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# CRVS technical guide

## SmartVA: Technical User's Manual (V1.0)

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March 2019





## Resources available from the University of Melbourne, Bloomberg Philanthropies Data for Health Initiative

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These resources outline the context, training approach, course content and course objectives for the suite of CRVS trainings delivered through the Bloomberg Philanthropies Data for Health Initiative. Each course focuses on a specific CRVS intervention or concept, and is designed to support countries to strengthen their CRVS systems and data.

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Melbourne School of Population and Global Health  
Building 379  
207 Bouverie Street  
Carlton, VIC 3053  
Australia

CRVS-info@unimelb.edu.au  
[www.mspgh.unimelb.edu.au/dataforhealth](http://www.mspgh.unimelb.edu.au/dataforhealth)

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## Acronyms and abbreviations

COD	cause of death
CRVS	civil registration and vital statistics
CSMF	cause-specific mortality fraction
CSV	comma-separated values
HCE	health care experience
IHME	Institute of Health Metrics and Evaluation
ODK	Open Data Kit
PHMRC	Population Health Metrics Research Consortium
VA	verbal autopsy
XML	extensible markup language

## Purpose of this user guide

The purpose of this technical user guide is to provide guidelines for the collection of verbal autopsy (VA) data using an electronic, shortened VA questionnaire; the use of tablets and the Open Data Kit (ODK) for data management; and for the ascertainment of cause of death (COD) using SmartVA-Analyze (Tariff 2.0).

This step-by-step guide describes how to:

1. install ODK Collect, the VA questionnaire and media files onto a tablet
2. operate the tablets for data collection, editing and saving (data management)
3. convert XML (extensible markup language) data into CSV (comma-separated values) data
4. generate COD using SmartVA-Analyze
5. troubleshoot common problems with tablets.

This manual can be used in conjunction with the *SmartVA: Interviewer's manual*, which covers the roles and responsibilities of VA interviewers and supervisors, ethics and sensitivities of the interview and guidance around the questions included in the SmartVA questionnaire (also known as the PHMRC [Population Health Metrics Research Consortium] shortened questionnaire). Both manuals can be used as resources for trainers and implementers of SmartVA. This *SmartVA: Technical user guide* is orientated towards personnel responsible for the management of the IT around VA data collection and the processing of the data to assign COD.

**The information contained in this manual provides generic information to technical support personnel for the implementation of automated VA methods. It has been developed for implementation as part of a broader package of resources and tools. As such, countries are strongly recommended to adapt the manual to meet their local needs and context.**

**In addition, software, devices and documents described in this manual are subject to updates. Technical personnel responsible for the IT around verbal autopsy implementation should visit the websites noted in this manual for the most up to date information, in particular [www.opendatakit.org](http://www.opendatakit.org) and <http://www.healthdata.org/verbal-autopsy/tools>**

## 1. Summary

VA is a method for collecting information about an individual's signs and symptoms prior to death, and interpreting this to diagnose the likely or most probable COD. VA is increasingly recognised as the only practical alternative to medical certification of deaths in many countries that are working to improve their civil registration system. VA is considered as the only practical option to increase the availability of COD data. VA can be used as:

- a research tool in longitudinal demographic and epidemiological studies to determine the COD of each individual being studied
- a source of routine COD statistics for populations with sub-optimal vital registration systems
- for monitoring the process of disease control and evaluating quality of routine COD statistics.

SmartVA is a VA tool consisting of an electronic VA data collection questionnaire and a desktop application that runs an automatic diagnostic method, the Tariff method, for analysis of VAs. The SmartVA-Analyze desktop application uses VA interview data collected electronically using the SmartVA Questionnaire (or PHMRC shortened questionnaire) on the ODK Collect system running on Android devices as input, and produces COD estimates at the individual and population levels. The Institute of Health Metrics and Evaluation (IHME) Tariff 2.0 assignment method was designed and validated against the PHMRC Gold Standard VA database that was collected as part of the PHMRC Gold Standard VA Validation Study.<sup>1</sup> We use SmartVA to refer to the whole package, including the PHMRC shortened questionnaire (or SmartVA Questionnaire), the ODK suite for data collection, and SmartVA-Analyze for computer certification of VAs.

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<sup>1</sup> Murray C, Lopez A, Black R, Ahuja R, Ali S, Barqui A et.al. Population Health Metrics Research Consortium gold standard verbal autopsy validation study: design, implementation, and development of analysis datasets. *Population Health Metrics*, 2011; volume 9, p. 27.

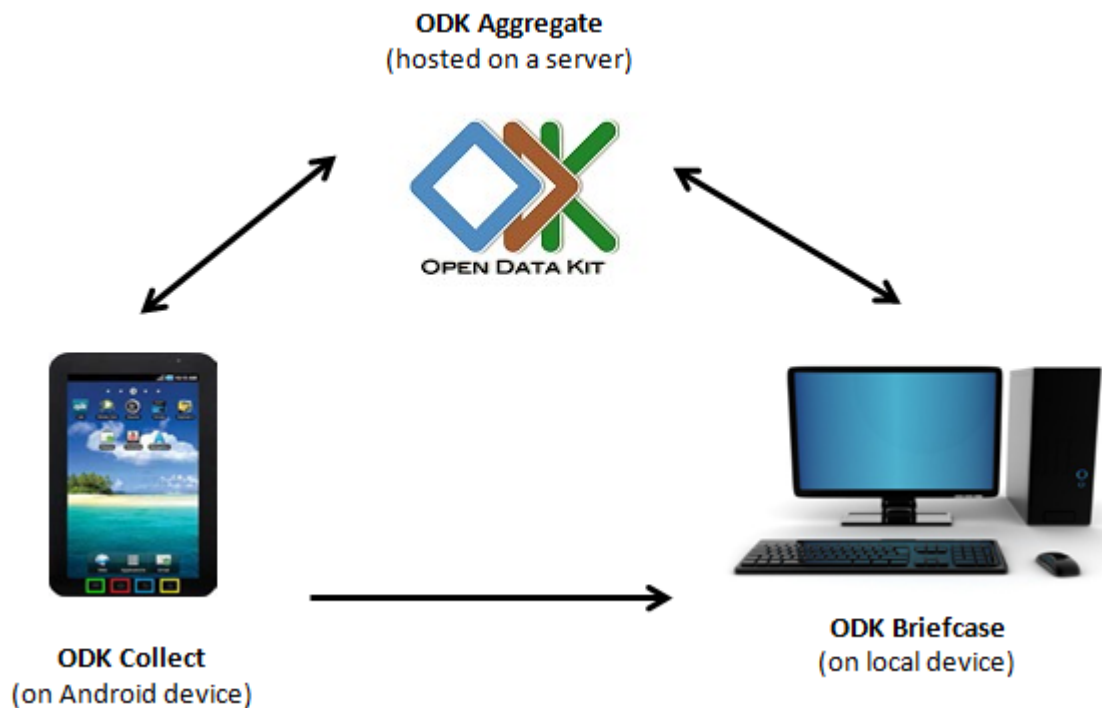
## 2. ODK tools for electronic data capture

The VA questionnaire can be collected on electronic platforms using Open Data Kit (ODK). ODK is an open-source set of tools that allows survey creation, collection, and management to be simple and straightforward. SmartVA uses three of the commonly used tools within ODK:

1. **ODK Collect** is where forms to collect data are completed. It is used on Android devices and can communicate with Aggregate and Briefcase to send and retrieve forms.
2. **ODK Aggregate** acts as a portal to view collected data that are stored on a server. It is accessible through a website and an easy login process.
3. **ODK Briefcase** allows forms to be stored on an offline device. Data sent to the ODK Briefcase storage location can be manipulated like any other file.

In this section, we describe the use of these ODK tools and the procedures that must be followed to collect VAs using this platform. The overall architecture is presented in Figure 1.

Figure 1: Procedure for VA collection and data management



**Note:** Updates to ODK tools and documentation can be found on their website [www.opendatakit.org](http://www.opendatakit.org). Technical personnel responsible for the IT around VA data collection and management should access this website frequently to access the latest information.

## 2.1 ODK Collect

**ODK Collect** is a tool to allow forms to be uploaded and data to be collected. It is used on Android devices, which can communicate with Aggregate and Briefcase to send or retrieve forms. Figure 2 presents a common Android tablet with four buttons highlighted.

*Not all Android devices will look exactly like the one shown, but the same actions should still be achievable.*

Figure 2: Example of an Android tablet



See Appendix A: Configuring Samsung Galaxy tablets

Note: Consider installing AppLock on your tablet to prevent unintended use of the tablet. For further information see the AppLock website <http://app-lock.en.uptodown.com/android>

### 2.1.1 Steps in downloading and installing ODK Collect

To use **ODK Collect** to send data from a mobile device to a remote server you must first prepare the tablet for data collection, and then load an empty questionnaire into the tablet. **ODK Collect** can be installed onto a tablet in three ways, by downloading it onto the tablet from the internet through 'Play Store', by downloading onto the tablet through the internet from the ODK website, or by downloading to a computer and copying it across to the tablet for installation.

*Note that instructions on how to download and install software may vary from those described below. Refer to your user manual for further details for specific devices. In additional documentation, can be found at*

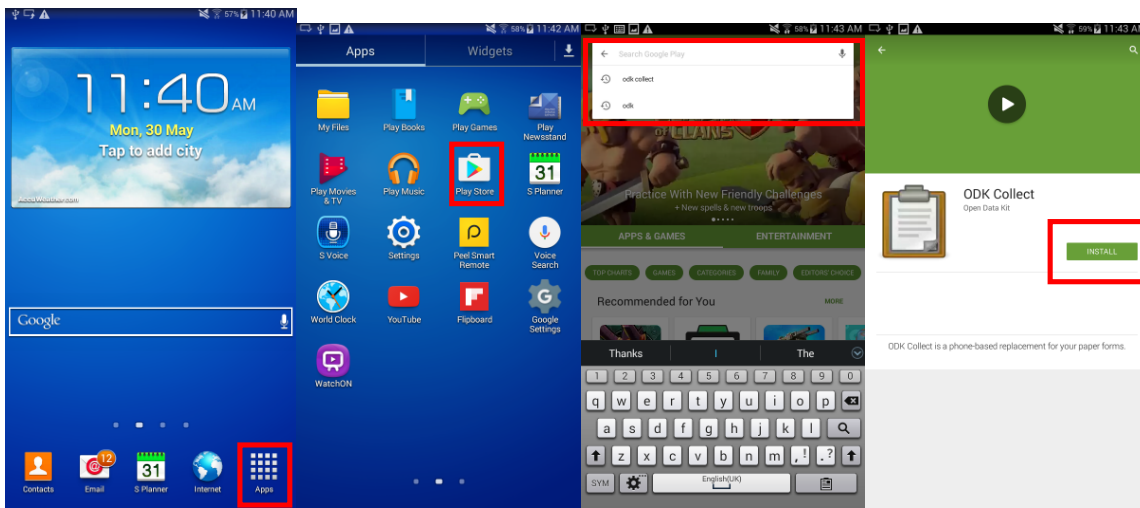
<http://docs.opendatakit.org/collect-guide/>

#### Downloading directly to a tablet

Steps to download ODK Collect from the internet through the Google Play store (see Figure 3)

1. Set a Gmail account (eg abc@gmail.com) to download any software from the Google Play store. For training purposes, a generic email account can be set up for multiple devices/participants to use.
2. Open the application drawer ('Apps').
3. Open 'Play Store' and enter your gmail account details.
4. Search for 'ODK' and select 'ODK Collect' from the options.
5. Click the **install** button.
6. Click on **OK** after viewing the security settings, and install the ODK APK file to the tablet (Figure 3).

