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IMPROVING CAUSE OF DEATH INFORMATION

Smart VA: Technical user manual

Resources and Tools 7

November 2016



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Important information

The information contained in this manual provides generic information on the collection of VA data using an electronic, shortened VA questionnaire; the use of tablets and ODK for data management; and the use of Tariff. 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. This should be done in consultation with their D4H Country Implementation team, prior to any VA activities taking place.

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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).

This step by step guide describes:

1. ODK tools for electronic data capture: practical steps on how to install ODK Collect, the VA questionnaire and media files onto tablet;
2. Conducting VA interviews in the field using a tablet: practical steps on how to operate the tablets for data collection and data management;
3. Assigning cause of death from VA interviews: including how the output of the electronic questionnaire can be directly inputted into SmartVA and analyzed for producing results;
4. How to troubleshoot common problems with tablets;

This manual can be used in conjunction with the SmartVA Interviewer's Manual that covers the roles and responsibilities of VA interviewers and supervisors, ethics and sensitivities of the interview and guidance around the questions included in SmartVA questionnaire. Both manuals can be used as a resource for trainers and implementers of SmartVA.

1. Summary

Verbal autopsy (VA) is a method for collecting information about an individual's signs and symptoms prior to death from their family, and interpreting this to diagnose the likely or most probable cause of death (COD). VA is increasingly recognized as the only practical alternative to medical certification of deaths in many countries 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 in a number of ways, primarily as:

- A research tool in longitudinal demographic and epidemiological studies to determine the COD in each individual enrolled in such studies or surveillance sites;
- A source of routine COD statistics for populations with dysfunctional vital registration systems and;
- For monitoring the process of disease control and evaluating quality of routine causes of death statistics.

SmartVA is a verbal autopsy tool consisting of an electronic verbal autopsy data collection questionnaire and a desktop application that runs an automatic diagnostic method, the 'Tariff Method', for mapping of verbal autopsies. The SmartVA desktop application uses VA interview data collected electronically using the Population Health Metrics Research Consortium (PHMRC) Shortened Questionnaire on the Open Data Kit (ODK) collect system 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 with the PHMRC Gold Standard VA database collected as part of the PHMRC Gold Standard VA Validation Study.¹ We refer to SmartVA as the whole package that includes the PHMRC shortened questionnaire, the ODK suite for data collection, and SmartVA-Analyze for computer certification of VAs.

¹ Murray CJ, et.al. **Population Health Metrics Research Consortium gold standard verbal autopsy validation study: design, implementation, and development of analysis datasets.** Population Health Metrics 2011, 9:27.

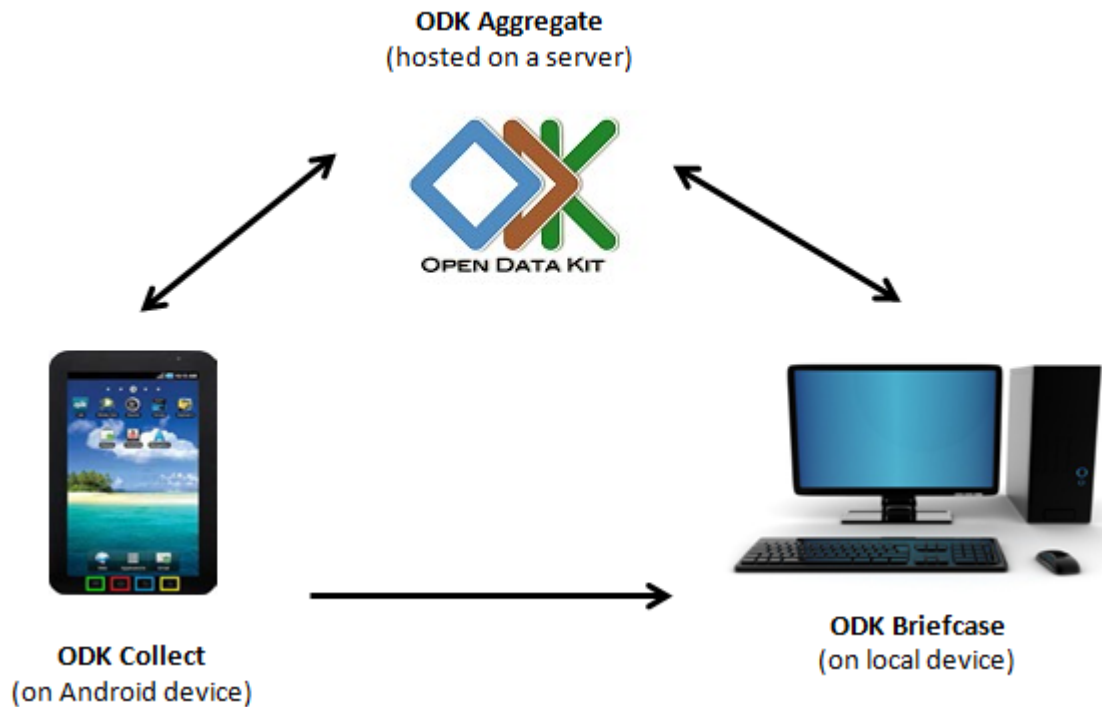
2. ODK tools for electronic data capture

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

1. **ODK Collect** is where forms to collect data are completed. It is used on Android devices, which can communicate with Aggregate and Briefcase to send or retrieve forms.
2. **ODK Aggregate** acts as a medium to see 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 need to be followed to collect verbal autopsies using this platform, presented in Figure 1.

Figure 1 Procedure for VA collection and analysis using SmartVA



2.1 ODK Collect

ODK Collect is a tool where forms are uploaded and data collection is completed. 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

2.1.1 Steps in downloading and installing ODK Collect

In order 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 in the tablet. ODK Collect can be installed directly onto a tablet in two ways, either downloading it from the Internet through “Play Store” or from a website, or by downloading to a computer and copying it across to the tablet for installation.

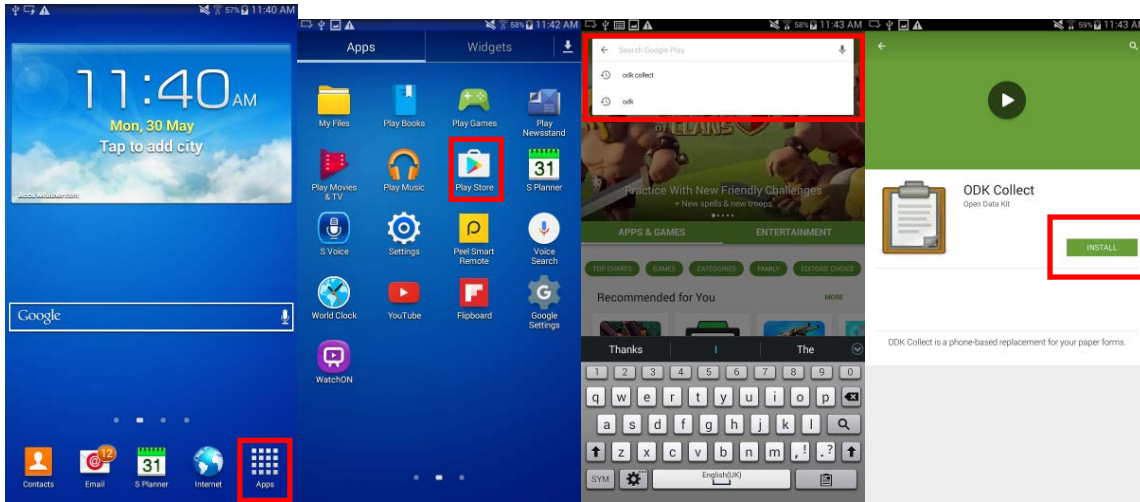
Note: Consider installing AppLock on your tablet to prevent unintended use of the tablet. For further information see the AppLock website <http://app-lock.en.uptodown.com/android>

Downloading directly to a tablet

Steps to download ODK Collect from the Internet through “PlayStore”

- Set a Gmail account (e.g. *abc@gmail.com*) to download any software from PlayStore
 - Note: for training purposes, a generic email and account can be set-up for multiple devices/participants to use
- Register the tablet using the Gmail account and password
- Open the ‘application drawer’ (Apps)
- Open ‘Playstore’
- Search for ‘ODK’ and select ‘ODK Collect’ from the options
- Click the ‘install’ button
- Click on OK after viewing the security settings and install the ODK APK to the tablet (Figure 3).

