Levels of Administrative Hierarchy

Name	Description	Note 1	Note 2
Level 1	Entire country	There is only one level 1 stratum per VCQI analysis	Calculating results for level 1 makes sense if the level 2 strata are exhaustive (comprise the entire country).
Level 2	Sub-national strata (e.g., provinces)	All level 2 strata are contained within level 1; level 2 strata are mutually exclusive, (meaning that each level 3 stratum is part of only one level 2 stratum) but level 2 strata do not have to be exhaustive (you do not have to do the survey in every province in the nation).	Calculating results for level 2 makes sense if the level 3 strata are exhaustive (comprise the entire level 2 stratum). If you do a survey only of high-risk districts at level 3, then it may not make sense to calculate results at levels 2 or 1.
Level 3	Sub-sub-national (i.e., health districts nested within provinces)	Each level 3 stratum is contained within a level 2 stratum; level 3 strata are mutually exclusive, (each cluster appears in only one level 3 stratum) but they do not have to be exhaustive (you do not need to do a survey in every district in the province).	Level 3 is typically the lowest administrative level at which the survey was conducted. Level 2 is constructed by aggregating data from a set of level 3 strata, and level 1 is constructed, if appropriate, by aggregating all the data from all level 2 strata.
Level 4	Demographic variable that defines sub-groups within Levels 1-3	The user specifies one or more categorical variables to define Level 4 strata. This variable might code the sex of the respondent, or whether they live in an urban or rural cluster	The Level 4 stratification variables are optional; users may decide not to define Level 4 strata by clearing out the global macro VCQI_LEVEL4_SET_VARLIST

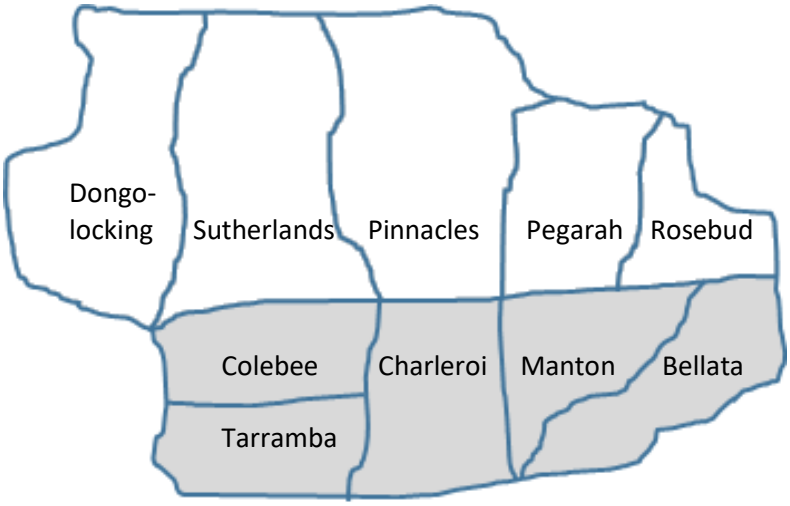
Consider the imaginary nation of Sassafrippi.



It is comprised of two provinces, named Upper Province and Lower Province.



Each province is made up of five health districts.



VCQI is designed to be able to analyze vaccination coverage surveys conducted at any of these three levels of administrative hierarchy. The terminology can be a little confusing because the terms Level 1, Level 2, and Level 3 can refer to different things depending on how the survey was done. Table A1 indicates what level of hierarchy the three terms would refer to under several common survey scenarios.

Note: In every case, Level 3 refers to the lowest level of administrative hierarchy where survey reports will be reported in separate strata. So if the survey is designed to yield district-level results, then Level 3 is the district level. If it is designed to yield provincial results (but not district level) then Level 3 is the provincial level. If it is only a national survey with no sub-national strata, then Level 3 is the national level.

If the Level 3 strata are nested within a higher level, and if the survey is conducted in every Level 3 stratum, then it may make sense to report aggregated results at Level 2 and possibly at Level 1.

Table A-2. Levels 1-3 vary depending on where the survey was conducted

Survey conducted in :	Level 1	Level 2	Level 3
Each health district in each province in the nation	Nation	Province	District
Each province in the nation (alternative #1)		Nation	Province
Each province in the nation (alternative #2)	Nation		Province
A subset of health districts (not all in any province)			District
All health districts in one province		Province	District
National survey only (no sub-national strata)			Nation
Single district survey			District

VCQI also alludes to something called Level 4, which gives users the flexibility to stratify results by demographic sub-groups within each administrative stratum. Common demographic sub-groups might include urban/rural, boy/girl, literate caregiver/illiterate caregiver, wealthy household/poorer household, etc. To calculate results using a demographic stratification variable, first be sure to establish

a variable that codes the demographic sub-groups. This can be accomplished with an integer variable that has a value label, or using a string variable. Once the stratification variable is defined for every respondent, then tell VCQI to use it by including the following line in the control program:

```
vcqi_global VCQI_LEVEL4_SET_VARLIST stratification_variable_name

e.g.,
vcqi_global VCQI_LEVEL4_SET_VARLIST urban_cluster
or
vcqi_global VCQI_LEVEL4_SET_VARLIST gender
or
vcqi_global VCQI_LEVEL4_SET_VARLIST literacy_status
```

If the user specifies a single stratifier then it will appear in VCQI tables and figures. If the user specified more than one stratifier, it will appear in tables, but not in plots. In fact, VCQI does not make inchworm plots or unweighted proportion plots when the user specifies 2+ LEVEL4 stratification variables.

For example, when it is meaningful to have results at national, provincial, and district level, and the user requests sub-group estimates for urban and rural, then VCQI will summarize the following in tables and plots:

1. National results
    a. All respondents combined
    b. Urban respondents only
    c. Rural respondents only
2. Provincial results for each province
    a. All respondents combined
    b. Urban respondents only
    c. Rural respondents only
3. District level results for each district
    a. All respondents combined
    b. Urban respondents only
    c. Rural respondents only

See Annex B for examples of tabulated output calculated at Levels 1-3 plus urban/rural sub-groups.

ANNEX B. CONTROLLING HOW STRATA ARE LISTED IN VCQI OUTPUT

The user has control over the names of strata at all levels. The user has control over which strata will be listed, and in what order, in Excel tables. The user has control over which strata will be listed, but not the listing order for inchworm plots. In inchworm plots, the strata are always sorted by estimated coverage with the lowest levels at the bottom of the figure and higher levels near the top.

Table B-1 lists how stratum names and their order for tabulated output are defined:

Table B-1. Where to specify the names and listing order of various strata

Level	Names	Order	Notes
1	Dataset: level1name	Not applicable	There is NO 's' on the end of the dataset name as there can only be one Level 1 stratum.
2	Dataset: level2names	Dataset: level2order	There is an 's' on the end of the dataset name.
3	Specified in the survey dataset in the variable.	Dataset: level3order	VCQI obtains stratum names from variables like RI02, TT02, or SIA02, which hold the survey stratum name
4	If the user does not specify the name of a VCQI_LEVEL4_SET_LAYOUT dataset then VCQI obtains the LEVEL4 names from value label of the variable that defines the sub-groups or if the variable is a string variable, then the names are the strings themselves. If the user names a VCQI_LEVEL4_SET_LAYOUT dataset, then VCQI takes the LEVEL4 names from that file.	If the user does not specify the name of a VCQI_LEVEL4_SET_LAYOUT dataset then VCQI obtains the LEVEL4 order from the order in which stratifiers are listed in the VCQI_LEVEL4_SET_VARLIST and the order of values of those variables. If the user names a VCQI_LEVEL4_SET_LAYOUT dataset, then VCQI takes the LEVEL4 order from that file.	Examples: urban_cluster, gender If the string variable *gender* took on string values of *Male* and *Female* then the Level 4 names would be *Male* and *Female.* If the variable gender was an integer with a value label where 1 is labeled *Male* and 2 is labeled *Female* then once again, the Level 4 names would be Male and Female.