Figure 3: Steps in installing ODK Collect using Play Store

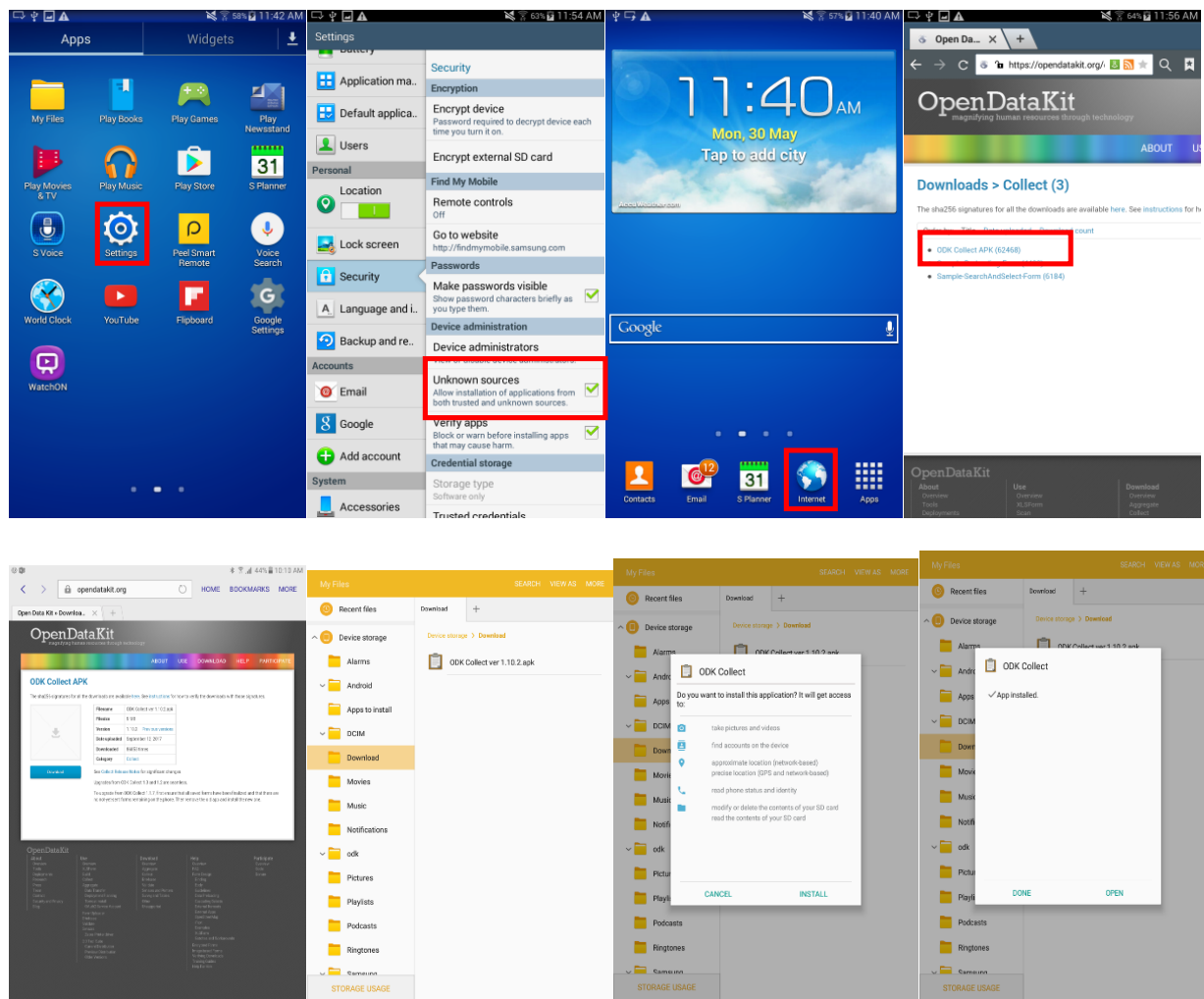




Steps to download ODK Collect directly from the ODK website (See Figure 4)

1. From your tablet's application drawer, choose 'Settings', then 'Security/Applications'. Make sure 'unknown source' is checked.
2. Return to the home screen of the tablet and click 'Internet'.
3. In the top URL menu, type <https://opendatakit.org/downloads/download-category/collect/> and click on the 'Go' button on the keyboard, or on the image of the magnifying glass.
4. In the download window, you will see 'ODK Collect APK'. Select it and you will be taken to another window to download the file.
5. Once the file has been downloaded, navigate to your downloads folder in 'My Files'. Click on the ODK Collect application and when a box appears press 'Install'. You will see a screen to let you know that the app was successfully installed.

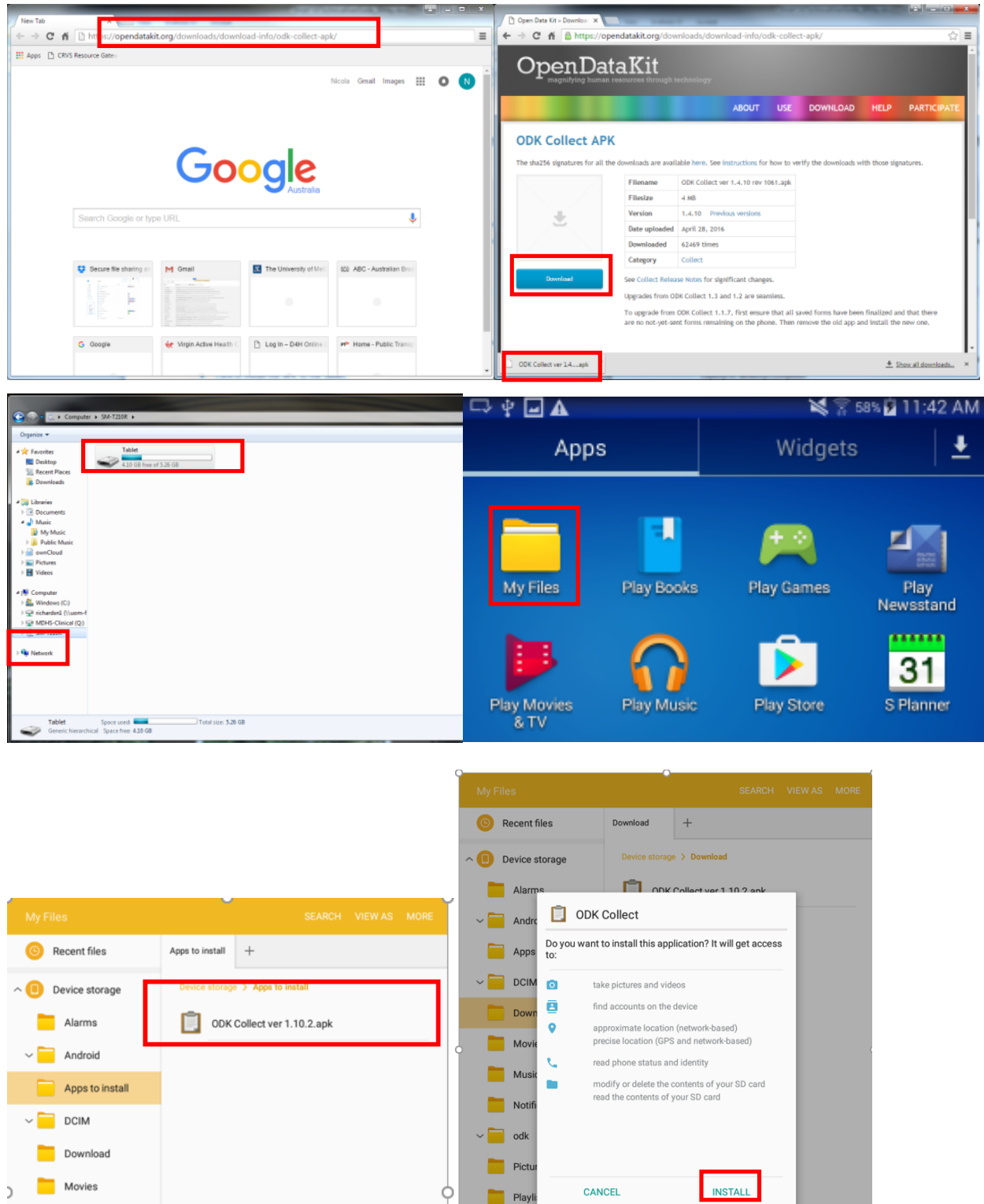
Figure 4: Steps in installing ODK Collect through the ODK website



*Downloading to a computer (Windows)(See Figure 5)*

1. If you are experiencing reduced internet speed or have many tablets to configure at the same time, you can download ODK Collect to your computer, copy/paste it to your tablet via a USB cable and install it on the tablet.
2. From your computer, open Internet Explorer, Edge or Google Chrome and
  - a. create a folder in your desktop
  - b. go to <https://opendatakit.org/downloads/download-info/odk-collect-apk/> and click on **download**, and wait for the file to download
  - c. once the ODK Collect installation file has finished downloading either drag and drop, or copy and paste it, from the download folder of your internet browser into a folder on your computer.
3. Connect the tablet to the computer using the USB cable and open the tablet's storage by going to the 'Start' button on your computer and clicking 'Computer'. The tablet will appear under the list of directories, on the left-hand side of the screen.
4. On the tablet, go to the applications drawer and click 'My files'. Then
  - a. create "AppsToInstall" folder in tablet
  - b. copy and paste the .apk file from the 'My Computer' folder into this "AppsToInstall" folder
  - c. select ODK Collect
  - d. click 'install'
  - e. you can delete the "AppsToInstall" folder after installation.

Figure 5: Steps in downloading ODK Collect to a computer



### 2.1.2 Installing a blank VA questionnaire/media files on to ODK Collect

Once you have downloaded **ODK Collect** and installed it onto the tablet, you will need to install a blank VA questionnaire.

*Note: Countries that already have a SmartVA questionnaire with administrative details tailored to their needs should use this version. The instructions below relate to the generic PHMRC shortened questionnaire on the IHME website.*

#### **For countries not using ODK Aggregate for data transfer and storage<sup>2</sup>**

1. Create a folder called 'ODK Materials' on your computer
2. To download a copy of the VA questionnaire, go to [www.healthdata.org/verbal-autopsy/tools](http://www.healthdata.org/verbal-autopsy/tools) (from the computer, not the tablet) and
  - a. click on 'ODK version of PHMRC Shortened Questionnaire'<sup>3</sup> (by default, these files will be saved to the 'Downloads' folder on your computer)
  - b. copy the downloaded .zip file from your 'Downloads' folder to the 'ODK Materials' folder you created earlier
  - c. extract or unzip this file and confirm that you have two Excel spreadsheets, one XML document, and a subfolder now showing in your ODK Materials folder. Note that the .zip file can be deleted once this has been confirmed (Figure 6).
3. Ensure that the tablet is connected by USB cable to the computer (to check that it has connected, go to 'Computer' and look for the tablet on the left-hand side menu).
4. After successfully installing ODK Collect, you will see the 'odk' folder in the home directory of the tablet storage. Note
  - a. if it does not come up automatically, open 'My Computer' and find the tablet folder
  - b. once the tablet folder is open it should look similar to Figure 7
  - c. from here, open the 'odk' folder, which should look similar to Figure 8.
5. In the ODK folder there will be three subfolders ('forms', 'instances', 'metadata'), so
  - a. click and open the 'forms' subfolder
  - b. copy and paste the media folder and the form extracted earlier (from your 'ODK Materials' folder) into the forms folder (e.g. 'PHMRC\_Shortened\_Instrument\_8\_20\_2015.xml')
  - c. If you receive the alert message 'Do you want to convert grunting.wav before it is copied to your device?'. Click on 'No, just copy file'

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<sup>2</sup> These instructions relate to manual download of the questionnaire into ODK Collect. If using ODK aggregate, questionnaires should be uploaded directly onto the tablet from the ODK aggregate server (See Appendix B)

<sup>3</sup> Most recent version of the generic questionnaire on the IHME website. Updates to this may be titled differently.

- d. If you receive the alert message 'Do you want to copy 'PHMRC\_Shortened\_Instrument\_8\_20\_2015.xml' to your device?' Click on 'Yes'
- 6. Once finished, newly added forms should now be available on the ODK collect under 'Fill Blank Form'. You may need to restart the tablet before these are visible.

