

Getting Started with



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Expanded
Programme on
Immunization

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This manual was written by Dale Rhoda in 2021 with helpful testing and feedback from Shiraz Johnson.

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INTRODUCTION

The Vaccination Coverage Quality Indicators (VCQI¹) software is a set of programs written in Stata to make standard output tables and figures using vaccination coverage survey datasets. The VCQI programs are freely available, courtesy of the World Health Organization. Annex A of this manual describes where to find VCQI programs, documentation, demo files, and supporting materials. You must have a licensed copy of Stata software (version 14.1 or later) to run VCQI.

This document is meant to help you install the software on your computer and run it for the first time. The guide assumes that you have basic knowledge of how to use Stata.

VCQI is organized around three types of surveys:

1. Routine Immunization, abbreviated RI in VCQI documentation
2. Tetanus protection at birth surveys, abbreviated TT, and typically administered to women who had a live birth in the past 12 months
3. Post-campaign coverage surveys – typically administered directly following a vaccination campaign or supplemental immunization activity – abbreviated SIA in VCQI documentation

Running VCQI

The usual practice is to copy a VCQI control program (a Stata .do file) from the examples provided to a new empty folder on your computer, edit it (to provide the appropriate file locations and analysis parameters), 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 the new folder where the control program is saved; change some analysis options, save the control program, and run it.

VCQI performs a series of checks to be sure the user has defined the necessary inputs and that the input datasets and necessary variables are all present. 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, 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.

If you experience problems running VCQI, post a message on the VCQI User’s Group (See Annex A for details.) or contact Dale.Rhoda@biostatglobal.com.

¹ Pronounced “Vicki”

The Indicators

Several types of analyses are included with VCQI; they are described 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

Or by the types of figures that they make:

- CCC: Make *cumulative coverage curves* to summarize vaccination timeliness
- CIC: Make *cumulative interval curves* to summarize vaccination timeliness
- VCTC: Vaccination coverage and timeliness charts

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 are added over time.

Goals of this Manual

VCQI is flexible and all its various options can be overwhelming to a new user, so this document has modest and achievable goals:

1. Download the VCQI programs
2. Download some demo datasets
3. Download a demo control program
4. Edit the control program to point to paths on your computer
5. Run VCQI for the first time
6. Look at output
7. Customize the control program & run it again

For more advanced work, such as learning to make your dataset compatible with VCQI or running an analysis with a more ambitious set of changes to options and indicators, see the section of this manual titled Next Steps and then we refer you to the other more comprehensive documents described in Annex A.

GOAL 1. DOWNLOAD THE VCQI PROGRAMS

VCQI source code and supporting materials are freely available at the VCQI resources website² and the VCQI Public GitHub website³.

- ✓ Download the latest version of VCQI from one of those two sites.
- ✓ If your download is a .zip file, unzip the folders on your computer.
- ✓ Make a note of where you save them; you will tell VCQI the path to that folder in a later step.

The VCQI programs and documentation are stored in a set of subfolders named CONTROL, DESC, Documentation, DIFF, LIBRARY, PLOT, RI, SIA, TT.

To run the demo procedures in this guide, you will probably not need to interact with any of those folders; VCQI will automatically call the programs that it needs from each folder. But when your skills progress, you will access files in two of those nine folders:

1. There are helpful files in the **Documentation** folder. You will need to look at those to do advanced analyses.
2. When you progress beyond the demonstrations in this document and analyze data from a new VCQI project, you will copy control program templates from the **CONTROL** folder.

But there is no need to worry about any of the files yet. Simply download them and make a note to remember where you have saved them.

Write the name of the path to your VCQI programs here. Inside this folder you have nine sub-folders holding VCQI files.

Path to folder where I saved VCQI programs:

e.g., On a Windows PC, the path might be:

C:/Users/Dale/VCQI Work/VCQI Programs/Downloaded 2021-01-26

² http://www.biostatglobal.com/VCQI_RESOURCES.html

³ <https://github.com/BiostatGlobalConsulting/vcqi-stata-public>

GOAL 2. DOWNLOAD DEMO DATASETS

The VCQI resources website⁴ has several sets of files for VCQI demonstration purposes. The datasets for fictional District 20 are simple surveys with a single stratum each. The datasets for the fictional country of Harmonia are larger, with ten strata nested within two provinces, nested within the country. Both District 20 and Harmonia have demo datasets for an RI survey, an SIA survey, and a TT survey. Start by downloading the and unzipping the file with District 20 RI files. Again, make a note to remember where you saved the files.