B.0 Demographic stratification using the VCQI_LEVEL4_SET_VARLIST and LAYOUT

There are two global macros that control demographic stratifiers. The first is VCQI_LEVEL4_SET_VARLIST. This macro must be populated with one or more variable names for VCQI to use demographic stratifiers.

If the user lists a single variable in that macro, then VCQI will include the stratifier in both tables and plots, per the levels that the user request using the SHOW_LEVELS_* macros. This annex shows several examples of how the output varies with different combinations of SHOW_LEVELS_* macros.

If the user lists two or more variables in VCQI_LEVEL4_SET_VARLIST then the demographic stratifiers will be used to make tables, but not to make plots. VCQI will suppress inchworm plots and unweighted proportion plots when the user asks for 2+ demographic strata.

If the demographic stratifiers have clear and succinct variable labels and value labels then it may not be necessary to also define a VCQI_LEVEL4_SET_LAYOUT dataset. When the user does not define such a dataset, VCQI builds one and saves it in the $VCQI_OUTPUT_FOLDER. The file will be named VCQI_LEVEL4_LAYOUT_automatic.dta. This dataset controls the layout of demographic strata in the tables. If the user wants to modify how the strata are listed, they may edit this dataset and rename it and then tell VCQI to use their layout dataset rather than guess what they might want with the _automatic file.

Structure of a LEVEL4 LAYOUT dataset

The LAYOUT dataset holds four variables.

1. order is a numeric variable that takes integer values starting with 1 and increasing by 1. It indicates the order in which the rows should appear in VCQI tables.
2. label is a string variable that holds the label, if any, that should appear in this row in the table
3. rowtype is a string variable that takes three possible values:
    a. LABEL_ONLY means the row contains a label (i.e., Sex)
    b. DATA_ROW means the row contains a condition (i.e., sex == 1)
    c. BLANK_ROW means the user wants tables to include an extra blank row
4. condition is a string variable that holds Stata syntax to identify the demographic sub-group. For urban respondents, the condition might read “urban_cluster == 1” and for rural respondents it might read “urban_cluster == 0”.

So a simple LAYOUT dataset might look like this:

order	label	condition	rowtype
1	Is the cluster urban?		LABEL_ONLY
2	0: Rural	urban_cluster == 0	DATA_ROW
3	1: Urban	urban_cluster == 1	DATA_ROW

And if the user did not want the initial label to appear, then the dataset would look like this:

order	label	condition	rowtype
1	0: Rural	urban_cluster == 0	DATA_ROW
2	1: Urban	urban_cluster == 1	DATA_ROW

And if the user wanted the urban row to appear first and the rural row to appear second, the dataset might look like this:

order	label	condition	rowtype
1	1: Urban	urban_cluster == 1	DATA_ROW
2	0: Rural	urban_cluster == 0	DATA_ROW

If the user specified three demographic stratifiers, like this:

```
vcqi_global VCQI_LEVEL4_SET_VARLIST urban_cluster RI20 RI136
vcqi_global VCQI_LEVEL4_SET_LAYOUT
```

Then VCQI would write a file named VCQI_LEVEL4_LAYOUT_automatic.dta that looks like this:

order	label	condition	rowtype
1	Is the cluster urban?		LABEL_ONLY
2	0: Rural	urban_cluster == 0	DATA_ROW
3	1: Urban	urban_cluster == 1	DATA_ROW
4	Sex		LABEL_ONLY
5	1: Male	RI20 == 1	DATA_ROW
6	2: Female	RI20 == 2	DATA_ROW
7	Did anyone from this household travel for 1+ months of the last 12 months		LABEL_ONLY
8	1: Yes	RI136 == 1	DATA_ROW
9	2: No	RI136 == 2	DATA_ROW

The user might edit the dataset to remove two unnecessary labels and shorten the third label, like this:

order	label	condition	rowtype
1	0: Rural	urban_cluster == 0	DATA_ROW
2	1: Urban	urban_cluster == 1	DATA_ROW
3			BLANK_ROW
4	1: Male	RI20 == 1	DATA_ROW
5	2: Female	RI20 == 2	DATA_ROW
6	Anyone travel for 1+ months?		LABEL_ONLY
7	1: Yes	RI136 == 1	DATA_ROW
8	2: No	RI136 == 2	DATA_ROW

The user could rename the dataset “layout_edited.dta” and re-run VCQI, specifying:

```
vcqi_global VCQI_LEVEL4_SET_VARLIST urban_cluster RI20 RI136
vcqi_global VCQI_LEVEL4_SET_LAYOUT ${VCQI_OUTPUT_FOLDER}/layout_edited
```

And the resulting Excel table would look like this:

1	**BCG Received Before Age 7 Days**		
2			
3		Received BCG Before Age 7 Days (%)	N
4	**Sassafrippi**	**90.1**	**2,153**
5	*0: Rural*	90.2	813
6	*1: Urban*	90.1	1,340
7			
8	*1: Male*	90.7	1,071
9	*2: Female*	89.6	1,082
10	*Anyone travel for 1+ months?*		
11	*1: Yes*	87.4	199
12	*2: No*	90.4	1,954

The ability to edit the layout file gives the user substantial flexibility in specifying which stratifiers will appear in the tables. The conditions in the example above are simple, but the user could specify more complex strata, like this:

order	label	condition	rowtype
1	Rural Males (Families who Travel)	urban_cluster == 0 & RI20 == 1 & RI136 == 1	DATA_ROW
2	Rural Females (Families who Travel)	urban_cluster == 0 & RI20 == 2 & RI136 == 1	DATA_ROW

Which results in a table like this:

	A	B	C
1	**BCG Received Before Age 7 Days**		
2			
3		Received BCG Before Age 7 Days (%)	N
4	**Sassafrippi**	**90.1**	**2,153**
5	*Rural Males (Families who Travel)*	83.9	31
6	*Rural Females (Families who Travel)*	87.2	39

B.1 Sample listings of stratum name and order datasets

The following section shows the datasets listed above for the sample dataset analyzed in this user's guide.

Dataset: level1name

level1id	level1name
1	Sassafrippi

Dataset: level2names

level2id	level2name
1	Lower Province
2	Upper Province

Dataset: level2order

level2id	level2order
1	1
2	2

Values of TT01 and TT02

TT01 (also level3id)	TT02 (also level3name)
1	Pegarah
2	Dongolocking
3	Colebee
4	Manton
5	Bellata
6	Tarramba
7	Rosebud
8	Sutherlands
9	Charleroi
10	Pinnacles

Dataset: level3order

level3id	level3order
1	10
2	9
3	8
4	7
5	6
6	5
7	4
8	3
9	2
10	1

Dataset: level4_layout_rural_urban

order	label	condition	rowtype
2	0: Rural	urban_cluster == 0	DATA_ROW
1	1: Urban	urban_cluster == 1	DATA_ROW

Note: When the user asks to see Level 4 stratified output, either under the national, provincial, or district level results, it will appear with urban first and rural second.