Figure 6: Example of files downloaded from IHME

Name	Date modified	Type	Size
PHMRC_Shortened_Instrument_8_20_2015-media	15/10/2017 2:54 PM	File folder	
Guide for data entry.xlsx	15/09/2016 9:10 AM	Microsoft Excel W...	27 KB
PHMRC_Shortened_Instrument_8_20_2015.xls	15/09/2016 9:10 AM	Microsoft Excel 97...	230 KB
PHMRC_Shortened_Instrument_8_20_2015.xml	15/09/2016 9:10 AM	XML Document	317 KB

Figure 7: Sample of screen showing ODK folder on the tablet

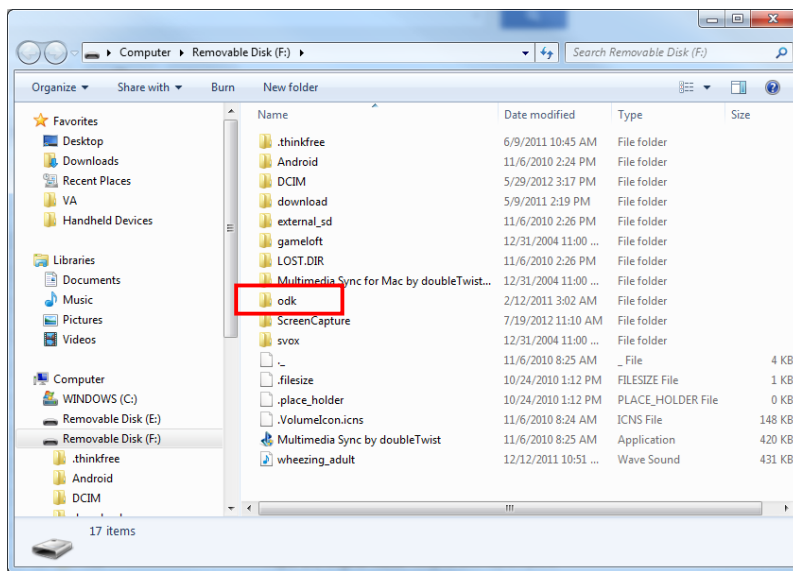
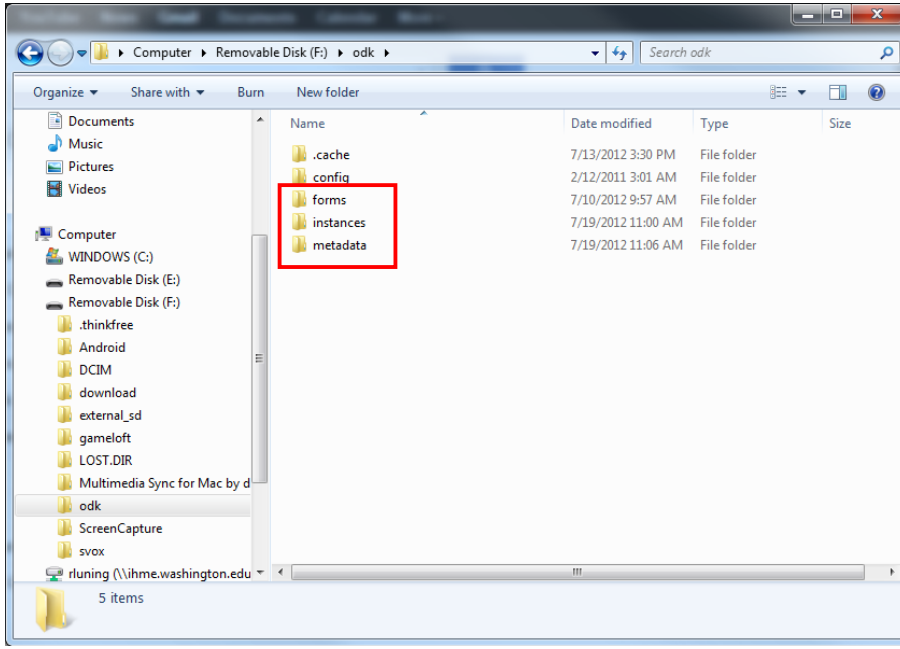


Figure 8: Sample of screen showing ODK folder contents



### Countries using ODK Aggregate for data transfer and storage

The countries using **ODK Aggregate** should follow the guidelines outlined in Appendix B: Configuring tablets for ODK Aggregate in setting up the tablet with SmartVA questionnaires and media files.

## 2.2 ODK Briefcase

**ODK Briefcase** plays two primary roles. The first is to extract data from an ODK Aggregate server for later analysis. The second is as a stand-alone replacement for **ODK Aggregate**, where using a remote server is not achievable or efficient.

Although sending collected data to a remote server can be useful, it is not always possible. Limited data credit, internet outages, and other obstacles can be problematic for moving data from a mobile device to elsewhere. As an alternative, it is possible to use **ODK Briefcase** to store data on a local device such as a laptop or desktop computer without needing internet access. The following will explain how to do this.

See also <http://docs.opendatakit.org/briefcase-guide/>

Note: If you choose to deploy ODK Briefcase for the purpose, consideration should be given to the long-term storage and archiving of the raw VA data that is collected from your tablets.

### 2.2.1 Downloading ODK Briefcase onto a computer

1. Download the latest version of **ODK Briefcase** here: <https://opendatakit.org/downloads/download-info/odk-briefcase/>.
2. By default, the files will save to the 'Downloads' folder on the computer;
3. Click on the 'ODK Briefcase' folder to open it and then
  - a. a pop-up box will appear asking you where on your computer you would like to save your forms (Figure 9)
  - b. click on 'Change' to select where you would like to save your forms (ie My Documents, Desktop, etc).
4. After an initial location has been set, you will be able to change the destination with the 'Change ...' button highlighted by the red circle like that shown in Figure 10.
5. This folder will not only store blank forms or completed surveys, but can also store forms that will be 'pushed' to another device. For example, you can 'pull' a completed survey from a tablet to the ODK Briefcase folder stored on a PC, and then 'push' it from the ODK Briefcase folder to an Aggregate server for central storage. The 'Pull', 'Push', and 'Export' tabs are highlighted in a red box in Figure 11.

Note: Briefcase cannot push a form from a PC to Collect (onto a tablet). The only way to download a form onto a tablet is manually (by connecting the tablet and copy/pasting the form into the tablet's ODK forms folder) or through Aggregate.

Figure 9: Pop-up box to determine ODK Briefcase location

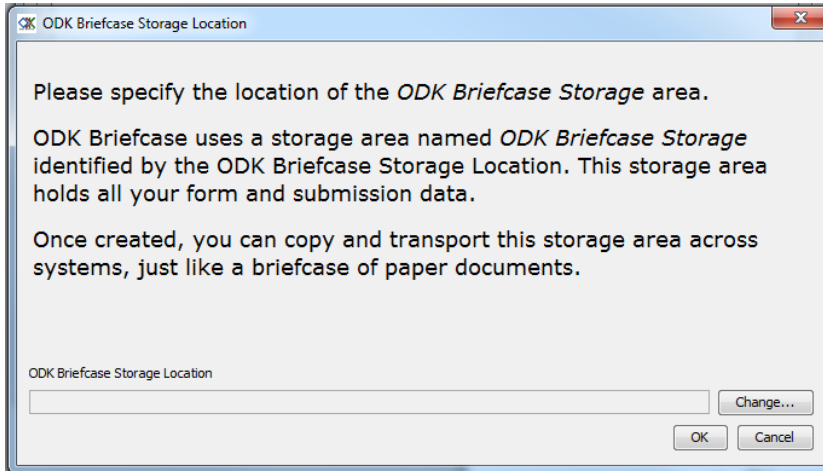


Figure 10: Changing the location where forms are saved

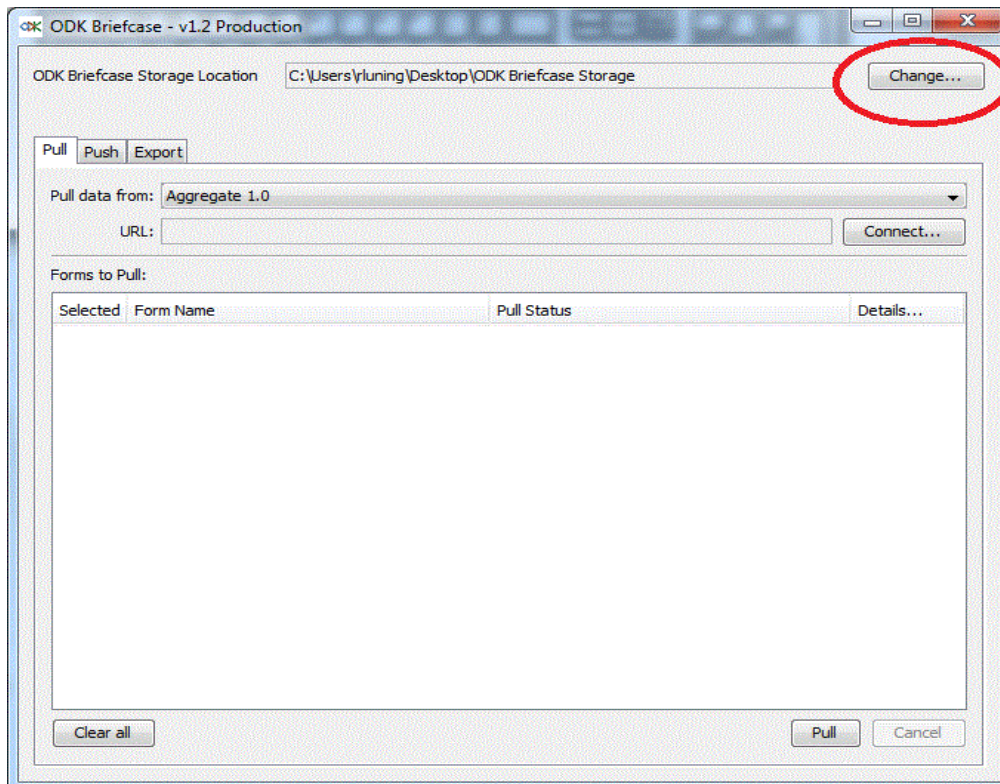
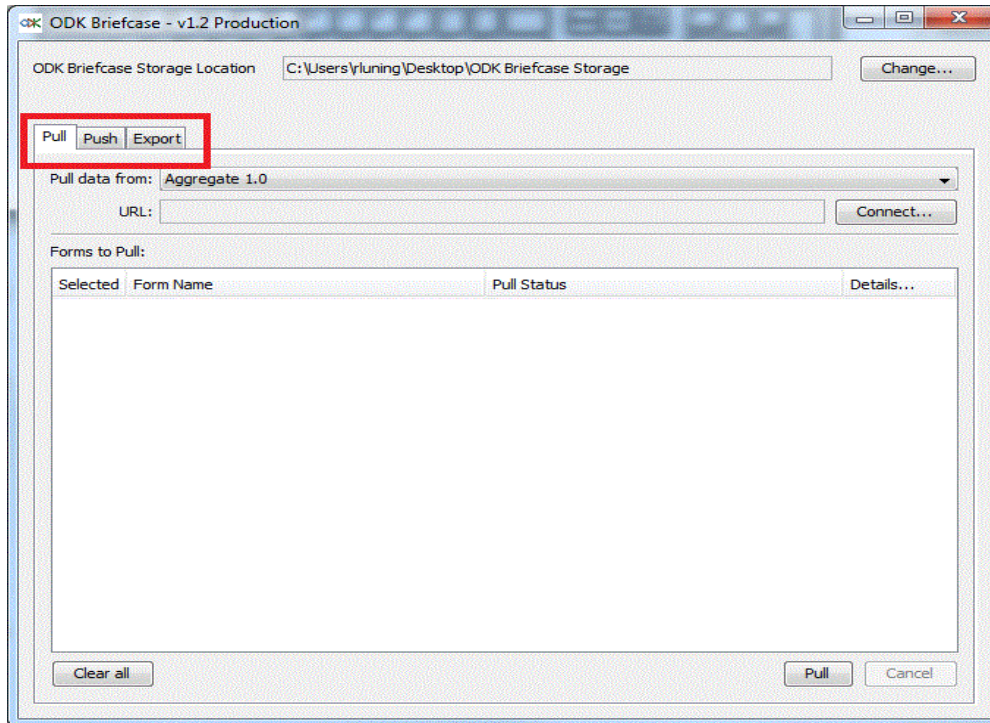




Figure 11: Pulling, pushing or exporting data



### 2.2.2 Pulling data

Under the 'Pull' tab is a 'Pull data from' drop-down menu. This allows you to choose where you wish to pull data from. The options are:

- Aggregate 0.9.x
- Aggregate 1.0
- Mounted Android SD Card
- Custom Path to ODK Directory.

To check what version your tablet is, open the applications draw, click on 'Settings' and then 'About device', on the right under 'Android version' will be a three-digit number. The first number gives the version number.

#### *Mounted Android SD Card*

##### *Android version 3.x or lower*

1. 'Mounted Android SD Card' refers to storage on the Android tablet. If the Mounted Android SD Card is chosen, make sure that the tablet is connected via USB and that it is connected.
2. Once this happens, click 'Choose...' and the correct drive associated with the tablet should be selected.
3. Click 'OK', and the list of forms should populate. Here you will be able to select the forms you wish to pull into the ODK Briefcase Storage folder.