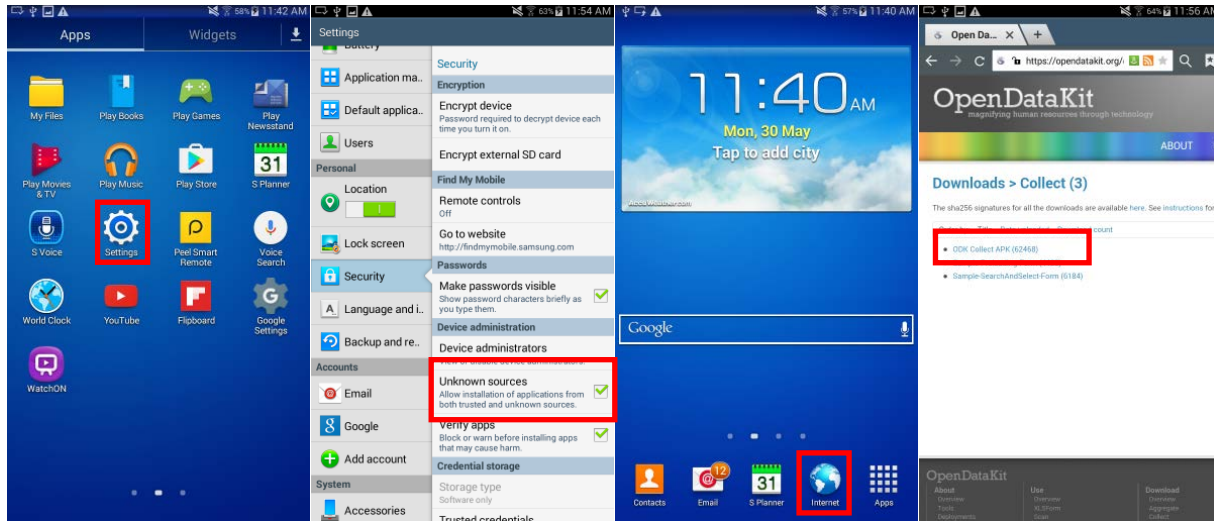
Figure 3 Steps in installing ODK Collect through PlayStore



Steps to download ODK Collect directly from the ODK website

- From your tablet's application drawer, choose 'Settings', then 'Security/Applications'
 - Make sure 'unknown source' is checked
- Return to the home screen of the tablet and click 'Internet'
- In the top URL menu, type in <https://opendatakit.org/downloads/download-category/collect/> and click on the 'go' button on the keyboard, or on the image of the magnifying glass
- In the download window, you will see ODK_Collect_APK
 - Select it to download the file (will take you to a new screen)
- On older tablets, the APK will automatically install after you approve the security settings
- On newer tablets, you must go to the download list, rename the file to restore the .apk extension (the extension will have been renamed to .man during the download process), then click on it to install it (Figure 4).

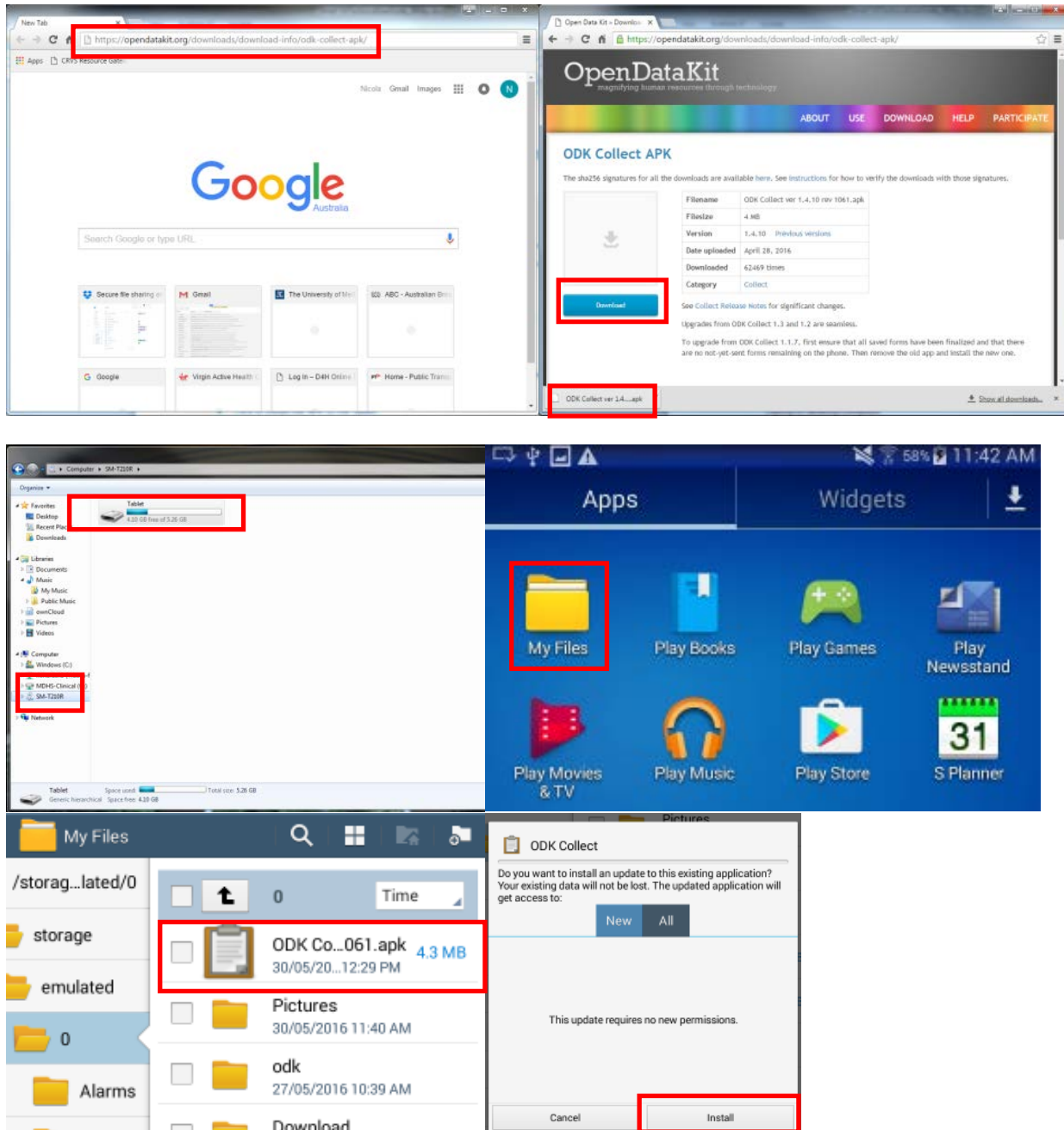
Figure 4 Steps in installing ODK Collect through the ODK website



Downloading to a computer

- 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
- From your Computer, open either Internet Explorer or Google Chrome
 - Go to <https://opendatakit.org/downloads/download-info/odk-collect-apk/> and click on 'download', and wait for the file to download
- Connect the tablet to the computer using the USB cable
 - To open the tablet's storage, go to the Start button, then click 'Computer'
 - The tablet will appear under the list of directories, on the left-hand side of the screen
- 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 to the tablet
- On the tablet, go to the applications drawer and click 'My files'
 - Select ODK Collect
 - Click 'install' (Figure 5).