Path to folder where I saved the District 20 demo data files:

e.g., C:/Users/Dale/VCQI Work/VCQI Demo Data/District 20 RI Data Files

⁴ http://www.biostatglobal.com/VCQI_RESOURCES.html

GOAL 3. DOWNLOAD A DEMO CONTROL PROGRAM

Each set of demo datasets is accompanied by one or more demo control programs. Download the zip file holding “District 20 - RI Control Program - Demo 01.do”. Make a new empty folder on your computer and unzip the files into that folder⁵.

Path to folder where I saved the control program.

e.g., C:/Users/Dale/VCQI Work/VCQI Demo Output/District 20 RI Run 01

Note: On the pages that follow, some lines in this document represent lines of Stata source code in a VCQI control program. Those are formatted using the Courier New font and use a light gray background, like this:

```
* This is a line of Stata code in the VCQI control program
```

⁵ There will be two zipped files: a control program and a program named “globals_for_timeliness_plots.do”.

GOAL 4. EDIT THE CONTROL PROGRAM TO USE YOUR FILE PATHS

Navigate to the folder whose path you wrote down in Goal 3. Open the “District 20 - RI Control Program - Demo 01.do” file in the Stata do-file editor.

Take a moment to scroll up and down. The control program is several hundred lines long. Don’t worry: you will only need to modify three lines of code. Notice that the program is divided into sections named Blocks. Each alternating block begins with some comments that tells you whether the user is allowed to change the code in that section or not. The user may change code in Blocks B, D, and F. You should not change code in Blocks A, C, E, or G.

Scroll to Block B and make these changes:

1. Find the line of code (around line 36) that says:

```
global S_VCQI_SOURCE_CODE_FOLDER <your path here>
```

Replace the string <your path there> with the full path that you wrote down under Goal 1: the path to your VCQI source folder. This will be the folder that holds the nine sub-folders of VCQI programs and documentation. On my computer it says:

```
global S_VCQI_SOURCE_CODE_FOLDER ///  
C:/Users/Dale/VCQI Work/VCQI Programs/Downloaded 2021-01-26
```

[Note that the three forward slashes (///) tell Stata that this line of code is continued on the next line of the program.]

2. Scroll down farther (around line 62); find the lines of code that say:

```
* Where should the programs look for datasets?  
global VCQI_DATA_FOLDER <your path here>
```

Replace the string <your path here> with the full path you wrote under Goal 2: the path to the VCQI datasets. On my computer this would say:

```
global VCQI_DATA_FOLDER ///  
C:/Users/Dale/VCQI Work/VCQI Demo Data/District 20 RI Data Files
```

3. Scroll down farther (around line 64); find the lines of code that say:

```
* Where should the programs put output?  
global VCQI_OUTPUT_FOLDER <your path here>
```

Replace the string <your path here> with the full path you wrote under Goal 3: the path to the folder where you saved the control program. On My computer, this would say:

```
global VCQI_OUTPUT_FOLDER ///  
C:/Users/Dale/VCQI Work/VCQI Demo Output/District 20 RI Run 01
```

4. Save the modified program.

GOAL 5. RUN VCQI FOR THE FIRST TIME

Run the control program that you just edited. If you see a red error message in Stata's log window, you probably made a typographical error. Check your three file paths and be sure you typed them correctly. If you put the paths on the line below the global statement, be sure you used three forward slashes with no spaces between them (///) to indicate that the line of code continues onto the next line. If you still receive a red error message, e-mail Dale.Rhoda@biostatglobal.com for some help.

If you have followed the directions above, VCQI should run successfully. The entire run will take several minutes and the Stata log window will update with messages to announce VCQI progress. When the program finishes, it will show a VCQI billboard like this:

```
=====
                   VACCINATION COVERAGE QUALITY INDICATORS
=====
_/\\_/_/_/\\_/_/_/\\/_/_/_/\\/_/_/_/\\/_/_/_/\\/_/_/_/\\/_/_/_/\\_
_\\/_/_/_/\\/_/_/_/\\/_/_/_/\\/_/_/_/\\/_/_/_/\\/_/_/_/\\/_/_/_/\\_
_\\/_/_/_/\\/_/_/_/\\/_/_/_/\\/_/_/_/\\/_/_/_/\\/_/_/_/\\/_/_/_/\\_
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_\\/_/_/_/\\/_/_/_/\\/_/_/_/\\/_/_/_/\\/_/_/_/\\/_/_/_/\\/_/_/_/\\_
_\\/_/_/_/\\/_/_/_/\\/_/_/_/\\/_/_/_/\\/_/_/_/\\/_/_/_/\\/_/_/_/\\_
_\\/_/_/_/\\/_/_/_/\\/_/_/_/\\/_/_/_/\\/_/_/_/\\/_/_/_/\\/_/_/_/\\_
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=====
                   (C) WORLD HEALTH ORGANIZATION
=====
```

Congratulations! You have successfully run VCQI!