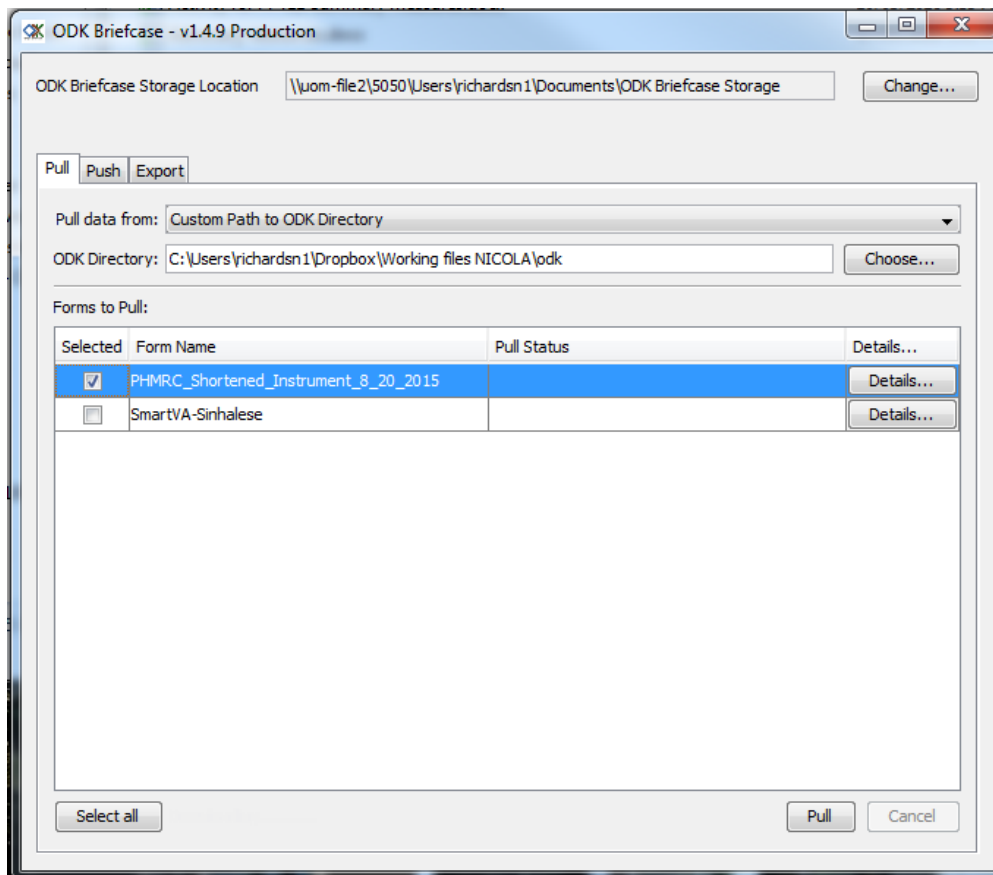
## Android version 4.x or higher

Note: At this time ODK Briefcase is unable to recognise Android devices running 4.x or higher. Use 'Custom Path' instead (see below).

### Custom path to ODK directory

1. Mount an Android device running version 4.x or higher.
2. Copy the 'odk' directory from the mounted MTP/Android device to a local hard drive of the computer.
3. Point Briefcase's 'Pull' functionality to the copied 'odk' directory. To do this
  - a. on the 'Pull' tab in Briefcase, you can use the 'Pull data from:' drop-down menu to select 'Custom Path to ODK Directory'
  - b. use the browse button to point Briefcase at the copied 'odk' folder on your local hard drive.
4. Click the 'Pull' button and your data will be pulled automatically (Figure 12).

Figure 12: Pulling data using a custom path

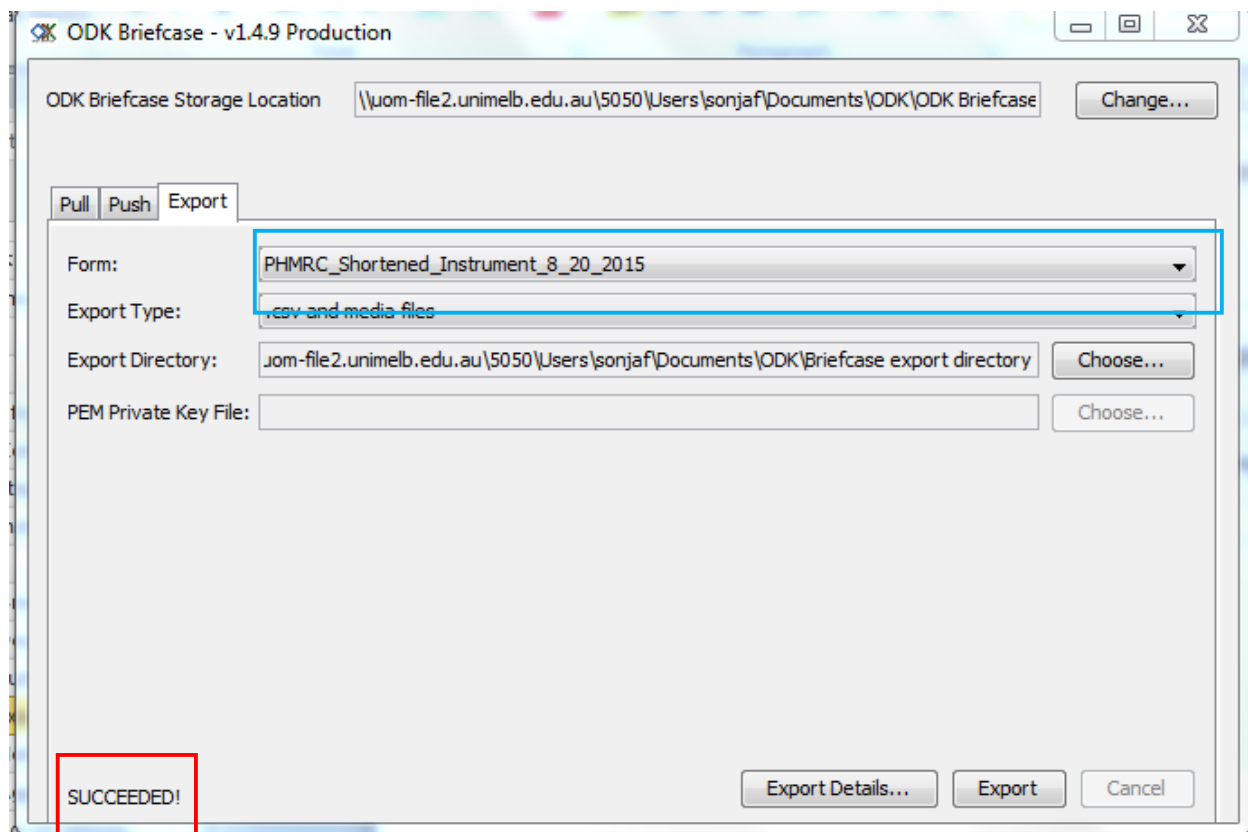


### 2.2.3 Exporting from Briefcase

ODK Briefcase allows you to export completed forms as CSV files to a specific location for use by other applications, such as Excel. This is also the format needed for the SmartVA-Analyze COD assignments of VA data. The process is outlined below:

1. Select the form from the drop-down menu highlighted in the blue box in Figure 13.
2. Change the export directory to a place where you wish to have the CSV file saved.
3. Click on export and, if successful, a 'succeeded' message will appear, as highlighted in the red box in Figure 13.
4. The csv file with all the exported VA data will be available in the designated export directory.

Figure 13: Exporting forms in ODK



### 2.2.4 Note on confidentiality

Confidentiality of data is often a concern. There are two main ways that ODK users can maintain the confidentiality of their data:

1. All ODK operations can be run locally on computers using **ODK Briefcase**.

2. If cloud storage is necessary for your specific project, there is a method for encrypting forms to keep data private even when using http: communications. More information on this can be found at <http://opendatakit.org/help/encrypted-forms/>

For information on ODK Briefcase from the developers, please visit <http://opendatakit.org/use/briefcase/>

## 2.3 ODK Aggregate

**ODK Aggregate** provides a central server for ODK Collect forms. It can provide blank forms to ODK Collect, accept finalised forms (submissions) from **ODK Collect**, visualise the collected data, and export data for use in SmartVA-Analyze.

ODK Aggregate can be deployed on Google's App Engine, enabling users to quickly get running without facing the complexities of setting up their own scalable web service. ODK Aggregate can also be deployed locally on a Tomcat server (or any servlet 2.5-compatible web container) backed with a MySQL or PostgreSQL database server.

ODK Aggregate is an alternative to ODK Briefcase that can streamline operations, but requires some additional work prior to use.

For detailed instructions on how to install and use Aggregate, see the ODK Aggregate guide at <https://opendatakit.org/use/aggregate/> and <http://docs.opendatakit.org/aggregate-guide/>

*See also Appendix B: Setting up tablets for ODK Aggregate.*

## 3. Conducting VA interviews in the field

### 3.1 General guidelines

#### 3.1.1 General instructions

- The SmartVA Questionnaire consists of a general module followed by age-specific modules – one of neonate (0–28 days), child (29 days – 11 years), or adolescent/adult ( $\geq 12$  years).
- The questionnaires include filter questions with automatic skips to an appropriate question.
- Responses to questions may include a mix of text fields, radio buttons, check boxes and date fields or a combination of these.
- The response categories of many questions are a mix of yes, no, refused to answer, and 'don't know', with each of these preceded by a radio button (a circular symbol which only allows selection of one category from the list – see Figure 14).

Figure 14: Example of a yes/no question in ODK

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Neonatal and Child Module > Background Section

**Did the baby ever cry?**

- Yes
- No
- Refused to answer
- Don't know

- Some questions allow multiple response categories to be selected, and each of these categories is preceded by a check box. These check boxes are rectangular and allow checking one or multiple categories by touching the boxes (Figure 15).

Figure 15: Example of a multiple-response question in ODK

Neonatal and Child Module > Background Section > Maternal History Section

**Was the late part of the pregnancy (defined as the last 3 months), labor, or delivery complicated by any of the following problems?**

*Read "the mother" if the mother is not the respondent.*


- You (the mother) had convulsions
- You (the mother) had high blood pressure
- You (the mother) had severe anemia
- You (the mother) had diabetes
- Child delivered not head first
- Cord first
- Cord around child's neck
- Excessive bleeding
- Fever during labor
- No complications
- Refused to answer
- Don't know

- There are also picture and audio capabilities (Figure 17). VA Interviewers can use these to demonstrate particular characteristics or symptoms of the deceased.

Figure 16: Example of picture capabilities of the verbal autopsy questionnaire in ODK

Neonatal and Child Module > Background Section

**At the time of the delivery what was the size of the deceased? (Read the question and slowly read the first 4 choices. Respondent should hear all four choices and then respond.)**



*Pictured above from left to right: very small, small, and average newborns (no large newborn pictured)  
For reference: <1 kg = very small, 1-2.5 kg = small, 2.5- 4 kg = average; >4 kg = large*

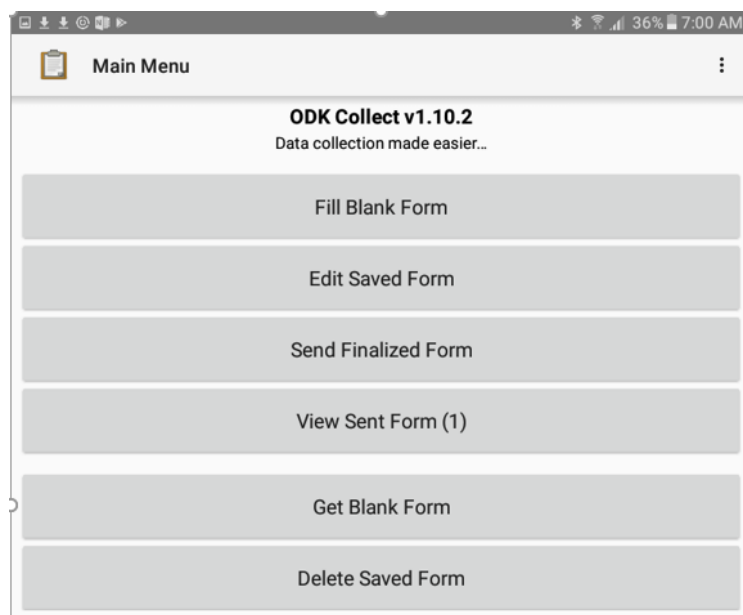
- Very small
- Smaller than usual
- About average
- Larger than usual
- Refused to answer
- Don't know

- Swipe the screen of the tablet right-to-left to continue data entry on the next page or left-to-right to check data entered on the previous page.
- Most often, working with the questionnaire on the tablet will require marking a radio or check box, or entering text, to navigate the screen or move from question to question
  - if you try to move to the next question without selecting an option, you will see a message on the screen 'Sorry, this response is required'
  - there are a few questions which will allow you to proceed without making any response
- Sometimes checking boxes/filling the radio button will provide space on next page to enter or write the appropriate response.
  - Touching the space will produce a temporary keyboard to enter the answers.
- The tablet has in-built instructions, so will select questions/VA modules automatically, based on previous answers.

### 3.1.2 Step-by-step instructions

1. Start the tablet (Tab) by pressing the start button (top-right). After about a minute the Tab will turn on.
2. Press the 'Home' button of the Tab and go to the home screen/ touch the application button.
3. Touch the 'ODK collect' icon on the Tab home screen.
4. On pressing the icon, the Tab will show a screen with five options ('Fill Blank Form', 'Edit Saved Form', 'Send Finalized Form', 'Get Blank Form', and 'Delete Saved Form') (Figure 17).