Figure 5 Steps in downloading ODK Collect to a computer



2.1.2 Installing a blank VA questionnaire/media file 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:

- Create a folder called 'ODK Materials' on your computer
- To download a copy of the VA questionnaire, go to <http://www.healthdata.org/verbal-autopsy/tools> from your computer

- Click on 'ODK version of PHMRC Shortened Questionnaire'²
- By default, these files will be saved to the 'Downloads' folder on your computer
- Copy the downloaded .zip file from your 'Downloads' folder to the 'ODK Materials' folder you created earlier
- Extract or 'Unzip' this file and confirm that you have two excel spreadsheets, one .xml document, and a sub-folder now showing in your ODK Materials folder. Note that the .zip file can be deleted once this has been confirmed (Figure 6)
- Ensure that the tablet is connected by USB cable to the computer
 - To check if it has connected, go to 'Computer' and look for the tablet on the left-hand side menu
- After successfully installing ODK Collect, you will see the "odk" folder in the home directory of the tablet storage
 - If it doesn't come up automatically, open My Computer and find the tablet folder
 - Once the tablet folder is open it should look similar to Figure 7
 - From here open the "odk" folder, which should look similar to Figure 8
- In the ODK folder there will be three sub-folders (forms, instances, metadata)
 - Click and open the "forms" sub-folder
 - By copying and pasting or by simply dragging a file from another folder to this forms folder, you can add new blank forms to your tablet
 - Copy and paste the media folder and the form "PHMRC_Reduced_Instrument_date.xml" extracted earlier (from your 'ODK Materials' folder) into the forms folder
- Once finished, restart the tablet
- Newly added forms should now be available on ODK Collect under Fill Blank Form.

Figure 6 Example of files downloaded from IHME

Name	Date modified	Type	Size
Media	24/08/2016 15:58	File folder	
Guide for data entry.xlsx	11/08/2016 10:00	Microsoft Excel W...	27 KB
PHMRC_Shortened_Instrument_8_20_2015.xls	11/08/2016 10:00	Microsoft Excel 97...	230 KB
PHMRC_Shortened_Instrument_8_20_2015.xml	11/08/2016 10:00	XML Document	317 KB

² Other more recent adaptations of the questionnaire may be available from alternative sources.

Figure 7 Sample of screen showing ODK folder

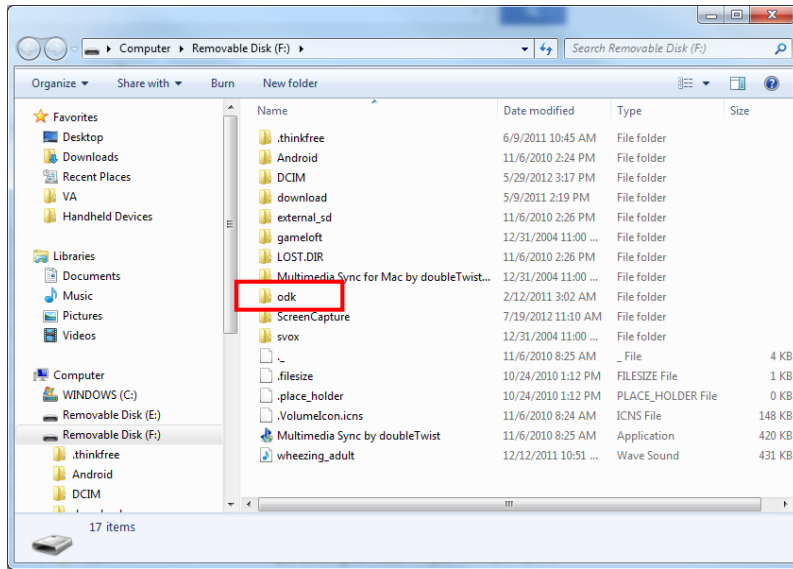
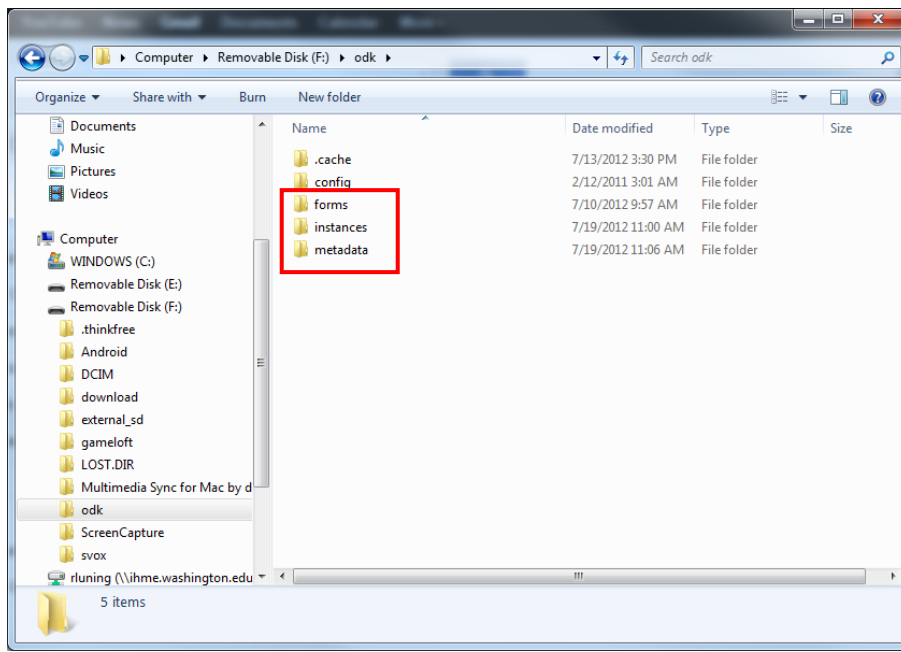


Figure 8 Sample of screen showing ODK folder contents



2.2 ODK Briefcase

ODK Briefcase is used to fulfill two primary roles. The first is to pull and 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 make this achievable.