Table B-2 lists the order in which strata appear in inchworm plots.

Table B-2. Stratum sort order for VCQI inchworm plots

Levels included	How Sorted
Only Level 1	Only one row so sorting is not applicable
Only Level 2 or Level 3	Sorted by estimated coverage
Level 2 & 4 or 3 & 4	Sorted by the Level 2 or 3 coverage and then by Level 4 coverage
Levels 1 & 2	Sorted by estimated coverage
Levels 1 & 2 & 3	Sorted by Level 2 coverage and then by Level 3 within Level 2

B.2 Example: Nested output for all Levels: 1, 2, and 3 with additional Level 4 stratification

This common combination of inputs will show output for every level, 1-3, and for each of the Level 4 sub-groups in each. In this example, the Level 4 stratifier is the variable that codes whether the cluster is urban or rural. The following pages show national, provincial, and district level results, each broken out by urban and rural sub-groups.[16]

```
vcqi_global VCQI_LEVEL4_SET_VARLIST urban_cluster
vcqi_global VCQI_LEVEL4_SET_LAYOUT ///
${VCQI_INPUT_FOLDER}/level4_layout_rural_urban

vcqi_global SHOW_LEVEL_1_ALONE         0
vcqi_global SHOW_LEVEL_2_ALONE         0
vcqi_global SHOW_LEVEL_3_ALONE         0
vcqi_global SHOW_LEVELS_2_3_TOGETHER   0

vcqi_global SHOW_LEVELS_1_4_TOGETHER   1
vcqi_global SHOW_LEVELS_2_4_TOGETHER   0
vcqi_global SHOW_LEVELS_3_4_TOGETHER   0
vcqi_global SHOW_LEVELS_2_3_4_TOGETHER 1

vcqi_global SHOW_BLANKS_BETWEEN_LEVELS 1
```

[16] The table shows columns for the main result only that considers evidence from card, history, and health facility records. It omits columns for intermediate variables like protected at birth by card, by history, and by card or history.

Table B-3. Nested output for all Levels: 1-3 with additional Level 4 stratification

Protected at Birth from Neonatal Tetanus

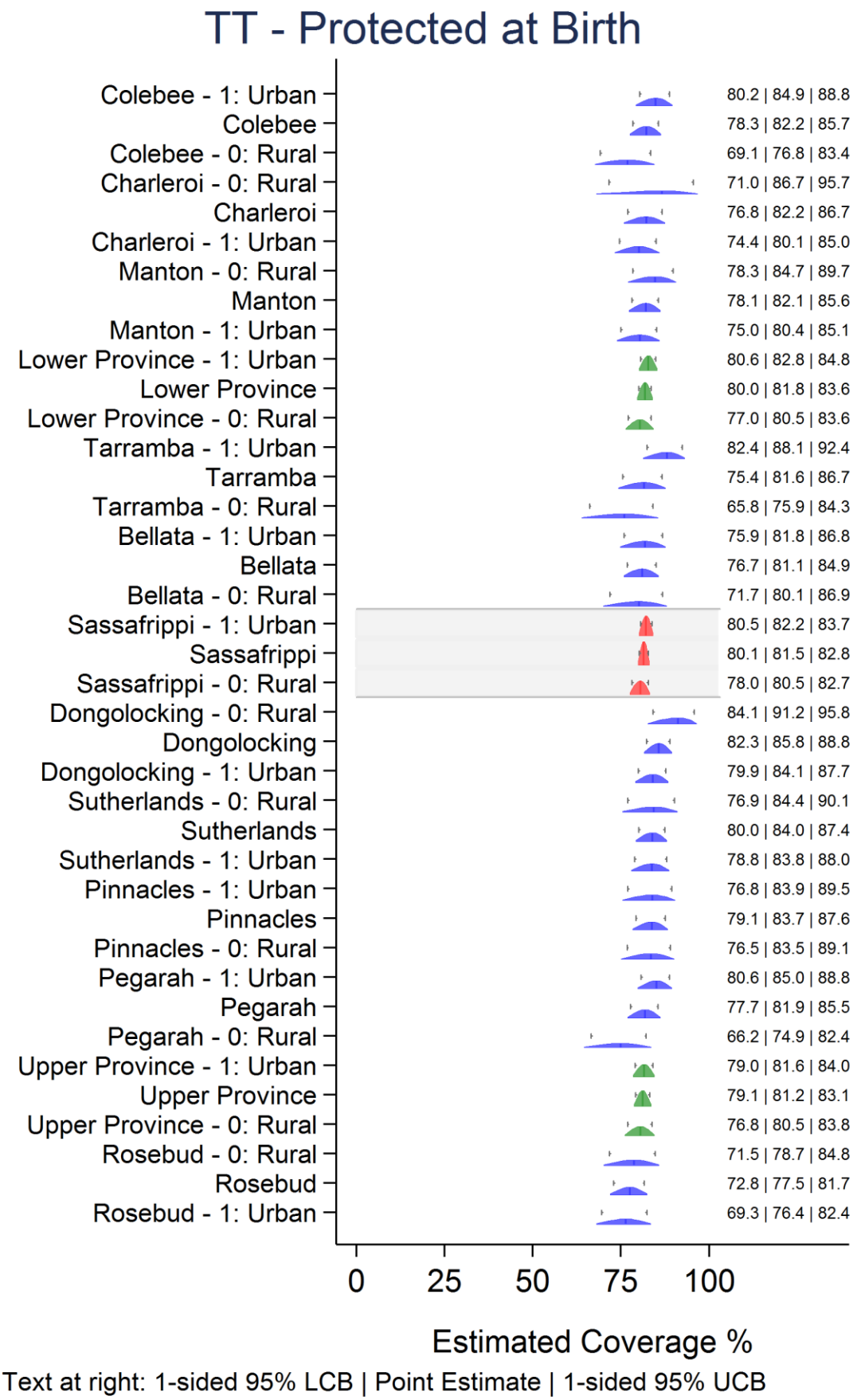
	Protected at birth (%)	95% CI (%)	95% LCB (%)	95% UCB (%)	DEFF	ICC	N	Weighted N
Sassafrippi	**81.5**	**(79.9, 83.0)**	**80.1**	**82.8**	**1.3**	**0.0322**	**3,064**	**6,417,278**
Sassafrippi - 1: Urban	82.2	(80.2, 84.0)	80.5	83.7	1.2	0.0217	1,909	3,891,568
Sassafrippi - 0: Rural	80.5	(77.6, 83.2)	78.0	82.7	1.4	0.0448	1,155	2,525,710
Lower Province	81.8	(79.6, 83.9)	80.0	83.6	1.1	0.0157	1,493	3,044,108
Lower Province - 1: Urban	82.8	(80.2, 85.2)	80.6	84.8	0.9	-0.0146	897	1,798,728
Lower Province - 0: Rural	80.5	(76.3, 84.1)	77.0	83.6	1.4	0.0416	596	1,245,380
Charleroi	82.2	(75.8, 87.5)	76.8	86.7	1.6	0.0628	310	284,985
Charleroi - 1: Urban	80.1	(73.3, 85.8)	74.4	85.0	1.1	0.0114	213	194,745
Charleroi - 0: Rural	86.7	(68.0, 96.6)	71.0	95.7	2.8	0.2054	97	90,240
Tarramba	81.6	(74.3, 87.5)	75.4	86.7	1.8	0.0974	285	611,843
Tarramba - 1: Urban	88.1	(81.3, 93.1)	82.4	92.4	0.6	-0.0547	132	283,421
Tarramba - 0: Rural	75.9	(63.9, 85.5)	65.8	84.3	1.9	0.1017	153	328,422
Bellata	81.1	(75.9, 85.6)	76.7	84.9	0.7	-0.0418	269	530,378
Bellata - 1: Urban	81.8	(74.8, 87.6)	75.9	86.8	0.3	-0.0863	153	304,827
Bellata - 0: Rural	80.1	(70.1, 87.9)	71.7	86.9	1.1	0.0148	116	225,551
Manton	82.1	(77.3, 86.2)	78.1	85.6	0.8	-0.0250	308	1,028,427
Manton - 1: Urban	80.4	(73.9, 85.8)	75.0	85.1	0.7	-0.0307	185	622,187
Manton - 0: Rural	84.7	(77.0, 90.5)	78.3	89.7	0.8	-0.0238	123	406,240
Colebee	82.2	(77.6, 86.2)	78.3	85.7	0.9	-0.0154	321	588,474
Colebee - 1: Urban	84.9	(79.3, 89.5)	80.2	88.8	0.9	-0.0087	214	393,548
Colebee - 0: Rural	76.8	(67.7, 84.4)	69.1	83.4	0.4	-0.0654	107	194,926
Upper Province	81.2	(78.7, 83.5)	79.1	83.1	1.4	0.0448	1,571	3,373,170
Upper Province - 1: Urban	81.6	(78.5, 84.5)	79.0	84.0	1.5	0.0476	1,012	2,092,840
Upper Province - 0: Rural	80.5	(76.1, 84.4)	76.8	83.8	1.4	0.0466	559	1,280,330
Pinnacles	83.7	(78.3, 88.3)	79.1	87.6	1.2	0.0249	301	223,164
Pinnacles - 1: Urban	83.9	(75.4, 90.3)	76.8	89.5	1.4	0.0444	163	122,839
Pinnacles - 0: Rural	83.5	(75.1, 90.0)	76.5	89.1	1.0	0.0037	138	100,325
Sutherlands	84.0	(79.3, 88.0)	80.0	87.4	0.5	-0.0536	292	870,605
Sutherlands - 1: Urban	83.8	(77.9, 88.7)	78.8	88.0	0.6	-0.0446	197	592,716
Sutherlands - 0: Rural	84.4	(75.5, 91.0)	76.9	90.1	0.4	-0.0751	95	277,889
Rosebud	77.5	(72.0, 82.4)	72.8	81.7	1.1	0.0079	305	1,330,046
Rosebud - 1: Urban	76.4	(68.0, 83.4)	69.3	82.4	1.1	0.0083	162	700,511
Rosebud - 0: Rural	78.7	(70.1, 85.8)	71.5	84.8	1.1	0.0061	143	629,534
Dongolocking	85.8	(81.6, 89.3)	82.3	88.8	0.7	-0.0276	337	327,062
Dongolocking - 1: Urban	84.1	(79.1, 88.3)	79.9	87.7	0.6	-0.0347	258	249,928
Dongolocking - 0: Rural	91.2	(82.7, 96.4)	84.1	95.8	0.6	-0.0433	79	77,134
Pegarah	81.9	(76.9, 86.2)	77.7	85.5	1.1	0.0091	336	622,294
Pegarah - 1: Urban	85.0	(79.8, 89.4)	80.6	88.8	0.8	-0.0154	232	426,845
Pegarah - 0: Rural	74.9	(64.5, 83.6)	66.2	82.4	0.9	-0.0093	104	195,448