Figure 17: ODK verbal autopsy questionnaire collection menu



5. Touch the 'Fill Blank Form' button from ODK Collect software to open the form.
6. Touch the relevant XML form to start a VA interview. Read the on-screen information about the questions before beginning to enter responses
7. Swipe the screen right-to-left and continue the interview as per instruction.
8. When the respondent agrees to continue the interview, read and follow the screen instructions carefully. More information on filling out structured questions and open response questions is provided in the interviewer manual.
9. At the end of each age-specific module, a keyword checklist will appear. At the end of each age-specific module, a screen will appear for checking off pre-selected keywords from a list while listening to the respondent's open-ended responses.

### 3.1.3 *Completing open-ended responses*

The PHMRC shortened (SmartVA) questionnaire includes an open-ended question, in which the informant can explain, in his/her own words, the sequence of events that led to the death. In this section, the interviewer needs to listen carefully to the informant, and register if he/she mentions some specific words or categories.

When entering the open-ended question, the following instructions will appear:

*Say to the respondent: 'Thank you for the patient responses to this exhaustive set of questions. Could you please summarize, or tell us in your own words, any additional information about the illness and/or death of your loved one?'*

*To the interviewer: Listen to what the respondent tells you in his/her own words. Do not prompt except for asking whether there was anything else after the respondent finishes. If the respondent mentions any of the following words, mark 'mentioned'. Tell the respondent to stop and start again if they mention a word of interest, so you have time to mark it down. Follow the interactive screen message and ask the respondent to answer each question as appropriate.*

#### *General points*

- The open-ended response file contains a list of predetermined categories preceded by check boxes, and these allow multiple answers.
- Consult with local people and health professionals and make a dictionary of locally used synonyms of these categories for training local VA interview staff.
- Select the categories by touching the boxes (a tick will appear).
- Save and exit the screen to finish the VA interview.



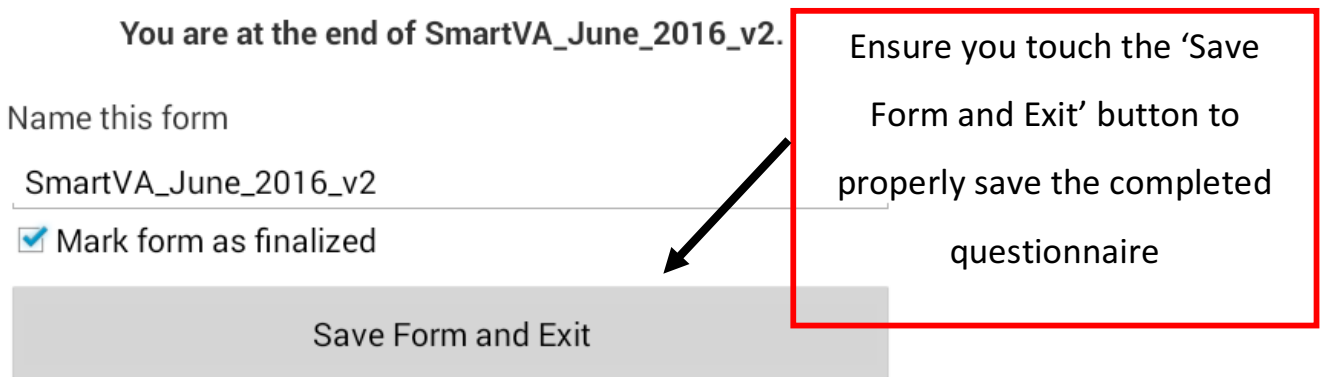
### 3.1.4 Saving the work and editing a VA

Incorrect entries can be edited by going back to the previous page (swiping left-to-right). After the form has been completed, edits can be made by clicking “Edit Saved Form”.

At the end of each interview, a screen like that shown below will pop up (Figure 18).

1. By default, the tablet will show the country-specific form name for the country in the ‘Name this form’ field. You should not change this field.
2. Touch the button ‘Save and Exit Form’ and finish the interview.

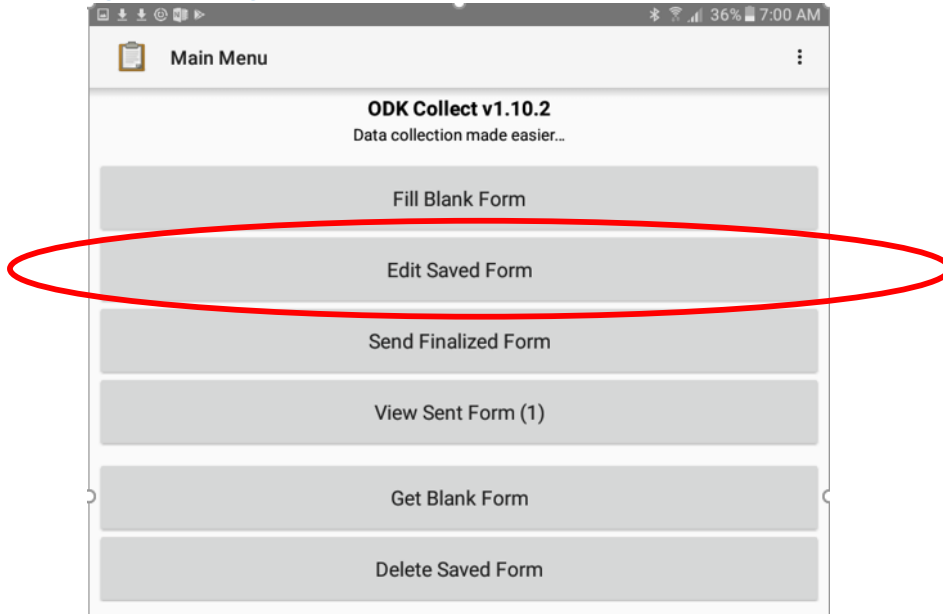
Figure 18: Save and exit screen at the end of ODK verbal autopsy questionnaire



### 3.1.5 Data editing

You can see and edit the completed VA by touching the ‘Edit Saved Form’ button on the main menu in the ODK Collect software (Figure 19).

Figure 19: Editing saved forms



1. After touching the 'Edit Saved Form' button you will see list of VA form names
  - a. touch one form and open it to see the data
  - b. you can see the entire questionnaire by scrolling up/down.
2. To edit, touch the desired question to open the question in a full screen, then correct the answer and press the save icon at the top-right corner of the Tab. It will save the changed data and you can come back to the overview of the questionnaire by touching the down arrow icon at the top-right corner of the tablet.
3. You can edit multiple questions by swiping left/right. When finished, touch the save icon on the Tab. Alternatively, when you reach the last question you can touch the 'Save Form and Exit' button.

### 3.1.6 Saving data at each step

It is possible to save the VA form after completing the VA or after completing any question by clicking 'Save Changes' in the dialog box.

- For a new interview, you can save the form by touching the button 'Save and Exit Form' in the last section of the questionnaire.
- To save individual questions you can touch the save icon at the top-right corner of the Tab.
- After completing any question from the VA questionnaire you can press the back button and touch 'Save Changes' in the dialog box.

### 3.1.7 Submitting interview data

Save the data and exit the screen by touching the home button. Data is automatically saved in the folder 'Instances' in XML format.

### 3.1.8 Starting a new interview

Go to the ODK icon from home screen and click the 'Fill the blank form' to start a new interview.

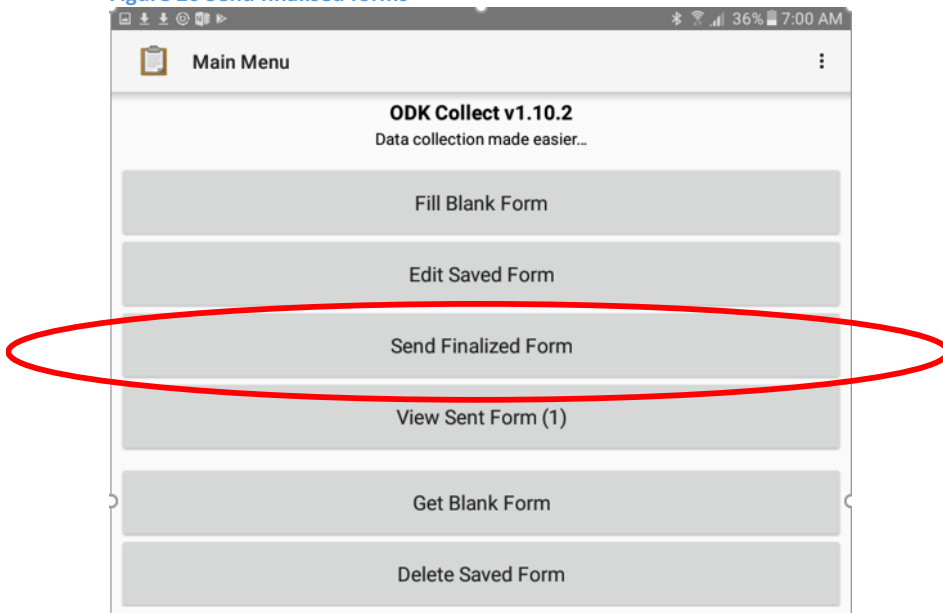
### 3.1.9 Data transfer and uploading

Once the VAs have been collected, they need to be transferred off the tablet for analysis in SmartVA-Analyze.

There are two methods of data transfer; online (through wi-fi or a cellular network) with the upload of the filled questionnaire going directly to **ODK Aggregate**; or offline, by uploading data to a computer using **ODK Briefcase**. The VA interviewer needs to be told the method of data transfer in advance.

- If using online methods, once the VA interview is completed and saved, the VA interviewer should select the interview on the Tab and press 'Send Finalised Form' (Figure 20). The relevant VA interviews can be selected and sent to a remote central server ready for VA raw data storage and eventual analysis.

Figure 20 Send finalised forms



- If using offline methods, the VA interviewer needs to take the tablet to the relevant centre. By connecting the tablet to a computer via a USB cable, the VA information can be saved to the local computer using ODK Briefcase and then exported ready for analysis (See Section 2.2 ODK Briefcase).

## 4. Analysis of VAs using SmartVA-Analyze

Once a VA is collected, it is necessary to analyse it to diagnose the COD. Originally, this process was done through review of the VA by physicians, a process called physician certified VA (PCVA). One or more physicians would review the VA, and diagnose a COD based on its information. However, this process has substantial limitations, as described in Box 1.

### Box 1. Limitations of physician certified verbal autopsy (PCVA)

- **Feasibility and practicality:** finding and training physicians to read VAs in resource-poor settings is difficult. In some cases, this led to long delays in the analysis of collected data.
- **Opportunity cost:** where there are shortages of physicians, assigning available physicians to read VAs may mean pulling them away from their primary role in providing essential health services to populations.
- **Inter-rater reliability.** The same VA questionnaire, read by two different physicians, could return two different diagnoses, with each physician bringing a unique set of knowledge, experience, training, history and personal opinion.

### 4.1 How can Tariff be used?

A research team at the University of Washington has developed an application that allows the collection of VA using the PHMRC-shortened (SmartVA) questionnaire on any Android device running ODK Collect. This has several advantages. Namely, it is low cost, rapid, reliable and includes automated data quality checks, like skip patterns, where interviewers must follow survey skip patterns and logic constraints (ie pregnancy cannot last more than 10 months). The tablet records VA interviews in XML format. This form of VA interview data must be converted to CSV format (usually using ODK Briefcase or the export option of ODK Aggregate) to use Tariff to determine COD. This process of assigning COD using the Tariff method is described below.