Note: If you choose to deploy ODK Briefcase for this 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*

- Download the latest version of ODK Briefcase here: <https://opendatakit.org/downloads/download-info/odk-briefcase/>
- By default, the files will save to the 'Downloads' folder on the computer, they will also appear on the bottom left-hand side of the website page
- Click on the 'ODK Briefcase' folder to open it
 - A pop-up box will appear asking you to set the location on your computer where you would like to save your forms (Figure 9)
 - Click on 'Change' to select where you would like to save your forms (i.e. My Documents, Desktop, etc.)
- After an initial location has been set, you will be able to change the destination with the "Change..." button highlighted by the red circle in Figure 10
- 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, one can 'pull' a completed survey from a tablet to the ODK Briefcase folder stored on a PC
 - This survey can then be 'pushed' from the ODK Briefcase folder to an Aggregate server
 - 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

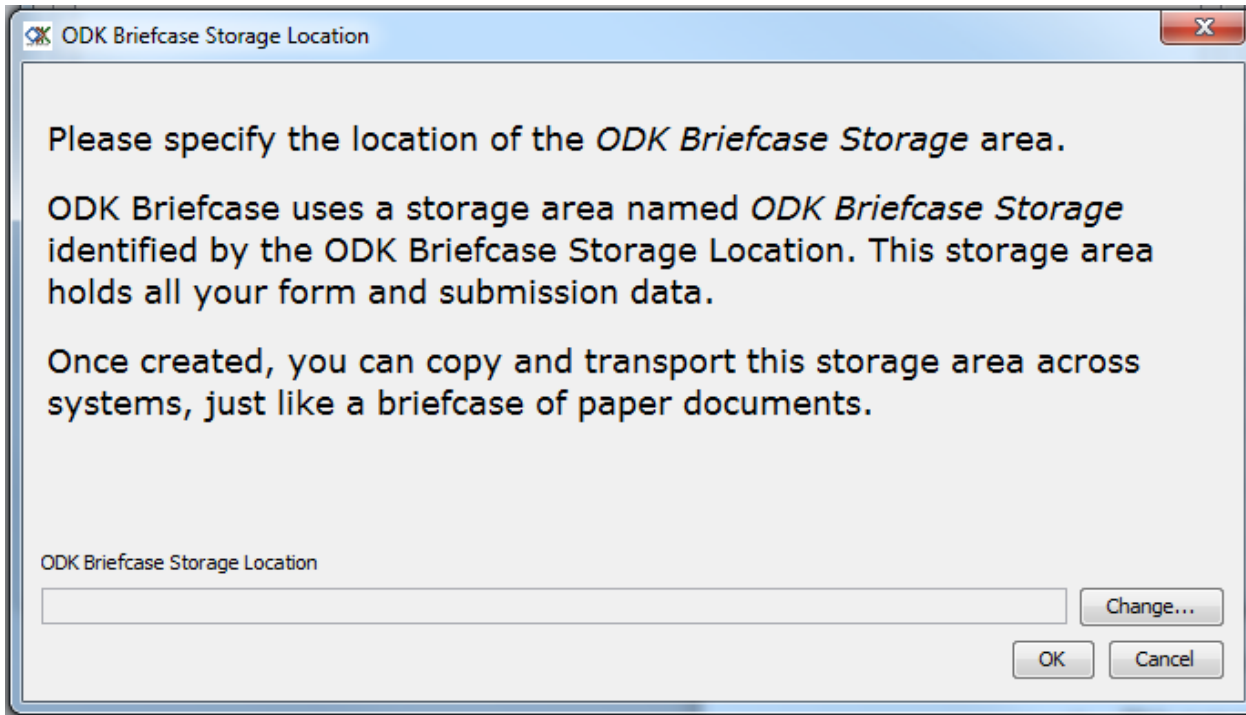


Figure 10 Changing the location where forms are saved

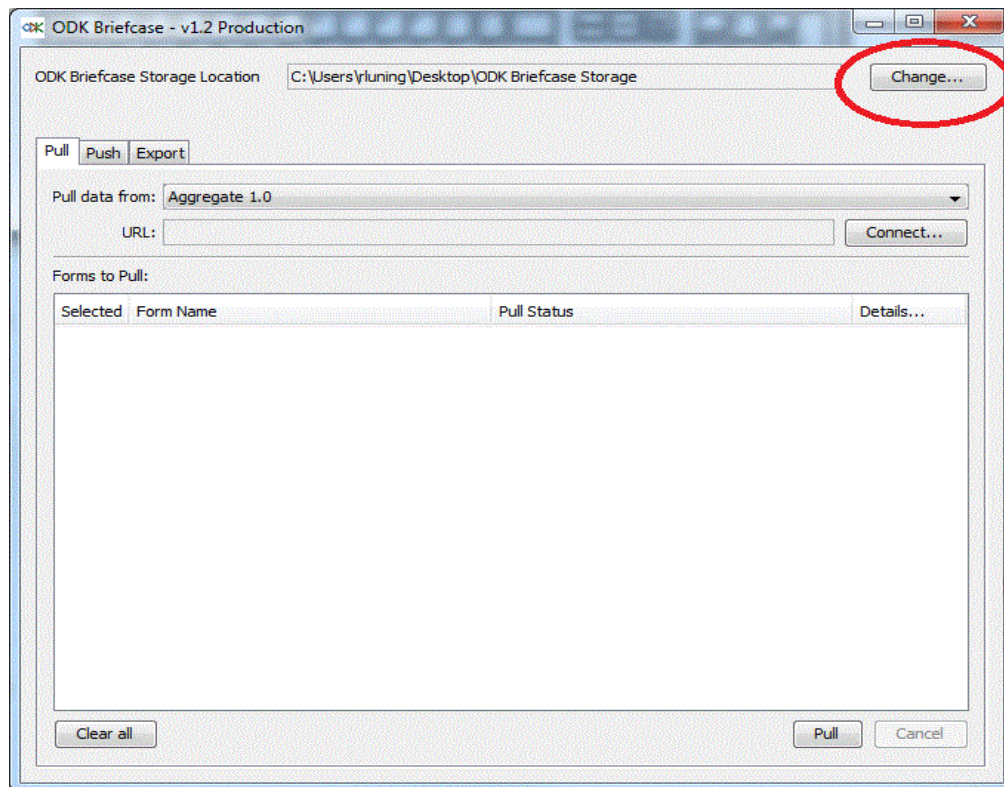
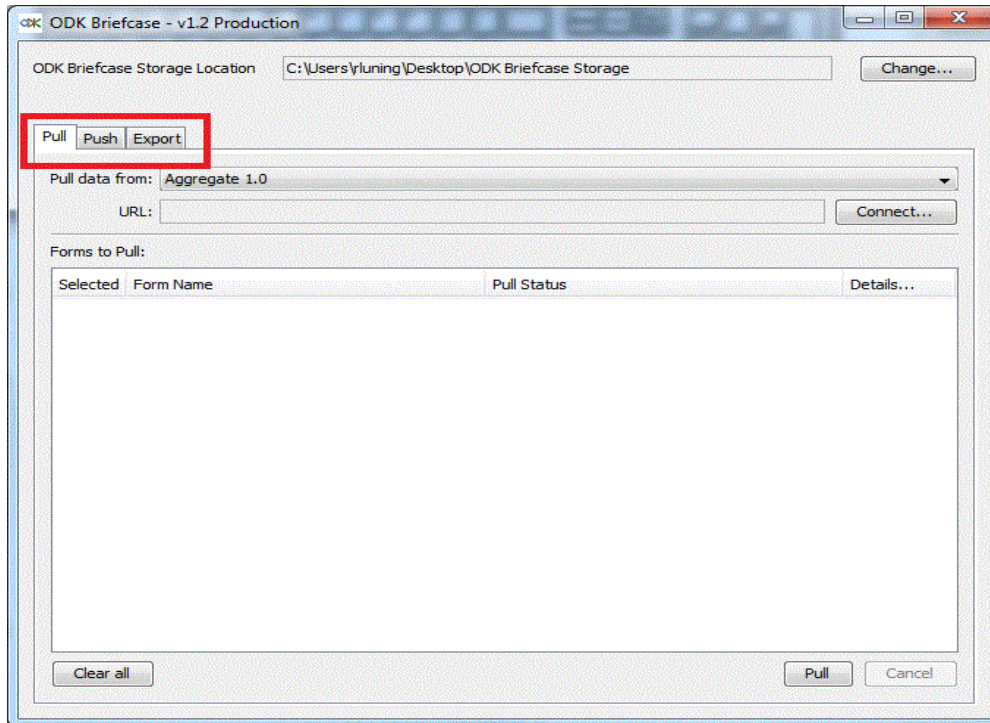


Figure 11 Pulling, pushing or exporting data



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, and 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 relates to what version the tablet is.