Abbreviations: CI=Confidence Interval; LCB=Lower Confidence Bound; UCB=Upper Confidence Bound; DEFF=Design Effect; ICC=Intracluster Correlation Coefficient

Note: This measure is a population estimate that incorporates survey weights. The CI, LCB and UCB are calculated with software that take the complex survey design into account.

Note: The figure on the following page shows coverage estimates sorted from bottom to top, by level 2 coverage (Upper Province has the lowest estimated coverage) and within each province the districts are sorted by district level coverage, so all the districts for the Upper Province appear at the bottom of the page, and then national coverage in the center, and then all the districts for the Lower Province appear above. Within each district, or province, or national level, the urban and rural sub-groups are sorted by estimated coverage.

Note: In Colebee, the urban coverage is higher than rural, so it appears at the top. In Charleroi, rural coverage is higher, so it appears above urban.



Text at right: 1-sided 95% LCB | Point Estimate | 1-sided 95% UCB

B.3 Example: Nested output for all Levels: 1, 2, and 3 with NO additional stratification

This combination of inputs will show output for every level, 1-3, with level 3 output nested under level 2, but no additional stratification by sub-group. The following page shows national, provincial, and district level results.[17]

```
vcqi_global VCQI_LEVEL4_SET_VARLIST

vcqi_global SHOW_LEVEL_1_ALONE         1
vcqi_global SHOW_LEVEL_2_ALONE         0
vcqi_global SHOW_LEVEL_3_ALONE         0
vcqi_global SHOW_LEVELS_2_3_TOGETHER   1

vcqi_global SHOW_LEVELS_1_4_TOGETHER   0
vcqi_global SHOW_LEVELS_2_4_TOGETHER   0
vcqi_global SHOW_LEVELS_3_4_TOGETHER   0
vcqi_global SHOW_LEVELS_2_3_4_TOGETHER 0

vcqi_global SHOW_BLANKS_BETWEEN_LEVELS 1
```

[17] The table shows columns for the main result only that considers evidence from card, history, and health facility records. It omits columns for intermediate variables like protected at birth by card, by history, and by card or history.

Table B-4. Nested output for all Levels: 1, 2, and 3 with NO additional stratification