### 4.2 Automated analysis and results using SmartVA-Analyze

Firstly, install the SmartVA-Analyze (Tariff) software onto a laptop or PC.<sup>4</sup>

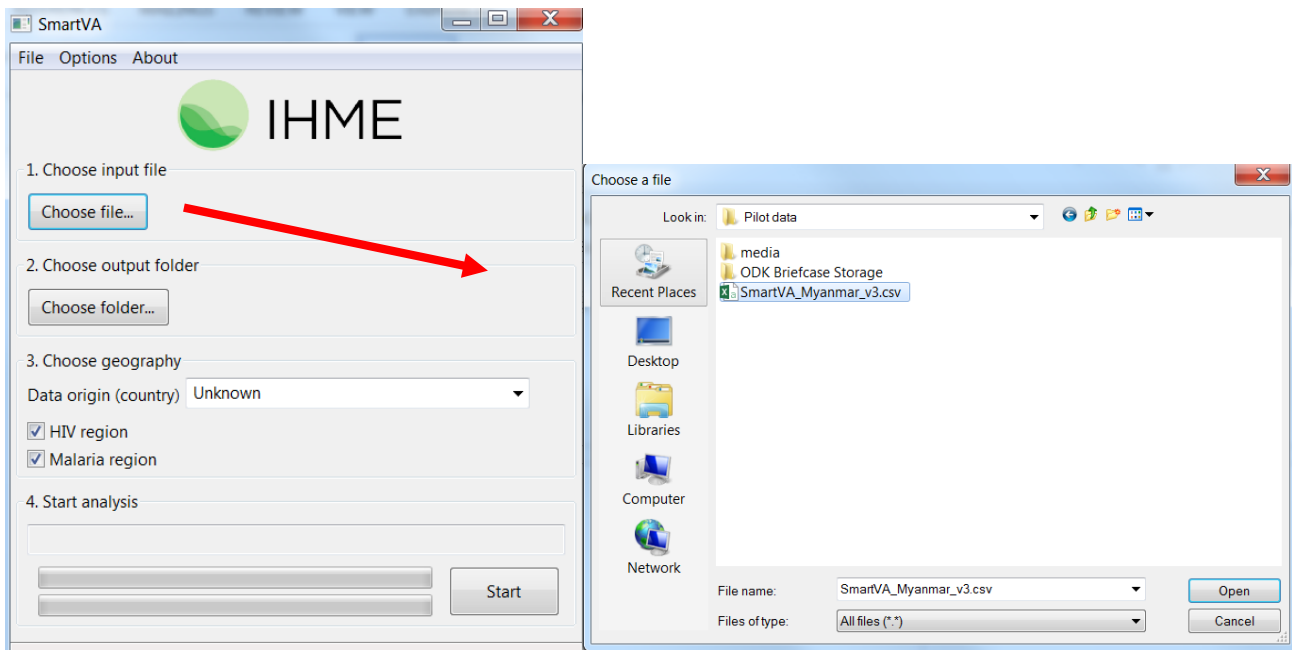
The analysis of VA using SmartVA-Analyze includes five basic steps:

---

<sup>4</sup> The current version of SmartVA-Analyze can be downloaded from [www.healthdata.org/verbal-autopsy/tools](http://www.healthdata.org/verbal-autopsy/tools)

1. Choose the input file. Once your data have been processed by ODK Briefcase to generate CSV data, you can open SmartVA-Analyze and select your input data (Figure 21)

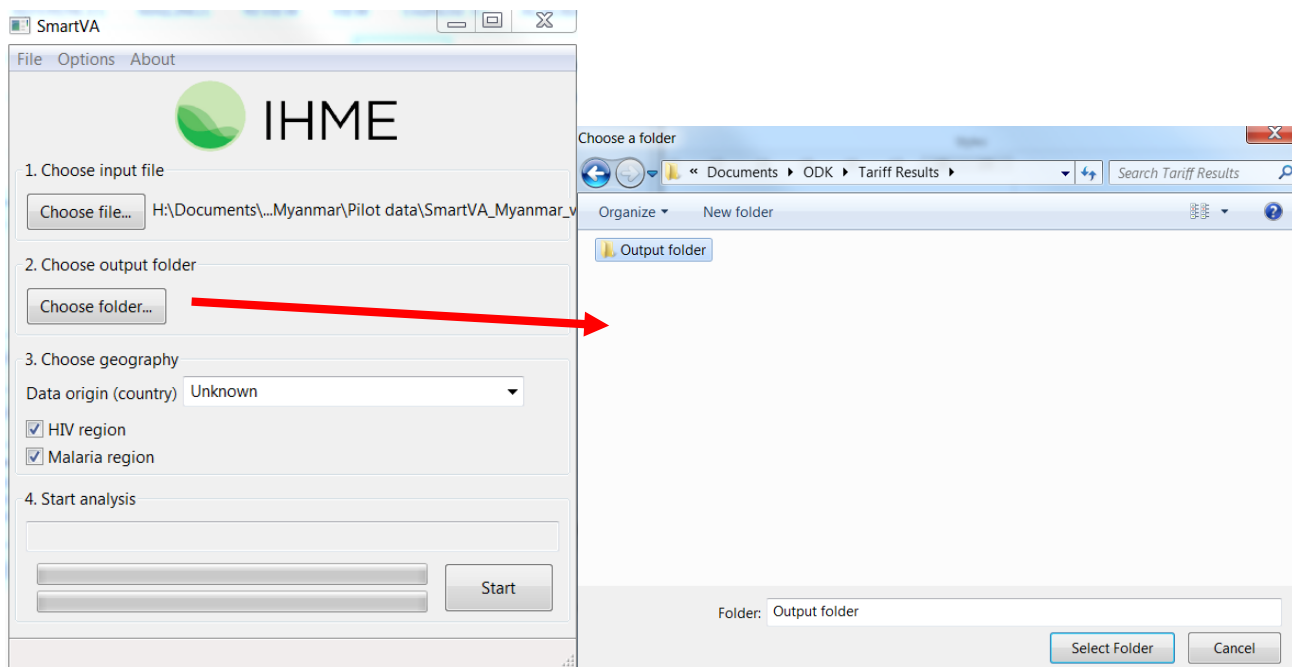
Figure 21 Choosing input file in SmartVA-Analyze



2. Choose the output folder:

- select where you would like the output from the analysis to be saved
- the output from the analysis will be saved in different subfolders within the folder you select in this step (Figure 22).

Figure 22: Choosing the output folder in SmartVA-Analyze



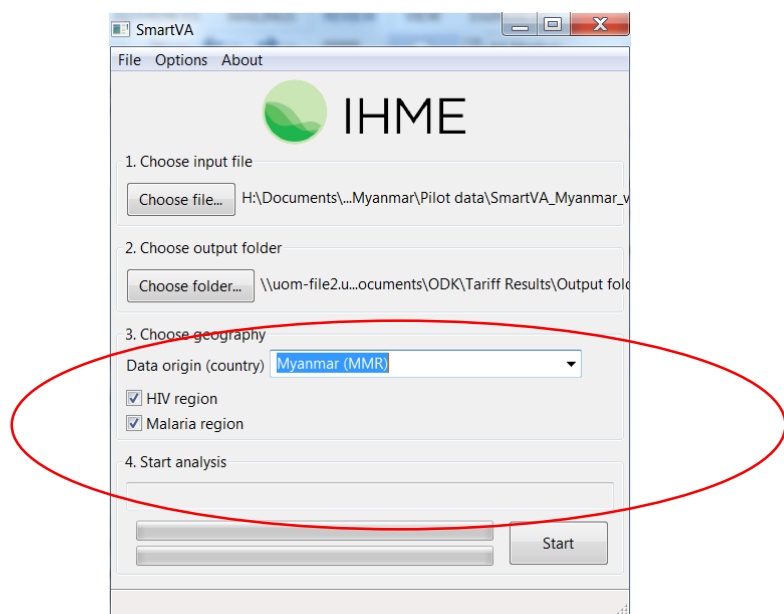
3. Set the options parameters. Three options can be specified – ‘Country of origin’, ‘HIV region’ and ‘Malaria region’ (Figure 23).

### Country of origin

- The user may select the country where the VA data were collected. This information is used for reallocation of undetermined VAs (that is, cases in which the method was not able to diagnose a COD in a reliable way based on the questionnaire) to allow statistical results for the entire population of VA to be collected more accurately.
  - individual observations from the data are not reallocated. Instead, the age and sex distribution of the ‘undetermined’ VAs in your sample are used to adjust the estimated population-level cause-specific mortality fractions (CSMFs) based on the Global Burden of Disease estimates for the country of VA origin and on the likelihood that these causes were allocated to Undetermined in the PHMRC gold standard validation study<sup>5</sup>
- If no country of origin is specified, the undetermined VAs will not be reallocated, and an additional category of ‘undetermined’ will appear on the final CSMF graphs as well as individual-level CSV files.

**HIV region and Malaria region:** The user must determine whether HIV or malaria is a possible COD in the population from which the VAs were collected. The Tariff method will not assign HIV or malaria as a COD unless the relevant box is selected.

Figure 23: Setting processing options in SmartVA Analyze



<sup>5</sup> Murray C, Lopez A, Black R, Ahuja R, Ali S, Barqui A et.al. Population Health Metrics Research Consortium gold standard verbal autopsy validation study: design, implementation, and development of analysis datasets. *Population Health Metrics*, 2011; volume 9, p. 27.

4. Set additional options. A number of additional options are included under an options menu (see Figure 24):

#### **Health care experience variables**

- The SmartVA questionnaire includes questions on health care experience. If the box next to 'Health Care Experience (HCE) variables' is not checked, these variables are not included in the analysis, and the software will use appropriate estimation data that are not enhanced with HCE variables.
- The following questions in the SmartVA (PHMRC) questionnaire are considered 'health care experience':
  - For adults, the question, 'was the deceased told by a health professional that they were suffering from any of the following?' followed by a checklist of chronic conditions
  - any data that were transcribed from health records (this is section 6 of the adult module and section 5 of the child/neonate module)
  - for all age modules, responses to the question, 'could you please summarise, or tell us in your own words, any additional information about the illness and/or death of your loved one?' including a checklist of words of interest (separately for each module) that can be analysed by Tariff.

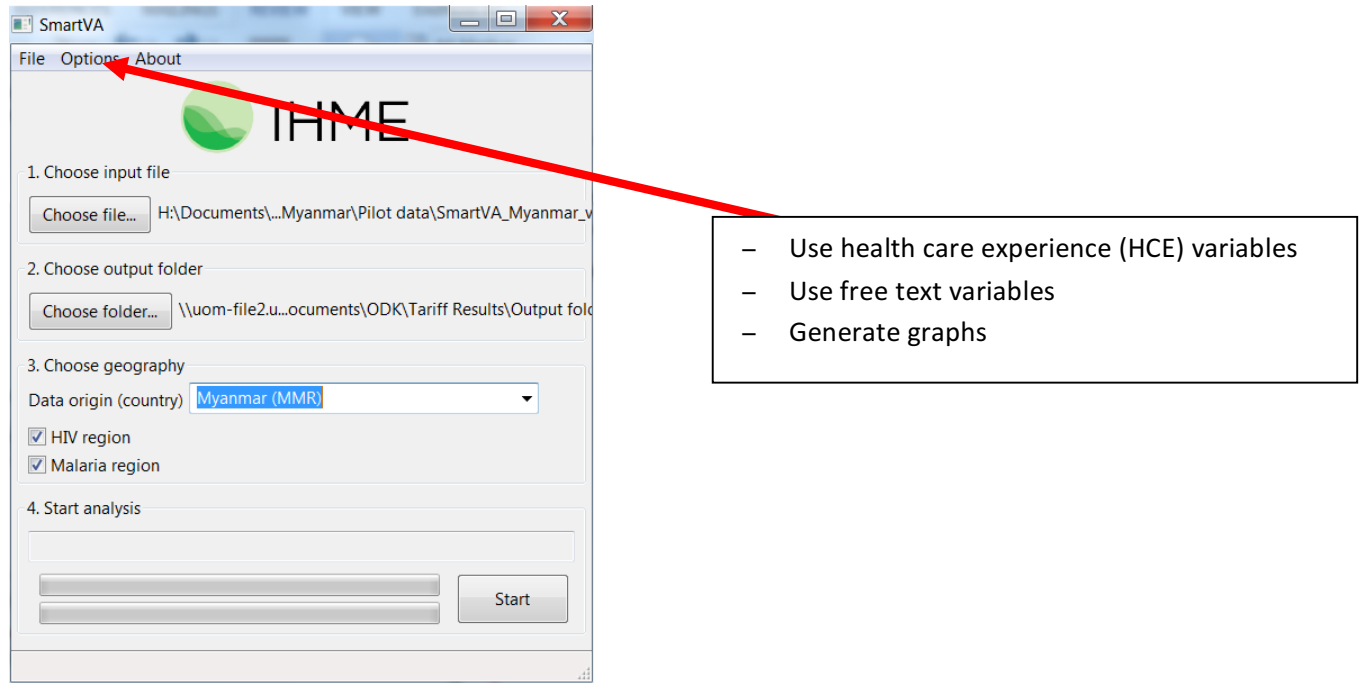
#### **Free text variables**

The Tariff method can analyse open response portions of the VA by turning them into 'free text' variables, though at present this is restricted to data in English. The SmartVA (PHMRC shortened) questionnaire considers transcribed information from some questions in the health record section (e.g. 'Did a health professional tell you the cause of death?' and 'Transcribe note') as free text variables.

#### **Generate graphs**

The Tariff analysis will by default automatically generate graphs. If only a small number of VAs are being analysed, such that graphs would not be useful, it is possible to uncheck this option. In this instance, no graphs will be generated from the Tariff analysis.