Mounted Android SD Card

Android version 3.x or lower

- The 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
- Once this happens, click “Choose...,” and the correct drive associated with the tablet should be selected
- Click OK, and the list of forms should populate. Here you’ll be able to select the forms you wish to pull into the ODK Briefcase Storage folder.

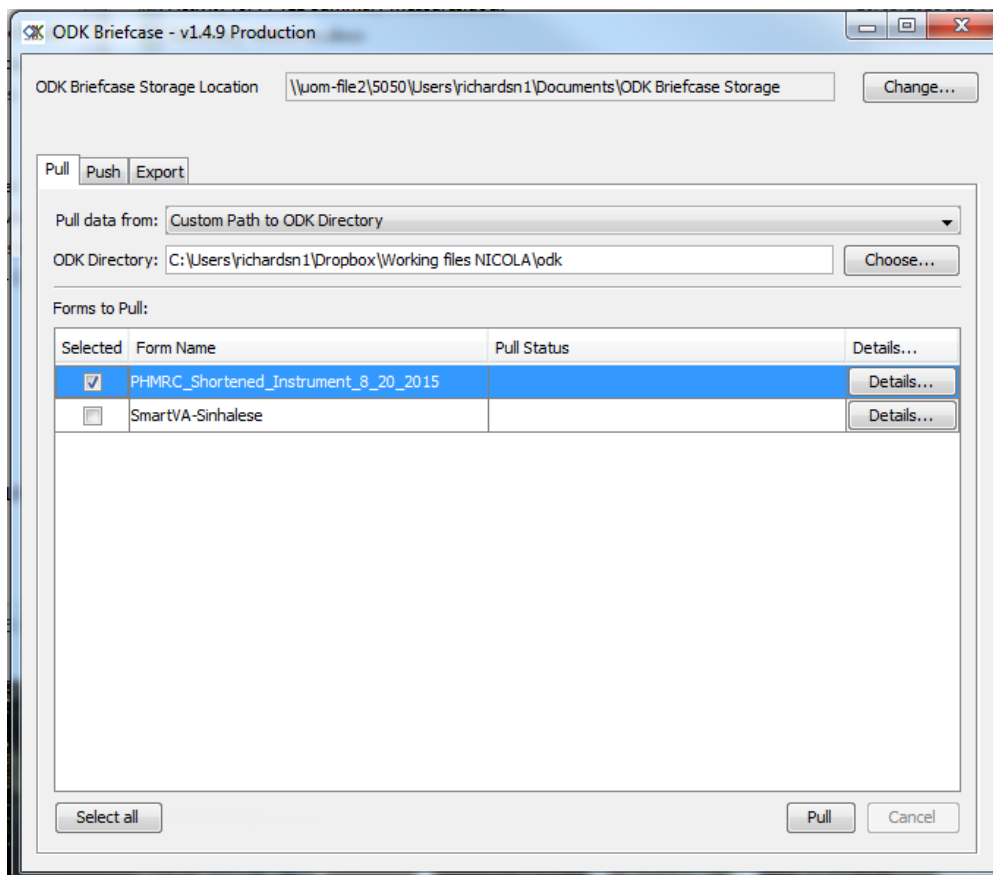
Android version 4.x or higher

- Note: At this time ODK Briefcase is unable to recognize Android devices running 4.x or higher. Use Custom path instead (See below).

Custom Path to ODK Directory

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

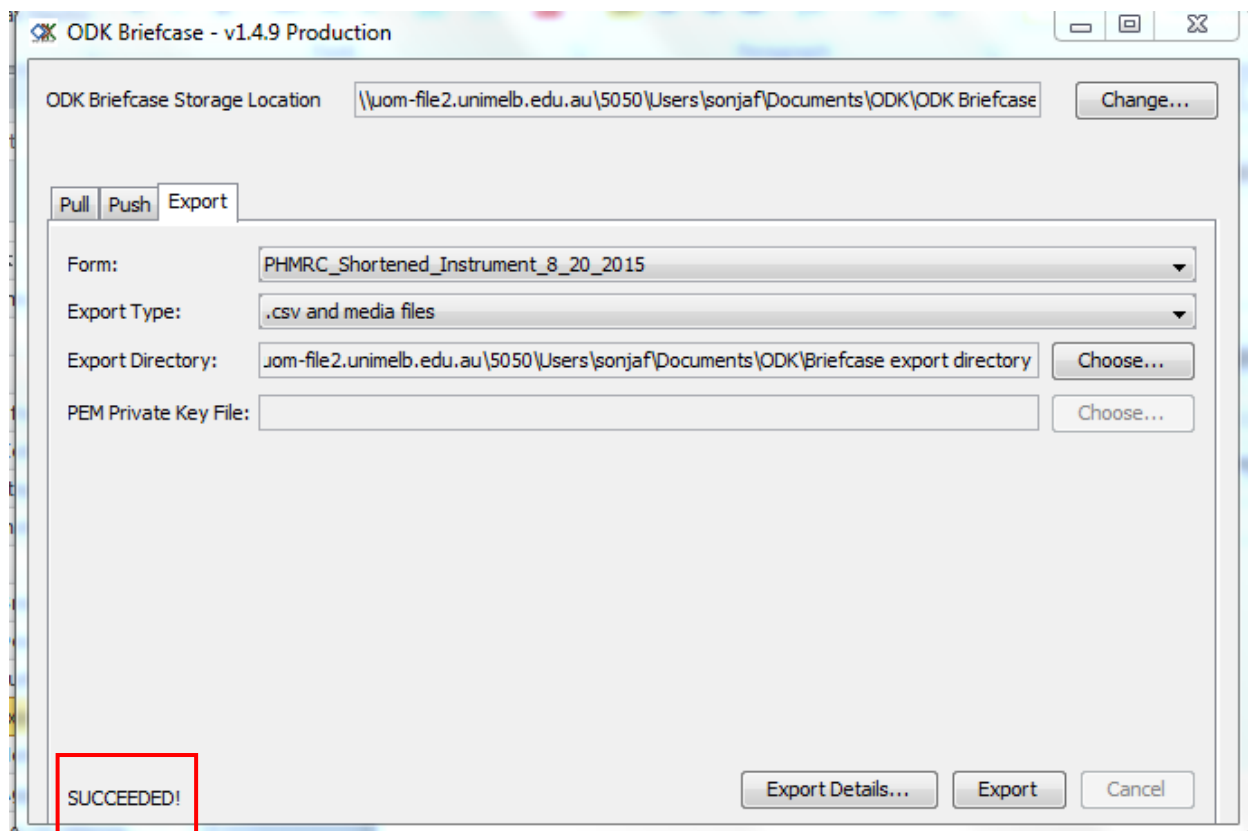
Figure 12 Pulling data using a custom path



2.2.3 Exporting from Briefcase

- Lastly, 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 SmartAnalyse cause of death assignments of VA data
- Select the form from the drop-down menu highlighted in the red box in Figure 13
- Change the export directory to a place where you wish to have the CSV file saved
- Click on export
 - If successful, a “succeeded” message will appear, as highlighted in the blue box in Figure 13.