Take a moment to join the VCQI User's Group on the TechNet-21 website. (See Annex A to learn how to join.) Post a message there introducing yourself and letting others know that you have conducted your first successful run.

GOAL 6. LOOK AT OUTPUT

Look in the folder that you wrote down in Goal 3: the VCQI output folder. You will see not only the control program .do file that you edited and ran, but also a set of output files and folders.

To learn how to interpret the VCQI tabular and graphical output, open the document named the *VCQI Results Interpretation Quick-Reference Guide*. You will either find this in the Documentation sub-folder in the folder you wrote down under Goal 1 or you may download the latest version from the VCQI Resources website⁶.

To explore the graphic output, navigate into one of the folders with the word *Plots_* in its name and double-click on the files with .png extension.

Spend a few minutes looking at output in:

1. The folder that holds the vaccination coverage and timeliness chart: *Plots_VCTC*. Double-click on the file(s) with extension .png.
2. The folder that holds organ pipe plots: *Plots_OP*.
3. The folder that holds inchworm and unweighted proportion plots: *Plots_IW_UW*. Double click on the files with .png extensions.
4. The folder that holds cumulative coverage curves: *Plots_CCC*.
5. The folder that holds cumulative interval curves: *Plots_CIC*.

To explore VCQI's tabular output, double-click on:

6. The spreadsheet that holds tabular output from VCQI indicators: *District_20_RI_TO.xlsx*
7. The spreadsheet that holds the date data quality report: *District_20_RI_dates_ticks.xlsx*.

Make a list of questions that the output raises in your mind. Try to answer them using the Results Interpretation Guide. If some questions persist, post them on the VCQI User's Group on TechNet-21.

⁶ http://www.biostatglobal.com/VCQI_RESOURCES.html

GOAL 7. CUSTOMIZE THE CONTROL PROGRAM & RUN IT AGAIN.

Now that you have successfully run VCQI, spend some time reading through the VCQI Users' Guide and select one or more user inputs to modify in Block D or Block F. Do not edit the control program that you already ran. Instead generate a new empty output folder and copy the control program from the output folder you wrote in Goal 3 to the new folder. Write the name of that folder here:

Path to new empty output folder where I copied the control program.

e.g., C:/Users/Dale/VCQI Work/VCQI Demo Output/District 20 RI Run 02

(Note: **Text shaded yellow** in this description of Goal 7 represents characters that differ from those used in Run 01.)

Open the file you just copied into the new folder and make some changes there. As an illustrative example, let's say that we wish to view outcomes stratified by the sex of the child.

1. First, change the path to the output folder in Block B. Change the name of the folder:

```
global VCQI_OUTPUT_FOLDER ///
      C:/Users/Dale/VCQI Work/VCQI Demo Output/District 20 RI Run 02
```

2. Scroll down to around line #224 and find the line that says:

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

3. Edit that second line so it says:

```
vcqi_global VCQI_LEVEL4_SET_VARLIST RI20
```

4. Scroll down a bit farther to the block of code that says:

```
vcqi_global SHOW_LEVEL_1_ALONE      0
vcqi_global SHOW_LEVEL_2_ALONE      0
vcqi_global SHOW_LEVEL_3_ALONE      1
vcqi_global SHOW_LEVEL_4_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 0
vcqi_global SHOW_LEVELS_2_3_4_TOGETHER 0
```

Modify the list of 0's and 1's to look like this:

```
vcqi_global SHOW_LEVEL_1_ALONE      0
vcqi_global SHOW_LEVEL_2_ALONE      0
vcqi_global SHOW_LEVEL_3_ALONE      0
vcqi_global SHOW_LEVEL_4_ALONE      0
```