Figure 24: Setting additional options in SmartVA Analyze



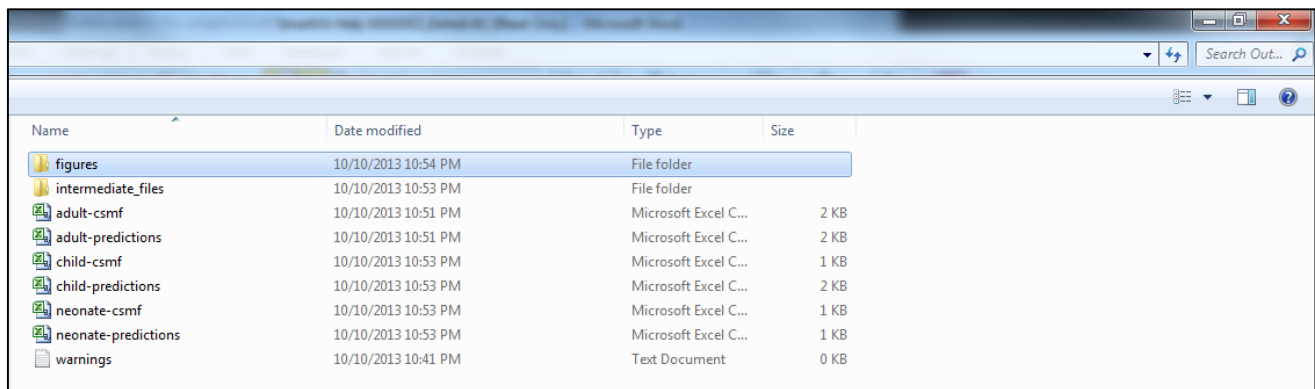
5. Push the **Start** button to begin the analysis.

### 4.3 Analysing output files

SmartVA generates several output files. The files containing the individual-level COD assignments for your data are the files called ‘adult-predictions.csv,’ ‘child-predictions.csv,’ and ‘neonate-predictions.csv’ (Figure 25).

These files can be found in the output folder you specified earlier.

Figure 25: SmartVA Analyze output files





Each row contains information about one death, including its unique identifier ('sid'), the estimated COD, and the age and sex reported on that VA (Figure 26 **Error! Reference source not found.**).

These data can be further processed into tables and graphs using Excel and other analytic software.

**Figure 26: Example of SmartVA output file (adult prediction file)**

	A	B	C	D	E
1	sid	cause	cause34	age	sex
2	Example VA_1	14	Falls	63	1
3	Example VA_2	12	Epilepsy	83	2
4	Example VA_3	32	Stroke	81	2
5	Example VA_4	14	Falls	96	1
6	Example VA_5	10	Diarrhea/Dysentery	81	1
7	Example VA_6	9	Diabetes	74	1
8	Example VA_7	10	Diarrhea/Dysentery	56	1
9	Example VA_8	32	Stroke	48	2
10	Example VA_9		Undetermined	72	1
11					
12					

During the Tariff analysis, the results are assessed for prediction quality, and low-scoring predictions, compared to gold standard reference, are marked as undetermined for individual-level estimates. Cases with an undetermined COD are redistributed to other causes based on country-specific cause fractions for population-level estimates (the output files are adult-csmf.csv, child-csmf.csv and neonate-csmf.csv). The final target cause list for adults, children, and neonates includes 32, 21, and 6 gold standard causes, respectively. This cause list can be mapped to International Classification of Diseases (ICD-10) codes (see Appendix D).

The other subfolders in the output folder contain intermediate files that the Tariff method requires to run, and figures that include graphs for CSMFs for each age and cause.

The graphs show bars whose heights are proportional to the estimated CSMF for each of the CODs on the cause list for that age module.

## 4.4 Logistic issues in the use of SmartVA

SmartVA can collect and analyse information collected for different purposes (contribution to vital registration systems, surveys, epidemiologic studies, etc). In this section, we discuss some logistic issues around data collection.

### 4.4.1 Translation of the VA questionnaire

The PHMRC questionnaire was developed in English, and so far has been translated to eight different languages. An interface has been created to facilitate translation of the questionnaire and SmartVA into various languages. The user needs to write down the translation of each question in the designated column of an Excel spreadsheet, and retrieve this information to the ODK. Below, a step-by-step process to develop a local language questionnaire to be used in ODK Collect is described (Box 2).

**Box 2: Developing a local language tool in Excel**

Step 1: From the Excel file, obtain all the text under the 'caption', 'hint' and 'label' headings and translate into the Unicode-supported local language.

Step 2: Copy and paste the translated local language text into the appropriate question under the 'caption', 'hint', and 'label' headings in the Excel file, and save the file.

Step 3: Convert the Excel file to XML format; by going to <http://opendatakit.org/xiframe/>

Step 4: In your browser, click the 'Browse ...' button and select the Excel file from your computer hard drive. Click the 'Submit' button.

Step 5: After some time (approximately one minute) the 'Download' button for downloading the 'XML Form' will appear. If the translated local language Excel file is acceptable, then it will show no error, otherwise it will show an error message. Click the 'Download' button and save it to you laptop/desktop computer.

Step 6: Finally, copy the local language translated 'XML Form' and paste it to the 'Forms' folder under the 'ODK' folder in your Tab.

Step 7: Turn the tablet off and restart to start the ODK Collect software.

*See Appendix C for more detailed instructions on the steps for including translations in the questionnaire.*

## **4.5 Data collection logistics and quality control**

The quality of data collected is must be high for an adequate estimation of CODs using VA. Therefore, it is crucial to consider proper training, supervision and quality control of interviewers. Given the sensitive topics of the VA interview, it is highly advisable to consider offering emotional support to interviewees after the interview, and to interviewers throughout the field work process. Although the VA questionnaire has been validated, it is very important to conduct a pilot test after training and before the final data collection to test the whole operation.

## 5. FAQ and troubleshooting

### 1. Tablet doesn't turn on

No matter what you do, you cannot get your tablet to turn on.

- **Press and hold the wake/sleep button**
- **Check if battery will charge**
  - First, connect your tablet to the power adapter.
  - If the tablet recognises the charger the battery will begin to recharge.
  - If it does not, the battery may be defective and need to be replaced.

### 2. Screen does not respond to touch

Nothing happens when I touch my screen.

- **Perform a soft reset.**
  - A soft reset restarts your device and does not erase any of your content or data.
  - Press and hold the power key until your device turns off.
  - Wait a moment, then press and hold the power key to turn your device back on.

### 3. Tablet overheats

Tablet is too hot to touch.

- **Reset the device**
  - Hold down the power button until the device shuts off.
  - Let it cool down for a few minutes, then hold the power button until the device powers on.
- **Bad battery**
  - If the device continues to heat up, the battery is most likely defective and needs replacement.
  - Purchase a battery, and replace the old with the new.

### 4. Tablet performs slowly

Remove SD card and do a soft reset. A soft reset restarts your device and does not erase any of your content or data.

- **Safely remove your SD card**
  - From the home screen, tap the menu key, then tap 'Settings'.

- Once in the settings menu, scroll to and tap 'Storage'. In storage menu, scroll to and tap 'Unmount SD card', then tap 'OK'.
- You can now safely remove the SD card.
- **Perform a soft reset**
  - Press and hold the power key until your device turns off.
  - Wait a moment, then press and hold the power key to turn your device back on.

#### 5. ODK folder not showing up when connected with PC/laptop

- When you connect the tablet to a PC using a USB cable, you should see the odk folder in the list of folders with three subfolders within it: 'Forms', 'Instances' and 'Metadata'.
- If the odk folder does not show up, turn off the tablet and PC and turn on again. Eventually it will show up and you will be able to copy the XML form and unzipped media file(s).

#### 6. What are the age cut-offs for 'Adult,' 'Child,' and 'Neonate' modules?

Age-specific module	Age range
Adolescent/adult	12 years and older
Child	29 days – 11 years old
Neonate	28 days or less



#### 6. What are the files 'adult-prepped.csv,' 'adult-presymptom.csv,' and 'adult-symptom.csv'?

- These files are the input data in standardised formats that are produced by the software.
- The 'adult-prepped.csv' file contains the raw data from the electronic questionnaire.
- The 'adult-presymptom.csv' file contains the data in the PHMRC questionnaire format.
- The 'adult-symptom.csv' file contains yes/no variables that are the direct inputs for the Tariff method analysis.

#### 7. How do I interpret the graphs?

- The graphs show bars whose heights are proportional to the estimated CSMF for each of the causes of death on the cause list for that age module
- These graphs include the added weights that were applied from the indeterminate VAs.

## Appendix A: Configuring Samsung Galaxy tablets

1. Setup with the project Google account. This requires an email and password.
2. 'Google Services' screen: uncheck the option underneath 'Communication'; this will disable updates and alerts from the Google Play store.
3. 'Payment' screen: select the 'Skip' option.
4. 'Backup and Restore' screen: keep all the options checked and hit the '>' button to proceed.
5. Name the tablet – D4H Initiative Tablet \*
  - \* = tablet number
  - once the tablet has been configured, you can change its name by going to the 'Contacts' app and selecting the first contact.
6. 'Samsung Account' screen
  - select 'Skip'
  - it will ask you to 'Verify Account' – select 'Skip'.
7. Dropbox screen: you will be asked to create a Dropbox account – select 'Skip'.
8. On the 'Device Name' screen you will be asked what you will want to name the device
  - Name the device using – 'D4H Initiative Tablet\*'
  - \* = tablet number.
9. Once you arrive at the home screen of the tablet, remove all apps from the screens
  - Press and hold any app until 'X remove' shows at the top of the screen and drag the applications to the trashcan icon at the top of the screen.
10. Install ODK Collect  from the Google Play store.
11. Install Applock (DoMobile Lab)  from the Google Play store.
12. Open Applock
  - Set the password to: 2016 – this is the same for all tablets. If you need to change the password
    - open Applock
    - go to the 'Protect' tab
    - select 'Unlock Settings'
    - under 'Password Setting' enter the new password.
13. Lock the following apps if they are installed on the machine. The exact list and order may vary based on the device and current version of the operating system
  - Play Store
  - Install/Uninstall
  - Email
  - Gmail
  - Messages
  - Chrome
  - Downloads
  - Drive
  - Dropbox
  - Earth

- Google
- Google+
- Hangouts
- Internet
- Maps
- Music
- Photos
- Play Books
- Play Games
- Play Movies
- Play Music
- Play Newstand
- Youtube
- Voice Search
- Galaxy Apps
- Samsung Apps
- Splanner
- Svoice.

## Appendix B: Configuring tablets for ODK Aggregate

1. Open ODK Collect.
2. Click on the upper-right corner and go to 'General Settings'.
3. Confirm that 'Platform' is 'ODK Aggregate'; change to this if required.
4. Click on 'Configure platform settings'
  - (a) change the URL to: https://<your server URL> (eg https://example.aggregate-server.com)
  - (b) username: enter the username provided to you by your Aggregate server administrator
  - (c) password: enter the password provided to you by your Aggregate server administrator.
5. Go back to the ODK Collect main menu.
6. Click on the upper-right corner and go to 'Admin Settings'
  - (a) click on 'Admin Password'
  - (b) change admin password: enter the password provided to you by your Aggregate server administrator
  - (c) click 'OK'.
7. Go back to 'Admin Settings'.

Deselect the following

  - (a) Delete saved form
  - (b) Platform
  - (c) Platform Settings
  - (d) Username
  - (e) Password
  - (f) Google account
  - (g) Delete after send
  - (h) Show splash screen.
8. Go back to the ODK Collect main menu.
9. Select 'Get Blank Form'
  - (a) connect with auto-filled credentials
  - (b) you should now see the name of the survey for download:  
'PHMRC\_Shortened\_Instrument\_8\_20\_2015'<sup>6</sup>
  - (c) select 'Get Selected'
  - (d) if it successfully downloads the survey, you should see a message such as  
'PHMRC\_Shortened\_Instrument\_8\_20\_2015 – Success'
  - (e) click 'OK'.

---

<sup>6</sup> Or name of the country specific questionnaire on your ODK Aggregate site

## Appendix C: Translation of the SmartVA instrument

*Last updated May 2016*

1. Download the Excel file and media folder for the VA questionnaire.<sup>7</sup>

Inside this document, you will find all of the information that creates the survey, including variable names, coding, skip patterns, constraints, and information regarding media files. **The majority of these columns should be left alone.** The only things you will be changing are marked with 'LANGUAGE'. From the 'Survey tab' this includes 'caption::LANGUAGE', 'constraint\_message::LANGUAGE' and 'hint::LANGUAGE'. From the 'Choices' tab it includes 'label::LANGUAGE'.

2. Change all pertinent titles to say specific language you are working with instead of 'LANGUAGE' (Figure 27 and Figure 28). These include:

- Excel document title
  - For example: 'PHMRC\_Shortened\_Instrument\_8\_20\_2015\_LANGUAGE.xls' to 'PHMRC\_Shortened\_Instrument\_8\_20\_2015\_Swahili.xls'
- Media folder
  - For example: 'PHMRC\_Shortened\_Instrument\_8\_20\_2015\_LANGUAGE-media' to 'PHMRC\_Shortened\_Instrument\_8\_20\_2015\_Swahili-media'
- Within the 'survey' tab:
  - Set form id in row 2
    - For Example: 'PHMRC\_Shortened\_Instrument\_8\_20\_2015\_LANGUAGE' to 'PHMRC\_Shortened\_Instrument\_8\_20\_2015\_Swahili'
  - Caption column header
    - For example: 'caption::LANGUAGE' to 'caption::Swahili'
  - Hint column header
    - For example: 'hint::LANGUAGE' to 'hint::Swahili'
- Within the 'choices' tab
  - Label column header
    - For example: 'label::LANGUAGE' to 'label::Swahili'

3. Create translations within the spreadsheet.

For captions, hints, and choices insert translations in corresponding row.