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 the capability of 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 finalized forms (submissions) from ODK Collect, visualize 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 **Appendix E**. See also the ODK Aggregate guide at <https://opendatakit.org/use/aggregate/>

See also Appendix B: Setting up tablets for ODK aggregate

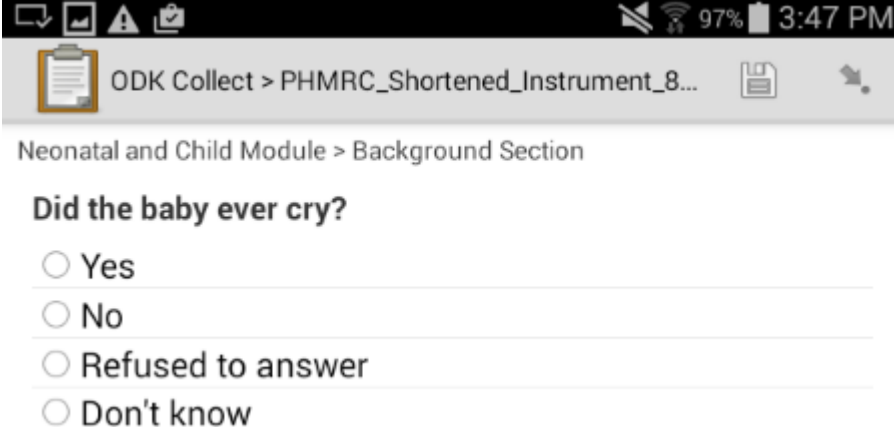
3. Conducting VA interviews in the field

3.1 General guidelines

3.1.1 General instructions

- The SmartVA Questionnaire consists of a general module followed by age-specific modules either for neonate (0-28 days), child (29 days- 11 years), or an adolescent/adult (>=12 years) death
- The questionnaires include filter questions with automatic skips to an appropriate question
- The response categories include options for a mix of Text Field, Radio Button, Check Box and Date Field for different questions
- The response categories of many questions are a mix of yes, no, refused to answer, and don't know, and these categories/responses by preceded by a radio button (a circular symbol which only allows selection of one category from the list (Figure 14).

Figure 14 Example of a yes/no question in ODK



ODK Collect > PHMRC_Shortened_Instrument_8...

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 select, and these categories are preceded by a check box. These check boxes are rectangular in shape and allow checking one or multiple categories on 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

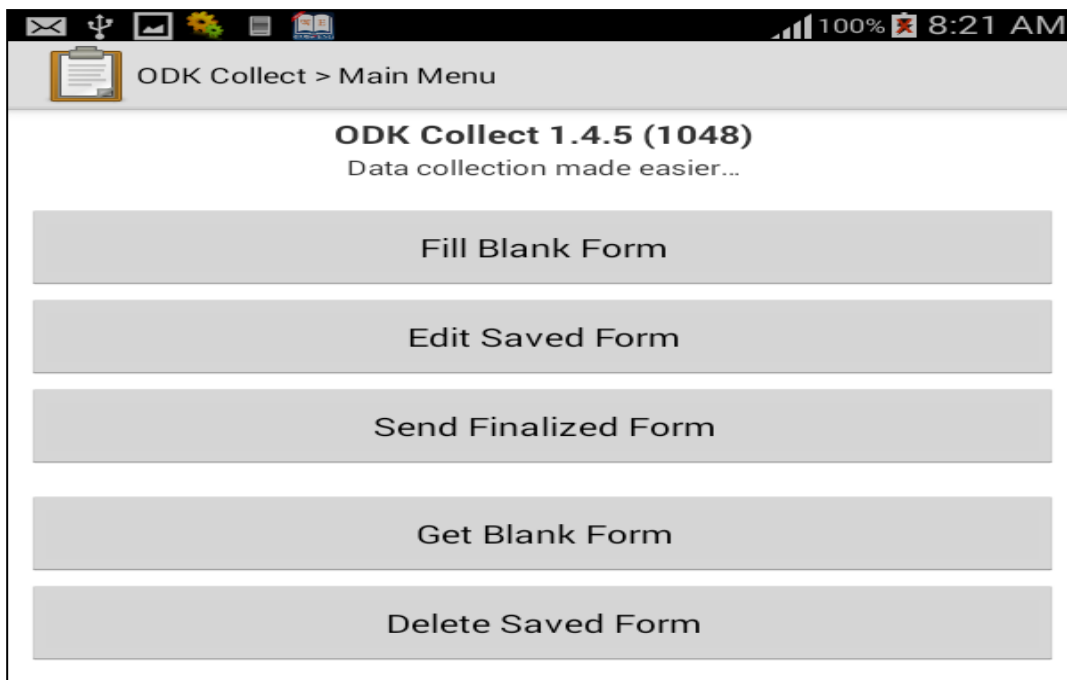
Don't know

- Swipe the screen of the tablet either right-to-left or left-to-right for continuing data entry (next page), or checking entered data (previous page)
- Generally 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"
 - A limited number of questions, however, will allow to proceed without making any responses
- Sometimes checking boxes/filling the radio button will provide space in next page to enter or write the appropriate response answer
- Touching the space will provide 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 from the Tab home screen (Figure 16)
 - a. 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 16 ODK VAQ collection menu



4. Touch the “Fill Blank Form” button from ODK Collect software to open the form
5. Touch the XML form named “SmartVA_Month_yyyy”³ to start a VA interview
 - a. Read the on-screen information about the questions before beginning to fill up questions
6. Swipe the screen right-to-left and continue the interview as per instruction
7. When the respondent agrees to continue the interview, read the screen instruction carefully on the Tab and follow the instructions (more information is provided in the interviewer manual on learning to fill up the interview process on structured questions). At the end of each age specific module, a screen will appear for filling a pre-selected keywords checklist while asking and hearing the open narrative section from the respondent.

³ The version may change. The latest version is June 2016

3.1.3 Completing open-ended responses

The 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 contain a list of pre-fixed categories preceded by check boxes and these allow multiple answers
- Discuss with local people and health professionals and make a dictionary of synonyms (locally used) of these categories for training local VA interview staff
- Select the categories by touching the boxes (a tick will appear)
- At the end, a screen will pop up asking for a file name
- Save and exit the screen to finish the work or start a new VA interview.
- When you get to the end of interview you will need to save the VA form completed for that death.

3.1.4 Saving the work and editing a VA

Editing can be made if anything was wrongly entered, by going back to the previous page (swiping right to left). After the form has been completed, edits can be made on VA form by clicking the "Edit Saved Form".

- At the end of each interview, a screen like below will pop-up (Figure 17)

- By default the tablet will show the form name “SmartVA_ Questionnaire_ Month_ yyyy” in the “Name this form” field
- Touch the button “Save and Exit Form” and finish the interview.

Figure 17 Save and exit screen at the end of ODK VAQ

You are at the end of SmartVA_June_2016_v2.

Name this form
SmartVA_June_2016_v2

Mark form as finalized

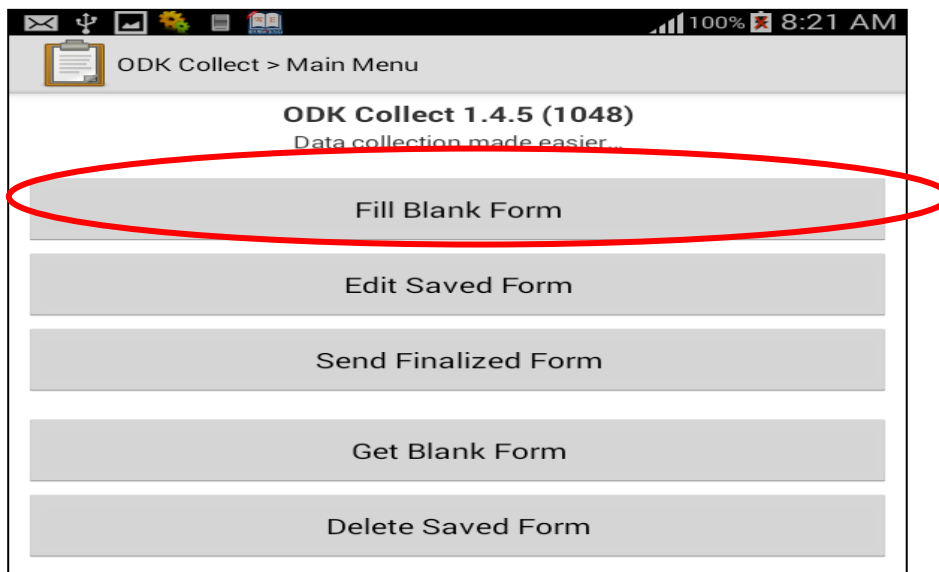
Save Form and Exit

Ensure you touch the ‘Save Form and Exit’ button to properly save the completed questionnaire

3.1.5 Data editing

You can see and edit the completed VA by touching the “Edit Saved Form” button from the main menu in the ODK Collect software (Figure 18).