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```
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
```

We turn off the option to show level 3 alone and turn on the option to show output from levels 3 and 4 together. In other words, rather than simply show output from the survey stratum District 20, which is defined as VCQI level 3 stratum, we want to show output from District 20 and also show outcomes for demographic sub-strata defined by the child sex variable (level 4). Read Annex A and B of the VCQI User's Guide for more information on levels of strata and how to ask for output for the levels that interest you.

5. Save the updated control program. Re-run it and look at the output again. All the tables will list outcomes for all respondents and list additional rows to show outcomes for boys and for girls. Many (but not all) of the figures will also show stratified output.

Congratulations! You have just modified a VCQI control program and re-run.

You may repeat Goal 7 many many times, experimenting with different sets of inputs in Blocks D and F.

Remember that for each new run, it is a best practice to make a new empty output folder, copy the control program there, edit it to point the VCQI_OUTPUT_FOLDER in Block B to the new folder, and then make other changes in Blocks B or D or F.

A list of possible changes you might like to explore in addition to adding the demographic stratifier, RI20:

- a) Ask VCQI to generate bar graphs instead of inchworm plots. Change the Block D line that reads:

```
vcqi_global IWPLOTT_SHOWBARS 0
```

to read:

```
vcqi_global IWPLOTT_SHOWBARS 1
```
- b) Turn off organ pipe plots. Change the Block D line that reads:

```
vcqi_global VCQI_MAKE_OP_PLOTS 1
```

to read:

```
vcqi_global VCQI_MAKE_OP_PLOTS 0
```
- c) Change the number of digits after the decimal place from 1 to 0. Change the Block D line that reads:

```
vcqi_global VCQI_NUM_DECIMAL_DIGITS 1
```

to read:

```
vcqi_global VCQI_NUM_DECIMAL_DIGITS 0
```


NEXT STEPS

1. To build more familiarity and skills with the VCQI control program, download a dataset from Harmonia, where there are ten survey strata. This will yield longer tables and figures. Work through Annex B of the User's Guide to master producing output for the strata that interest you, in the order that you wish to see them. Alternate between showing strata in the figures sorted by outcomes :

```
vcqi_global PLOT_OUTCOMES_IN_TABLE_ORDER 0
```

to listing the strata in the same order as they appear in the tables:

```
vcqi_global PLOT_OUTCOMES_IN_TABLE_ORDER 1
```

2. Also, the Harmonia dataset includes many more doses than District 20, so you can experiment with calculating dropout between additional dose pairs by changing the Block F line:

```
vcqi_global RI_CONT_01_DROPOUT_LIST PENTA1 PENTA3 OPV1 OPV3 PENTA3 MCV1
```

to read:

```
vcqi_global RI_CONT_01_DROPOUT_LIST ///
PENTA1 PENTA3 OPV1 OPV3 PCV1 PCV3 ROTA1 ROTA3 BCG MCV1
```

3. Next, download data and control programs for an SIA or TT dataset from District 20 or Harmonia. Consult the *VCQI User's Guide* to learn more about the indicators available for those types of surveys.
4. Next, learn to summarize stratification variables and responses to multiple-choice questions using the indicators named DESC_02 and DESC_03. See the *VCQI User's Guide* and the Harmonia demo control programs for examples and guidance.
5. Next, learn to make datasets compatible with VCQI by studying the *Forms and Variable List* document and by using Stata to explore the datasets from District 20 and Harmonia.

Write your notes & questions on the final page of this document and then post them (along with announcements of your successes) in the *Discussion* portion of the VCQI User's Group.

ANNEX A. OTHER VCQI RESOURCES

Five documents describe VCQI:

1. This *Getting Started with VCQI* guide
2. The *VCQI User's Guide* is a 200+ page reference manual that helps you understand how to modify a VCQI control program template to achieve your analysis goals.
3. The *VCQI Results Interpretation Quick-Reference Guide* tells the reader how to interpret output in VCQI's tables and figures. It also describes the RI data quality report.
4. The document named *Vaccination Coverage Surveys – Forms & Variable Lists (FVL) Structured for Compatibility with VCQI* specifies variable names and attributes of coverage survey datasets that are compatible with VCQI.
5. And finally, the *VCQI Working List of Vaccination Survey Analyses and Software Specifications* lists coverage indicators and describes how software can calculate them.

You may download the latest versions of VCQI software, documentation, and demo datasets at the VCQI resources website⁷.

You may also join a VCQI User's Group hosted on the TechNet-21 website⁸. The User's Group is useful for its discussion and announcement features.

You are welcome to contact the VCQI developers with any questions. E-mail Dale Rhoda at Biostat Global Consulting (Dale.Rhoda@biostatglobal.com) or Carolina Danovaro at the World Health Organization (danovaroc@who.int).

⁷ http://www.biostatglobal.com/VCQI_RESOURCES.html

⁸ <https://www.technet-21.org/en/network/groups/293-vcqi>

Notes & Questions