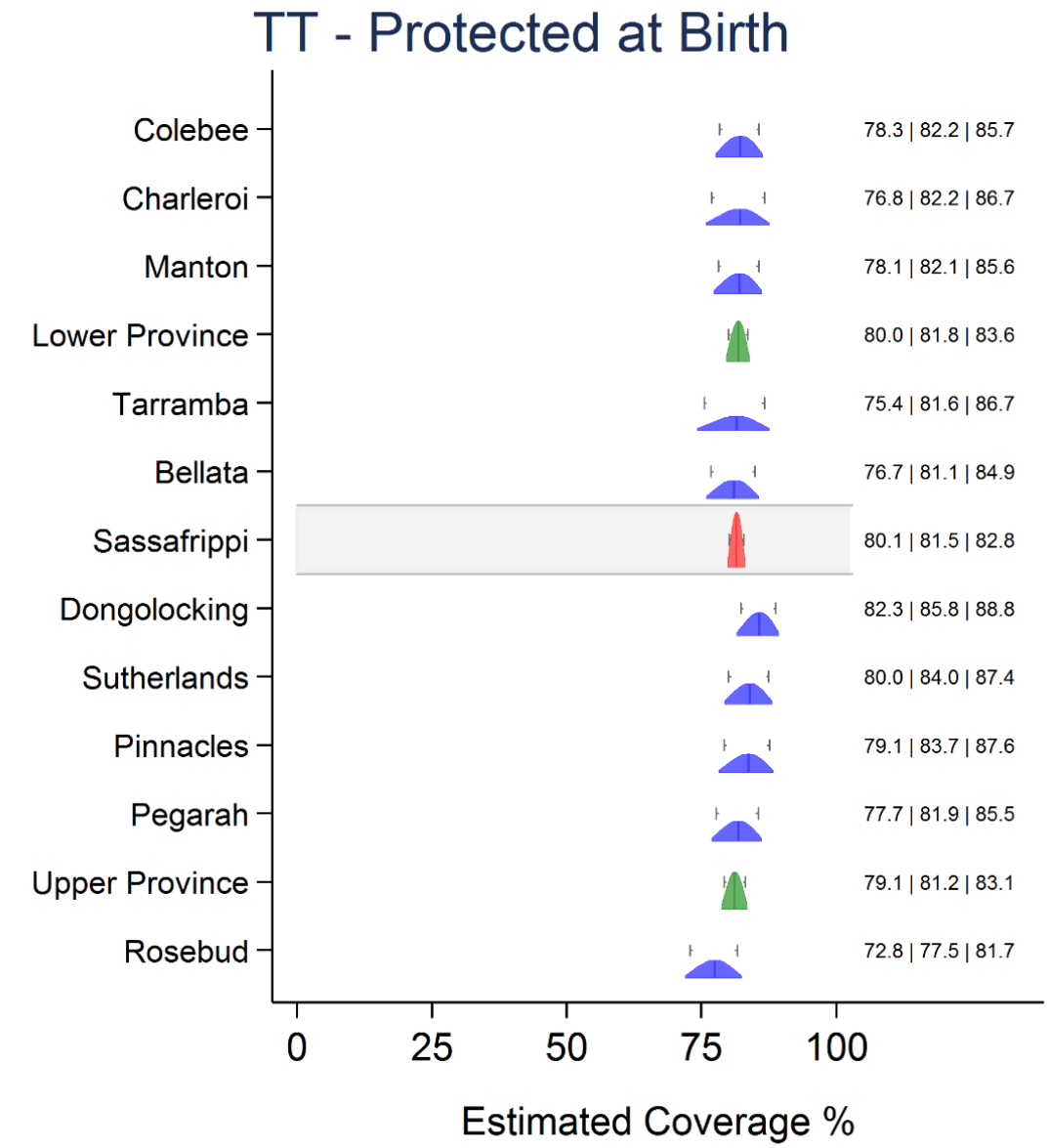
Protected at Birth from Neonatal Tetanus

	Protected at birth (%)	95% CI (%)	95% LCB (%)	95% UCB (%)	DEFF	ICC	N	Weighted N
Sassafrippi	**81.5**	**(79.9, 83.0)**	**80.1**	**82.8**	**1.3**	**0.0322**	**3,064**	**6,417,278**
Lower Province	81.8	(79.6, 83.9)	80.0	83.6	1.1	0.0157	1,493	3,044,108
Charleroi	82.2	(75.8, 87.5)	76.8	86.7	1.6	0.0628	310	284,985
Tarramba	81.6	(74.3, 87.5)	75.4	86.7	1.8	0.0974	285	611,843
Bellata	81.1	(75.9, 85.6)	76.7	84.9	0.7	-0.0418	269	530,378
Manton	82.1	(77.3, 86.2)	78.1	85.6	0.8	-0.0250	308	1,028,427
Colebee	82.2	(77.6, 86.2)	78.3	85.7	0.9	-0.0154	321	588,474
Upper Province	81.2	(78.7, 83.5)	79.1	83.1	1.4	0.0448	1,571	3,373,170
Pinnacles	83.7	(78.3, 88.3)	79.1	87.6	1.2	0.0249	301	223,164
Sutherlands	84.0	(79.3, 88.0)	80.0	87.4	0.5	-0.0536	292	870,605
Rosebud	77.5	(72.0, 82.4)	72.8	81.7	1.1	0.0079	305	1,330,046
Dongolocking	85.8	(81.6, 89.3)	82.3	88.8	0.7	-0.0276	337	327,062
Pegarah	81.9	(76.9, 86.2)	77.7	85.5	1.1	0.0091	336	622,294

Abbreviations: CI=Confidence Interval; LCB=Lower Confidence Bound; UCB=Upper Confidence Bound; DEFF=Design Effect; ICC=Intracluster Correlation Coefficient

Note: This measure is a population estimate that incorporates survey weights. The CI, LCB and UCB are calculated with software that take the complex survey design into account.

Note: The figure below shows coverage estimates sorted from bottom to top, by Level 2 coverage (Upper Province has the lowest estimated coverage) and within each province the districts are sorted by district level coverage, so all the districts for the Upper Province appear at the bottom of the page, and then national coverage in the center, and then all the districts for the Lower Province appear above.



Text at right: 1-sided 95% LCB | Point Estimate | 1-sided 95% UCB

B.4 Example: Non-nested output for all Levels: 1, 2, and 3 with NO additional stratification

This combination of inputs will show output for every level, 1-3, with level 3 output listed underneath level 2, but not nested, and without stratification by sub-group. The following page shows national, provincial, and district level results.[18] The order in which results are listed is controlled by input datasets named level2order, level3order, and level4order.

```
vcqi_global VCQI_LEVEL4_SET_VARLIST

vcqi_global SHOW_LEVEL_1_ALONE         1
vcqi_global SHOW_LEVEL_2_ALONE         1
vcqi_global SHOW_LEVEL_3_ALONE         1
vcqi_global SHOW_LEVELS_2_3_TOGETHER   0

vcqi_global SHOW_LEVELS_1_4_TOGETHER   0
vcqi_global SHOW_LEVELS_2_4_TOGETHER   0
vcqi_global SHOW_LEVELS_3_4_TOGETHER   0
vcqi_global SHOW_LEVELS_2_3_4_TOGETHER 0

vcqi_global SHOW_BLANKS_BETWEEN_LEVELS 1
```

[18] The table shows columns for the main result only that considers evidence from card, history, and health facility records. It omits columns for intermediate variables like protected at birth by card, by history, and by card or history.

Table B-5. Non-nested output for all Levels: 1-3 with NO additional stratification