Figure 18 Edit saved forms



- Step-1: After touching the “Edit Saved Form” button you will see list of VA form names
 - Touch one form and open it to see the data

- You can see the entire questionnaire by scrolling up/down
- Step-2: For editing, 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 in the Tab
 - It will save the changed data and you can come back to the entire questionnaire by touching the down-arrow icon at the top-right corner of the Tab.
- You can edit multiple questions by swiping left/right and finally touch the save icon in the Tab or when you reach the last question and touch the button “Save and Exit Form”.

3.1.6 *Data saving step by step*

Options are available to save the VA form either after entirely doing the VA or after completing any question by clicking "Save Changes" from the dialog box.

- For a new interview you can save the form by touching the button “Save and Exit Form” at 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" from 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*

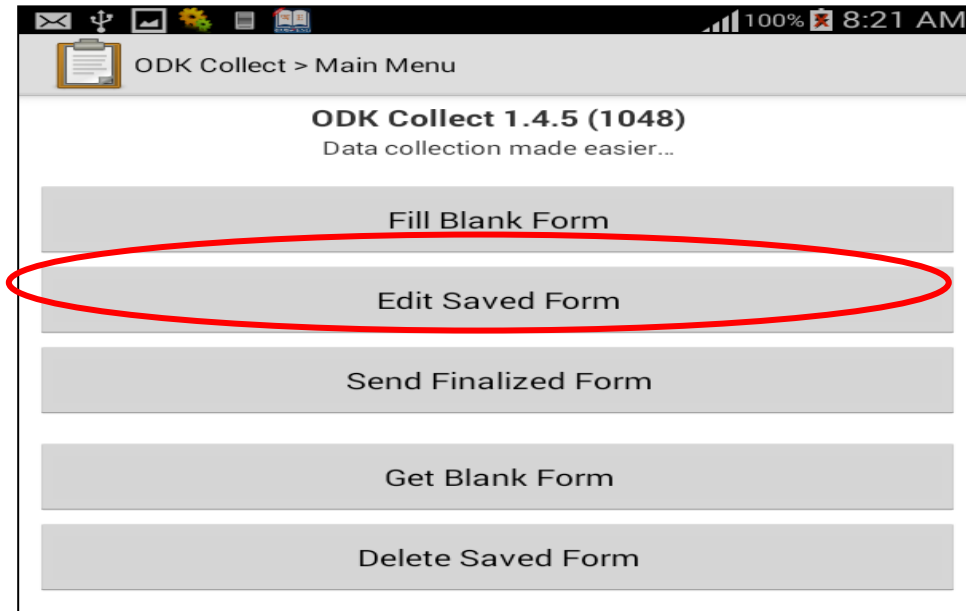
Once the VAs have been collected, they need to be transferred off the tablet for analysis in the SmartVA.

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) with the upload of the filled questionnaire using ODK Briefcase. The VA Interviewer needs to be told the method of data transfer in advance.

1. **If using online methods**, once the VA Interview is completed and saved, the VA Interviewer should select the interview on the tablet and press the ‘Send Finalised Form’ (Figure 19). The relevant VA

Interviews can be selected and sent to a remote central server ready for VA raw data storage and eventual analysis.

Figure 19 Send finalized forms



2. **If using off-line 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.

4. Analysis of VAs using SmartVA Analyze

Once a VA is collected, it is necessary to analyze it in order to diagnose the COD. Originally, this process was done through review of the VA by physicians, called PCVA. One or more physicians would review the VA, and diagnose a cause of death 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. 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 questionnaire on any Android device using ODK Collect. This has a number of advantages. Namely, it is low cost, rapid, reliable, and includes automated data quality checks, like skip patterns, where interviewers must follow survey skip patterns; logic constraints (i.e. pregnancy cannot last more than 10 months), and automated data entry (data is automatically downloaded and processed). There is also picture and audio capability (Figure 21). The questionnaire is also easily translatable into other languages.

Figure 20 Example of picture capabilities of the VAQ in ODK

ODK Collect > PHMRC_Shortened_Instrument_8...

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

4.2 Automated analysis and results using SMARTVA

The process of analysis of VA using Smart VA includes five basic steps:

1. Install the Tariff Software onto a laptop or PC
2. Choose input file
 - a. Once your data have been processed by ODK Briefcase, you can open SmartVA and select the location of your input data (Figure 22)
3. Choose output folder
 - a. Select where you would like the output from the analysis to be saved.
 - b. The output from the analysis will be saved in different subfolders within the folder you select in this step (Figure 23).

Figure 21 Choosing input file in SmartVA

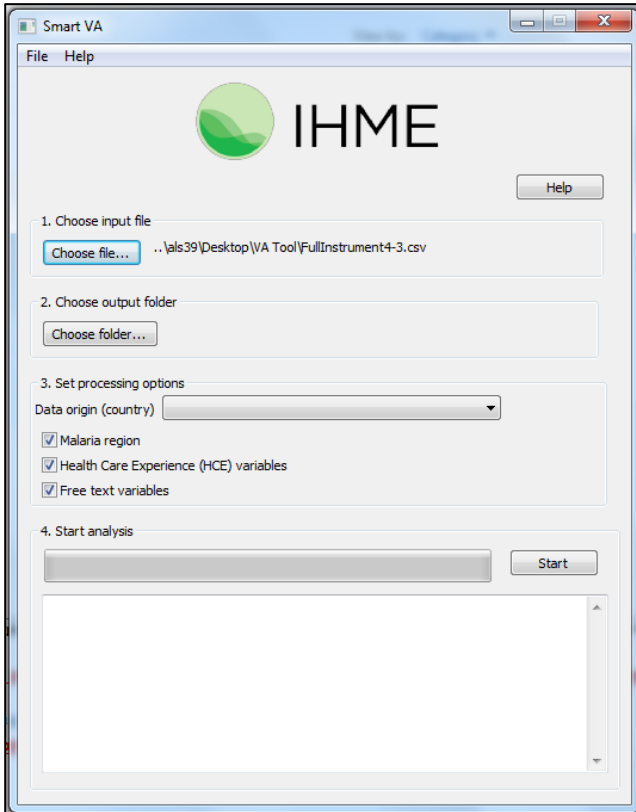
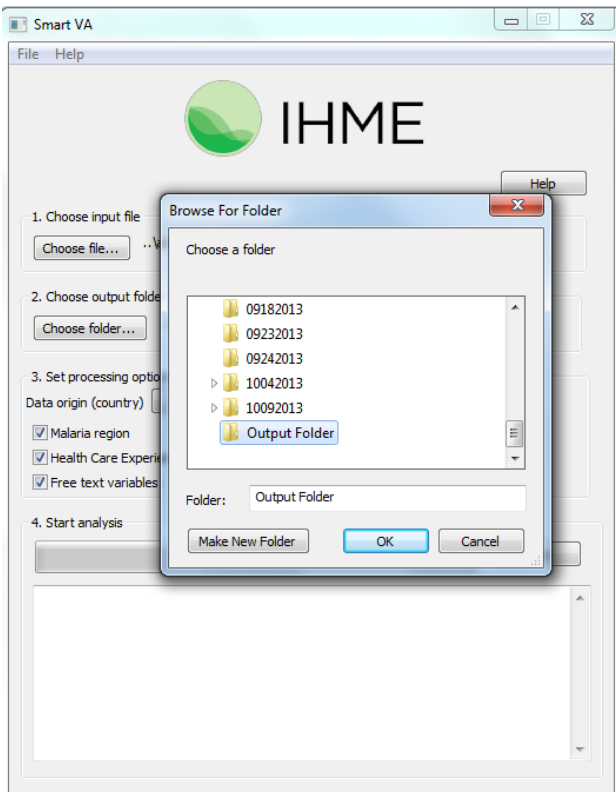