---

<sup>7</sup> Depending on what version you are using, these may be called 'ODK version of PHMRC shortened questionnaire', 'PHMRC\_Shortened\_Instrument', 'SmartVA\_countryname\_version' or something similar.



For example:

In the 'caption::English' column (column C) in row 37 it states, 'What is the sex of the respondent?'.  
Place the Swahili translation, 'Andika jinsia ya mhojiwa?', in the 'caption::Swahili' (column D) in row 37.

Translations need to be created for all captions and hints on the 'survey' tab and labels on the 'choices' tab.

4. Change default language setting.  
If you wish you can change the default language under the 'settings' tab from English.  
For example: Replace 'English' with 'Swahili' if you want to see the Swahili translations automatically when you open the survey.
5. Convert your excel document (.xls, .xlsx) into XForm (.xml). This can be done on the ODK website here: <http://opendatakit.org/use/xlsform/>
6. Download the converted XForm file created in Step 5 and put it on your tablet along with your media files. The instructions for how to do this can be found on the ODK help file: <http://www.healthdata.org/verbal-autopsy/tools>
7. Use the translated version of the instrument through ODK.  
Please note that it is possible to toggle between English and the language you have translated and put into the XLSForm. This toggling feature is different on each Android device but it is generally found as a part of the menu function (Figure 29).

**For further assistance:**

Many of users' concerns can be addressed by going directly to the ODK website, specifically the help page:

<http://opendatakit.org/help/>

There is also an ODK community group where questions can be posted:

<https://groups.google.com/forum/#!forum/opendatakit>

Figure 27: XLSForm (survey tab)

Rename these titles to specific language

	A	B	C	D	E	F
1	type	name	caption:English	caption:LANGUAGE	hint:English	hint:LANGUAGE
2	set form id	PHMRC_Full_Instrument_10_11_13_LANGUAGE				
3	get start time	interviewstarttime				
4	get today	interviewdate				
5						
6	begin group	Generalmodule	General Module			
7	add note prompt	gen_1_1	This instrument was developed by the Population Health Metrics Research Consortium.			
8	begin group	general2	Background about Interview Section			
9	add text prompt	gen_2_1	2.1: Language of interview			
10	add text prompt	gen_2_2	2.2: Interviewer name			
11	add integer prompt	gen_2_2a	2.2a: Interviewer ID number			
12	add text prompt	sid	2.2b: Study ID number			
13	end group					
14						
15	add note prompt	gen_2_4	Instructions to interviewer: Introduce yourself and explain the purpose of your visit. Ask to speak to the mother.	See example on next page.		
16	add note prompt	gen_2_4a	My name is \$(gen_2_2). I am your interviewer with (Organization Name). I have been informed that a death has occurred in your household. I am very sorry to hear that a member of your household has died.			
17						
18	add note prompt	gen_3_a	Consent Section			
19	begin group	general3	Consent Section			
20	add note prompt	gen_3_b	INTERVIEWER: Read the consent form to the respondent. Ask the respondent if he or she has any questions. Once any questions are answered, ask the respondent if he or she is willing to participate in the study.			
21	add select one prompt using yes/no/only	gen_3_1	3.1: Did respondent give consent?			
22						
23	begin group	qconsentCheck	No consent			
24	add note prompt	gen_3_2	Thank the respondent for his/her time and end the interview.			
25	end group					
26	end group					
27	add note prompt	gen_4_a	Information about Respondent Section			
28	begin group	general4	Information about Respondent Section			
29	add note prompt	gen_4_b	Instructions to interviewer: Inform the respondent that you would like to ask him/her some general questions about himself/herself.			
30	add text prompt	gen_4_1	4.1: What is your (the respondent's) name?			
31	add select one prompt using sex	gen_4_2	4.2: What is the sex of the respondent?			
32	add select one prompt using relationship	gen_4_3	4.3: What is your respondent's relationship to the deceased?			
33	add text prompt	gen_4_3a	4.3a: Birth attendant type (specify)			
34	add text prompt	gen_4_3b	4.3b: Other male (specify)			
35	add text prompt	gen_4_3c	4.3c: Other female (specify)			
36	add integer prompt	gen_4_4	4.4: How old are you?			Enter 999 if unknown

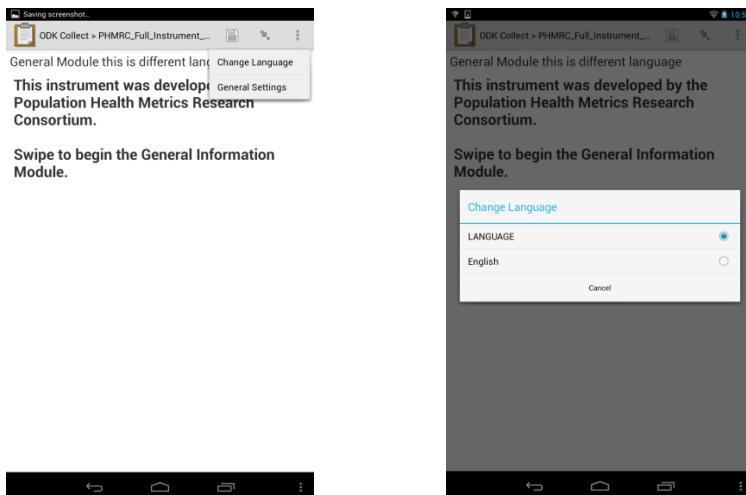
Fill translations into this column

Survey tab

Figure 28: XLS Form (choices tab)

list_name	name	label:English	label:LANGUAGE	image
yesno		1 Yes		
yesno		0 No		
yesno		8 Refused to answer		
yesno		9 Don't know		
monthDayNoAnswer		2 Months (enter on next page)		
monthDayNoAnswer		4 Days (enter on next page)		
monthDayNoAnswer		8 Refused to answer		
monthDayNoAnswer		9 Don't know		
yearMonthDayHourNoAnswer		1 Years (enter on next page)		
yearMonthDayHourNoAnswer		2 Months (enter on next page)		
yearMonthDayHourNoAnswer		4 Days (enter on next page)		
yearMonthDayHourNoAnswer		5 Hours (enter on next page)		
yearMonthDayHourNoAnswer		8 Refused to answer		
yearMonthDayHourNoAnswer		9 Don't know		
dayNoAnswer		4 Days (enter on next page)		
dayNoAnswer		8 Refused to answer		
dayNoAnswer		9 Don't know		
rashlocation		1 Face		
rashlocation		2 Trunk/Abdomen		
rashlocation		3 Extremities		
rashlocation		4 Everywhere		
rashlocation		5 Other (specify)		
rashlocation		8 Refused to answer		
rashlocation		9 Don't know		
sex		1 Male		
sex		2 Female		
sex		8 Don't know		
sex		9 Refused to answer		

Figure 29: ODK language selection screen



## Appendix D: Cause list for SmartVA against ICD-10 codes

ADULT CAUSES		
	Code to ICD-10	WHO ICD definition and comments
<b>GBD Cause Group A: Communicable, maternal, neonatal and nutritional disorders</b>		
AIDS	B24	Unspecified human immunodeficiency virus [HIV] disease
Diarrhea/Dysentery	A09	Other gastroenteritis and colitis of infectious and unspecified origin
Malaria	B54	Unspecified malaria
Maternal	O95	Obstetric death of unspecified cause: Maternal death from unspecified cause occurring during pregnancy, labour and delivery, or the puerperium
Other Infectious Diseases	B99	Other and unspecified infectious diseases
Pneumonia	J22	Unspecified acute lower respiratory infection
TB	A16	Respiratory tuberculosis, not confirmed bacteriologically or histologically
<b>GBD Cause Group B: Non-communicable diseases</b>		
Acute Myocardial Infarction	I24	Other acute ischaemic heart diseases (as for WHO 2014)
Breast Cancer	C50	Malignant neoplasm of breast
Chronic Respiratory Diseases	J44	Other chronic obstructive pulmonary disease
Cervical Cancers	C53	Malignant neoplasm of cervix uteri (WHO VA has C55 for all female reproductive neoplasms)
Cirrhosis	K74	Fibrosis and cirrhosis of liver
Colorectal Cancer	C18	Malignant neoplasm of colon
Diabetes	E14	Unspecified diabetes mellitus
Esophageal Cancer	C15	Malignant neoplasm of oesophagus
Leukemia/Lymphomas	C96	Other and unspecified malignant neoplasms of lymphoid, haematopoietic and related tissue
Lung Cancer	C34	Malignant neoplasm of bronchus and lung
Other Cardiovascular Diseases	I99	Other and unspecified disorders of circulatory system
Other Non-communicable Diseases	R100*	
Prostate Cancer	C61	Malignant neoplasm of prostate
Renal Failure (due to renal disease)	N19	Unspecified kidney failure
Stomach Cancer	C16	Malignant neoplasm of stomach
Stroke	I64	Stroke, not specified as haemorrhage or infarction
Other Cancers	C76	Malignant neoplasm of other and ill-defined sites
<b>GBD Cause Group C: Injuries</b>		
Bite of Venomous Animal	X27	Contact with other specified venomous animals
Drowning	W74	Unspecified drowning and submersion
Falls	W19	Unspecified fall
Fires	X09	Exposure to unspecified smoke, fire and flames
Homicide (assault)	Y09	Assault by unspecified means
Other Injuries	X58	Exposure to other specified factors

Poisonings (accidental)	X49	Accidental poisoning by and exposure to other and unspecified chemicals and noxious substances
Road Traffic	V89	Motor- or nonmotor-vehicle accident, type of vehicle unspecified
Suicide (intentional self-harm)	X84	Intentional self-harm by unspecified means
<b>CHILD CAUSES</b>		
<b>GBD Cause Group A: Communicable, maternal, neonatal and nutritional disorders</b>		
AIDS	B24	Unspecified human immunodeficiency virus [HIV] disease
Diarrhea/Dysentery	A09	Other gastroenteritis and colitis of infectious and unspecified origin
Encephalitis	G04	Encephalitis, myelitis and encephalomyelitis
Hemorrhagic fever	A99	Unspecified viral haemorrhagic fever
Malaria	B54	Unspecified malaria
Measles	B05	Measles
Meningitis	G03	Meningitis due to other and unspecified causes
Other Infectious Diseases	B99	Other and unspecified infectious diseases
Pneumonia	J22	Unspecified acute lower respiratory infection
Sepsis	A41	Other sepsis
<b>GBD Cause Group B: Non-communicable diseases</b>		
Other Cancers	C76	Malignant neoplasm of other and ill-defined sites
Other Cardiovascular Diseases	I99	Other and unspecified disorders of circulatory system
Other Defined Causes of Child Deaths	R99	Other ill-defined and unspecified causes of mortality
Other Digestive Diseases	K92	Other diseases of digestive system
<b>GBD Cause Group C: Injuries</b>		
Bite of Venomous Animal	X27	Contact with other specified venomous animals
Drowning	W74	Unspecified drowning and submersion
Falls	W19	Unspecified fall
Fires	X09	Exposure to unspecified smoke, fire and flames
Poisonings	X49	Accidental poisoning by and exposure to other and unspecified chemicals and noxious substances
Road Traffic	V89	Motor- or nonmotor-vehicle accident, type of vehicle unspecified
Violent Death	Y09	Assault by unspecified means
<b>NEONATE CAUSES</b>		
Birth asphyxia	P21	Birth asphyxia
Congenital malformation	Q89	Other congenital malformations, not elsewhere classified
Meningitis/Sepsis	P36	Bacterial sepsis of newborn
Pneumonia	P23/J22	Congenital pneumonia/Unspecified acute lower respiratory infection
Preterm Delivery	P07	Disorders related to short gestation and low birth weight, not elsewhere classified
Stillbirth	P95	Fetal death of unspecified cause

\*Non ICD-10 Code to signify other NCD not otherwise included in the SmartVA cause list.

The program partners on this initiative include: The University of Melbourne, Australia; CDC Foundation, USA; Vital Strategies, USA; Johns Hopkins Bloomberg School of Public Health, USA; World Health Organization, Switzerland.

Civil Registration and Vital Statistics partners:



## For more information contact:

CRVS-info@unimelb.edu.au  
crvsgateway.info

CRICOS Provider Code: 00116K

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