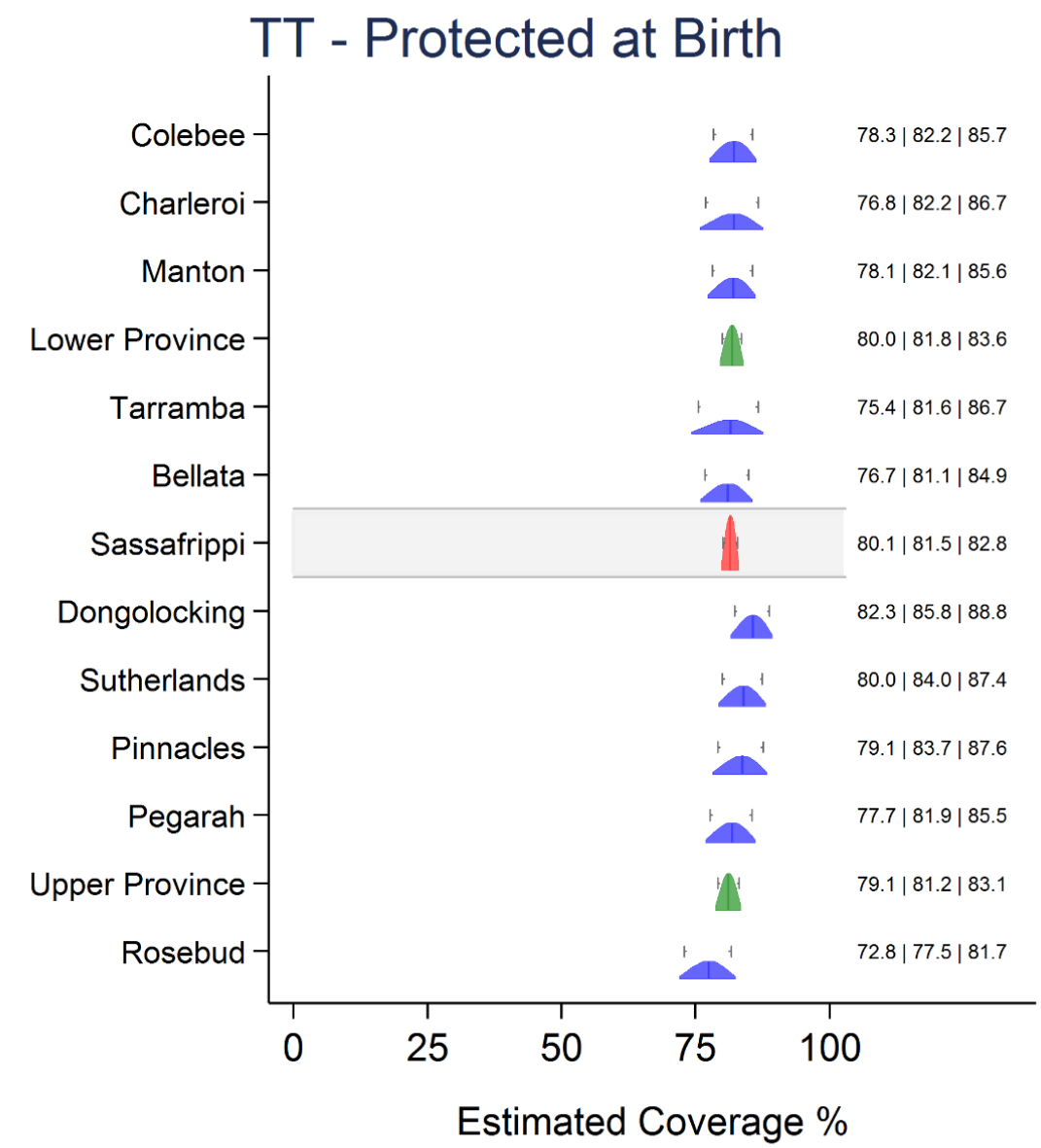
Protected at Birth from Neonatal Tetanus

	Protected at birth (%)	95% CI (%)	95% LCB (%)	95% UCB (%)	DEFF	ICC	N	Weighted N
Sassafrippi	**81.5**	**(79.9, 83.0)**	**80.1**	**82.8**	**1.3**	**0.0322**	**3,064**	**6,417,278**
Lower Province	81.8	(79.6, 83.9)	80.0	83.6	1.1	0.0157	1,493	3,044,108
Upper Province	81.2	(78.7, 83.5)	79.1	83.1	1.4	0.0448	1,571	3,373,170
Pinnacles	83.7	(78.3, 88.3)	79.1	87.6	1.2	0.0249	301	223,164
Charleroi	82.2	(75.8, 87.5)	76.8	86.7	1.6	0.0628	310	284,985
Sutherlands	84.0	(79.3, 88.0)	80.0	87.4	0.5	-0.0536	292	870,605
Rosebud	77.5	(72.0, 82.4)	72.8	81.7	1.1	0.0079	305	1,330,046
Tarramba	81.6	(74.3, 87.5)	75.4	86.7	1.8	0.0974	285	611,843
Bellata	81.1	(75.9, 85.6)	76.7	84.9	0.7	-0.0418	269	530,378
Manton	82.1	(77.3, 86.2)	78.1	85.6	0.8	-0.0250	308	1,028,427
Colebee	82.2	(77.6, 86.2)	78.3	85.7	0.9	-0.0154	321	588,474
Dongolocking	85.8	(81.6, 89.3)	82.3	88.8	0.7	-0.0276	337	327,062
Pegarah	81.9	(76.9, 86.2)	77.7	85.5	1.1	0.0091	336	622,294

Abbreviations: CI=Confidence Interval; LCB=Lower Confidence Bound; UCB=Upper Confidence Bound; DEFF=Design Effect; ICC=Intracluster Correlation Coefficient

Note: This measure is a population estimate that incorporates survey weights. The CI, LCB and UCB are calculated with software that take the complex survey design into account.

Note: The figure on the following page is the same as the figure for the previous table. Inchworm plots show Level 3 districts nested within Level 2, even if the Excel table does not.


TT - Protected at Birth
Colebee
Charleroi
Manton
Lower Province
Tarramba
Bellata
Sassafrippi
Dongolocking
Sutherlands
Pinnacles
Pegarah
Upper Province
Rosebud
78.3 | 82.2 | 85.7
76.8 | 82.2 | 86.7
78.1 | 82.1 | 85.6
80.0 | 81.8 | 83.6
75.4 | 81.6 | 86.7
76.7 | 81.1 | 84.9
80.1 | 81.5 | 82.8
82.3 | 85.8 | 88.8
80.0 | 84.0 | 87.4
79.1 | 83.7 | 87.6
77.7 | 81.9 | 85.5
79.1 | 81.2 | 83.1
72.8 | 77.5 | 81.7
0
25
50
75
100
Estimated Coverage %
Text at right: 1-sided 95% LCB | Point Estimate | 1-sided 95% UCB

B.5 Example: Output for Level 3 only

This combination of inputs will show output only for level 3. This might be appropriate if the survey were conducted only in high risk districts, but not in every district. The following page shows district level results.[19]

```
vcqi_global VCQI_LEVEL4_SET_VARLIST

vcqi_global SHOW_LEVEL_1_ALONE         0
vcqi_global SHOW_LEVEL_2_ALONE         0
vcqi_global SHOW_LEVEL_3_ALONE         1
vcqi_global SHOW_LEVELS_2_3_TOGETHER   0

vcqi_global SHOW_LEVELS_1_4_TOGETHER   0
vcqi_global SHOW_LEVELS_2_4_TOGETHER   0
vcqi_global SHOW_LEVELS_3_4_TOGETHER   0
vcqi_global SHOW_LEVELS_2_3_4_TOGETHER 0

vcqi_global SHOW_BLANKS_BETWEEN_LEVELS 1
```

[19] The table shows columns for the main result only that considers evidence from card, history, and health facility records. It omits columns for intermediate variables like protected at birth by card, by history, and by card or history.

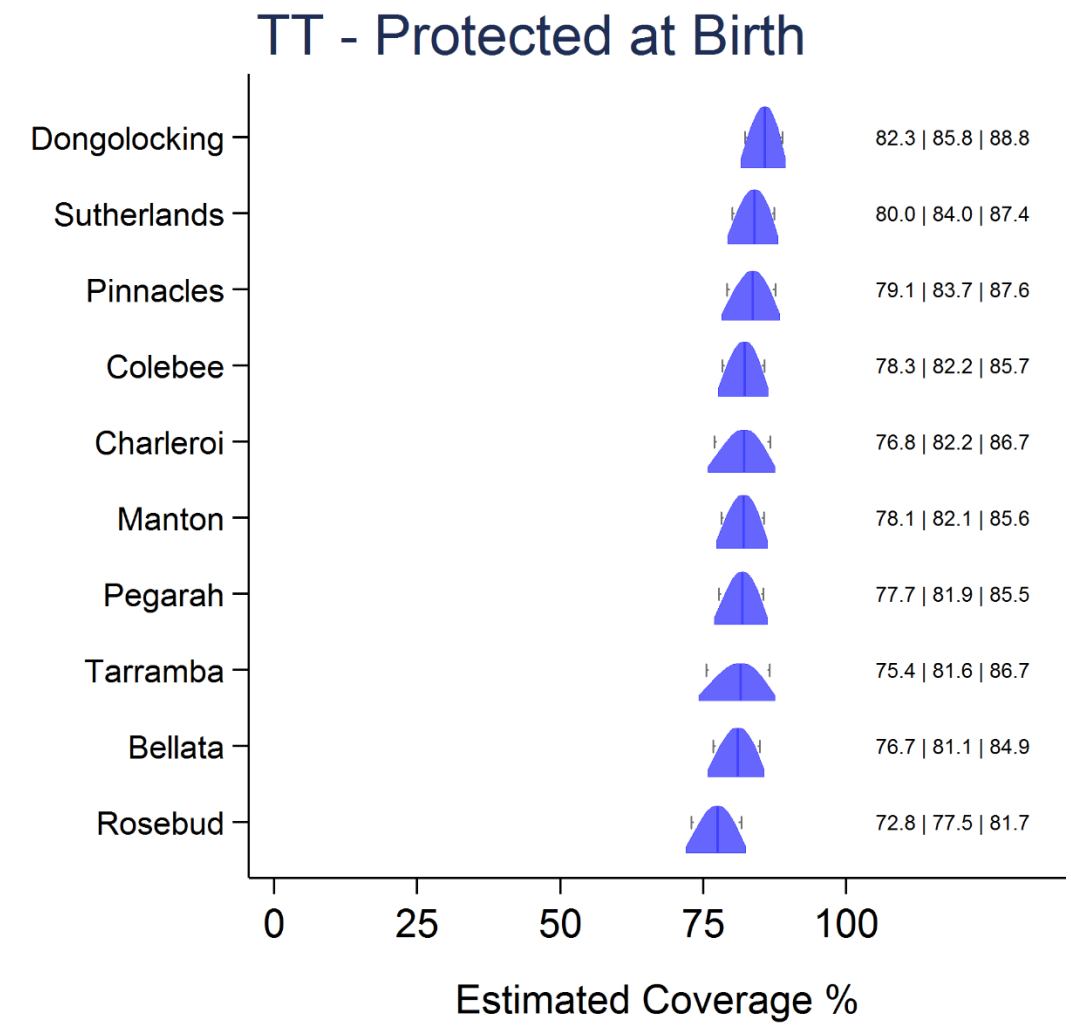
Table B-6. Output for Level 3 only

Protected at Birth from Neonatal Tetanus

	Protected at birth (%)	95% CI (%)	95% LCB (%)	95% UCB (%)	DEFF	ICC	N	Weighted N
Pinnacles	83.7	(78.3, 88.3)	79.1	87.6	1.2	0.0249	301	223,164
Charleroi	82.2	(75.8, 87.5)	76.8	86.7	1.6	0.0628	310	284,985
Sutherlands	84.0	(79.3, 88.0)	80.0	87.4	0.5	-0.0536	292	870,605
Rosebud	77.5	(72.0, 82.4)	72.8	81.7	1.1	0.0079	305	1,330,046
Tarramba	81.6	(74.3, 87.5)	75.4	86.7	1.8	0.0974	285	611,843
Bellata	81.1	(75.9, 85.6)	76.7	84.9	0.7	-0.0418	269	530,378
Manton	82.1	(77.3, 86.2)	78.1	85.6	0.8	-0.0250	308	1,028,427
Colebee	82.2	(77.6, 86.2)	78.3	85.7	0.9	-0.0154	321	588,474
Dongolocking	85.8	(81.6, 89.3)	82.3	88.8	0.7	-0.0276	337	327,062
Pegarah	81.9	(76.9, 86.2)	77.7	85.5	1.1	0.0091	336	622,294

Abbreviations: CI=Confidence Interval; LCB=Lower Confidence Bound; UCB=Upper Confidence Bound; DEFF=Design Effect; ICC=Intracluster Correlation Coefficient
Note: This measure is a population estimate that incorporates survey weights. The CI, LCB and UCB are calculated with software that take the complex survey design into account.

Note: The figure on the following page shows Level 3 strata sorted in order of estimated coverage. Neither the table above nor the figure below make any reference whatsoever to Level 2 strata.



Text at right: 1-sided 95% LCB | Point Estimate | 1-sided 95% UCB

B.6 Example: Output for Level 3 with additional Level 4 stratification

This combination of inputs will show output for level 3 and for the urban and rural sub-groups in each district. Again, omitting Levels 2 and 1 might be appropriate if the survey were conducted only in high risk districts, but not in every district. The following page shows district level results.[20]

```
vcqi_global VCQI_LEVEL4_SET_VARLIST urban_cluster
vcqi_global VCQI_LEVEL4_SET_LAYOUT ///
${VCQI_INPUT_FOLDER}/level4_layout_rural_urban

vcqi_global SHOW_LEVEL_1_ALONE         0
vcqi_global SHOW_LEVEL_2_ALONE         0
vcqi_global SHOW_LEVEL_3_ALONE         0
vcqi_global SHOW_LEVELS_2_3_TOGETHER   0

vcqi_global SHOW_LEVELS_1_4_TOGETHER   0
vcqi_global SHOW_LEVELS_2_4_TOGETHER   0
vcqi_global SHOW_LEVELS_3_4_TOGETHER   1
vcqi_global SHOW_LEVELS_2_3_4_TOGETHER 0

vcqi_global SHOW_BLANKS_BETWEEN_LEVELS 1
```

[20] The table shows columns for the main result only that considers evidence from card, history, and health facility records. It omits columns for intermediate variables like protected at birth by card, by history, and by card or history.

Table B-7. Output for Level 3 with additional Level 4 stratification

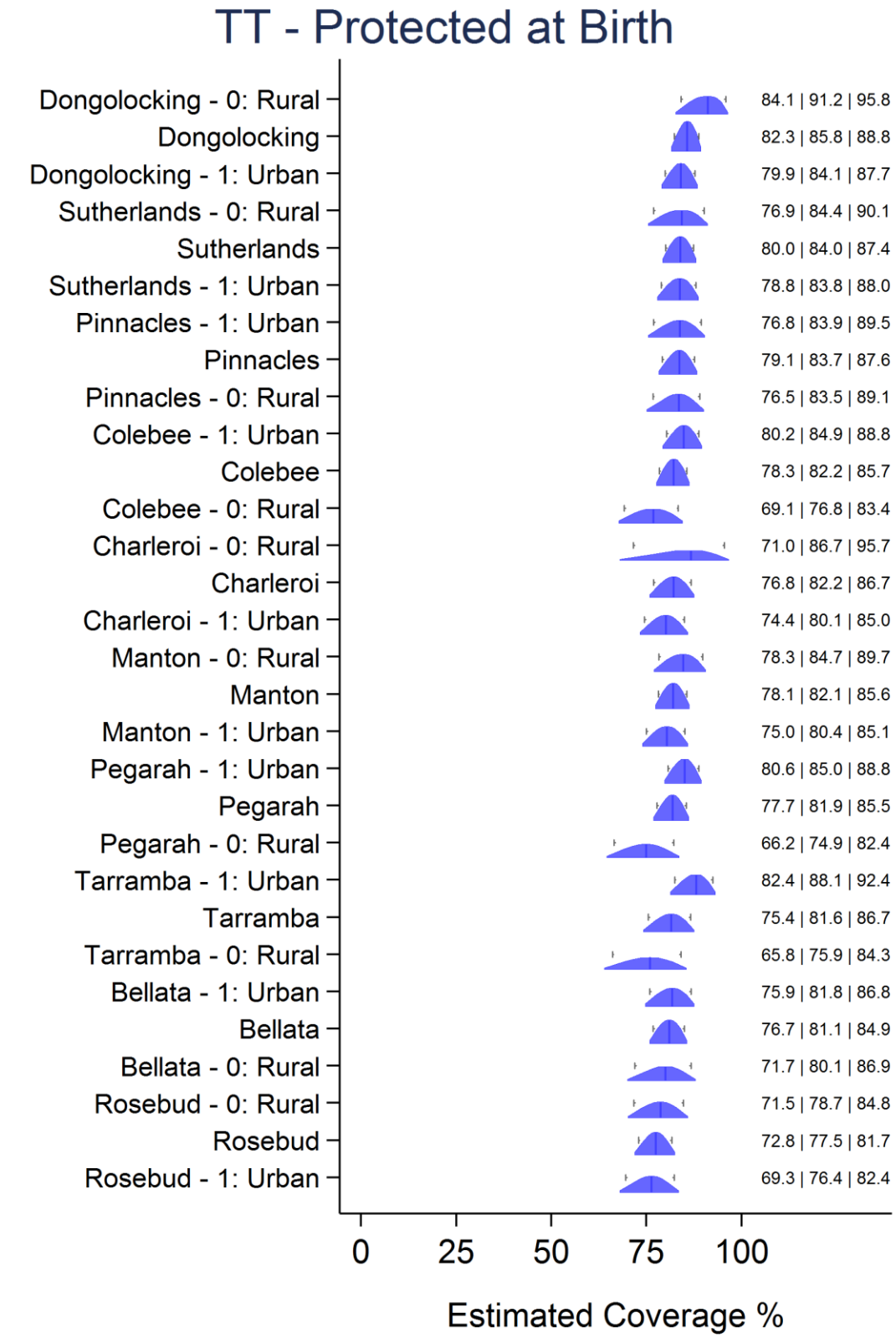
Protected at Birth from Neonatal Tetanus

	Protected at birth (%)	95% CI (%)	95% LCB (%)	95% UCB (%)	DEFF	ICC	N	Weighted N
Pinnacles	83.7	(78.3, 88.3)	79.1	87.6	1.2	0.0249	301	223,164
Pinnacles - 1: Urban	83.9	(75.4, 90.3)	76.8	89.5	1.4	0.0444	163	122,839
Pinnacles - 0: Rural	83.5	(75.1, 90.0)	76.5	89.1	1.0	0.0037	138	100,325
Charleroi	82.2	(75.8, 87.5)	76.8	86.7	1.6	0.0628	310	284,985
Charleroi - 1: Urban	80.1	(73.3, 85.8)	74.4	85.0	1.1	0.0114	213	194,745
Charleroi - 0: Rural	86.7	(68.0, 96.6)	71.0	95.7	2.8	0.2054	97	90,240
Sutherlands	84.0	(79.3, 88.0)	80.0	87.4	0.5	-0.0536	292	870,605
Sutherlands - 1: Urban	83.8	(77.9, 88.7)	78.8	88.0	0.6	-0.0446	197	592,716
Sutherlands - 0: Rural	84.4	(75.5, 91.0)	76.9	90.1	0.4	-0.0751	95	277,889
Rosebud	77.5	(72.0, 82.4)	72.8	81.7	1.1	0.0079	305	1,330,046
Rosebud - 1: Urban	76.4	(68.0, 83.4)	69.3	82.4	1.1	0.0083	162	700,511
Rosebud - 0: Rural	78.7	(70.1, 85.8)	71.5	84.8	1.1	0.0061	143	629,534
Tarramba	81.6	(74.3, 87.5)	75.4	86.7	1.8	0.0974	285	611,843
Tarramba - 1: Urban	88.1	(81.3, 93.1)	82.4	92.4	0.6	-0.0547	132	283,421
Tarramba - 0: Rural	75.9	(63.9, 85.5)	65.8	84.3	1.9	0.1017	153	328,422
Bellata	81.1	(75.9, 85.6)	76.7	84.9	0.7	-0.0418	269	530,378
Bellata - 1: Urban	81.8	(74.8, 87.6)	75.9	86.8	0.3	-0.0863	153	304,827
Bellata - 0: Rural	80.1	(70.1, 87.9)	71.7	86.9	1.1	0.0148	116	225,551
Manton	82.1	(77.3, 86.2)	78.1	85.6	0.8	-0.0250	308	1,028,427
Manton - 1: Urban	80.4	(73.9, 85.8)	75.0	85.1	0.7	-0.0307	185	622,187
Manton - 0: Rural	84.7	(77.0, 90.5)	78.3	89.7	0.8	-0.0238	123	406,240
Colebee	82.2	(77.6, 86.2)	78.3	85.7	0.9	-0.0154	321	588,474
Colebee - 1: Urban	84.9	(79.3, 89.5)	80.2	88.8	0.9	-0.0087	214	393,548
Colebee - 0: Rural	76.8	(67.7, 84.4)	69.1	83.4	0.4	-0.0654	107	194,926
Dongolocking	85.8	(81.6, 89.3)	82.3	88.8	0.7	-0.0276	337	327,062
Dongolocking - 1: Urban	84.1	(79.1, 88.3)	79.9	87.7	0.6	-0.0347	258	249,928
Dongolocking - 0: Rural	91.2	(82.7, 96.4)	84.1	95.8	0.6	-0.0433	79	77,134

Pegarah	81.9	(76.9, 86.2)	77.7	85.5	1.1	0.0091	336	622,294
Pegarah - 1: Urban	85.0	(79.8, 89.4)	80.6	88.8	0.8	-0.0154	232	426,845
Pegarah - 0: Rural	74.9	(64.5, 83.6)	66.2	82.4	0.9	-0.0093	104	195,448

Abbreviations: CI=Confidence Interval; LCB=Lower Confidence Bound; UCB=Upper Confidence Bound; DEFF=Design Effect; ICC=Intracluster Correlation Coefficient
Note: This measure is a population estimate that incorporates survey weights. The CI, LCB and UCB are calculated with software that take the complex survey design into account.

Note: The figure on the following page shows Level 3 strata sorted in order of estimated coverage. Within each Level 3 stratum, the Level 4 urban and rural sub-groups are sorted by estimated coverage. Neither the table above nor the figure below make any reference to Level 2 strata.



Text at right: 1-sided 95% LCB | Point Estimate | 1-sided 95% UCB

B.7 Additional Options for Customizing VCQI Output

If you have questions about how to order results, try changing the different SHOW_LEVEL settings. If the options are not to your liking, then you have the option of writing a program to access the results in the database files and construct customized tables of your own. Watch for a forthcoming tutorial on how to do this.

Similarly, you may wish to construct inchworm plots that use a different order or different set of colors than the VCQI default. (For instance, you may wish to always list the strata in the same order, regardless of estimated coverage.) In that case you might wish to copy and modify the program vcqi_to_iwplot.ado (located in VCQI's folder of PLOT programs) and introduce a different system for sorting the rows of the plots. Watch for a forthcoming tutorial on how to do this, also.