Figure 22 Choosing output folder in Smart VA



4. Set the options parameter. Four additional options can be specified (Figure 24):

a. **Country of origin.**

- i. The user may select the country where the VA data were collected. This information is used for reallocation of indeterminate VAs (that is, cases in which the method was not able to diagnose a cause of death in a reliable way based on the questionnaire) to present results for the entire population of VAs.
- ii. Individual observations from the data are not reallocated. Instead, the age and sex distribution of the “indeterminate” 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.
- iii. If no country of origin is specified, the indeterminate VAs will not be reallocated, and an additional category of “indeterminate” will be shown on the final CSMF graphs and CSV files

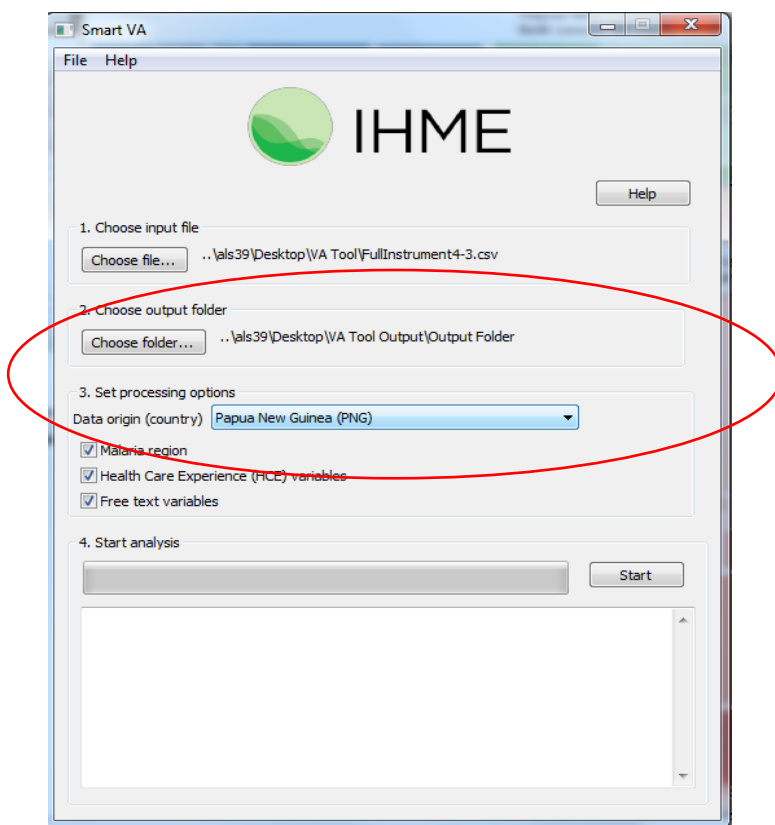
b. **Malaria region.** The user must determine whether malaria is a possible cause of death in the population from which the VAs were collected. If this box next to “**Malaria region**” is not selected, the Tariff Method will not assign malaria as a cause of death.

c. **Health care experience variables.**

- i. The user should determine whether, as part of the survey, questions regarding the health care experience (HCE) of the deceased or his/her family is asked. 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 training data which are not enhanced with HCE variables.
- ii. The following questions in the PHMRC questionnaire are considered “health care experience:”
 1. For adults, the question, “Did the deceased have any of the following?” followed by a list of chronic conditions.
 2. Any data that were transcribed from health records. (This is section 6 of the adult module and section 5 of the child/neonate module).
 3. For all age modules, responses to the question, “Could you please summarize, or tell us in your own words, any additional information about the illness and/or death of your loved one?”

- d. **Free text variables.** The Tariff Method has the capability of analyzing open response portions of the VA by turning them into “free text” variables.
- i. In the PHMRC questionnaire, the open response questions are the following:
 1. “Could you please summarize, or tell us in your own words, any additional information about the illness and/or death of your loved one?”
 2. Transcription of medical records and death certificates that are available at the time of interview
 - ii. If your data have an open response component and you would like this to be analyzed by the Tariff Method, make sure the box next to “**Free text variables**” is selected
 - iii. The Tariff Method currently is capable of analyzing open response data only in English
5. Push start button to begin the analysis.

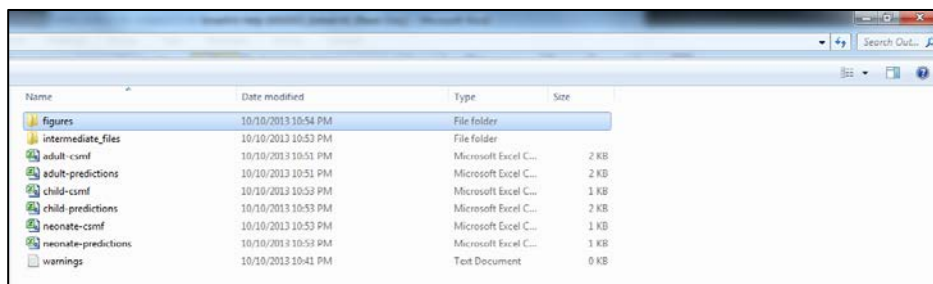
Figure 23 Setting processing options in Smart VA



4.3 Analyzing output files

SmartVA generates several output files. The file containing the individual-level cause of death 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 24 SmartVA output files



As denoted, 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).

Figure 25 Example of SmartVA output file

	A	B	C	D	E
1	sid	cause	cause34	age	sex
2	Example_VA_1	1	AIDS	31	1
3	Example_VA_2	1	AIDS	31	1
4	Example_VA_3	21	Maternal	23	1
5	Example_VA_4	21	Maternal	17	1
6	Example_VA_5	21	Maternal	27	1
7	Example_VA_6	9	Diabetes	43	1
8	Example_VA_7	32	Stroke	60	0
9	Example_VA_8	18	Leukemia/Lymphomas	42	0
10	Example_VA_9	30	Road Traffic	27	0
11	Example_VA_10	4	Breast Cancer	55	1
12					
13					
14					

While the program is running, it updates the user by printing update messages both on the user interface and in a file called “warnings” in the output folder (Figure 27). The warnings file alerts the user to any variables that contain illegal values such as skip patterns, violations of the PHMRC questionnaire, or values that are out of range or unexpected for each of the variables in the input data. If a row contains an illegal value, the software will reset this value to a default value and continue analyzing the data. The output in Figure 27 is showing that some observations in the VA dataset had values for variables that should have been skipped according to the PHMRC questionnaire.

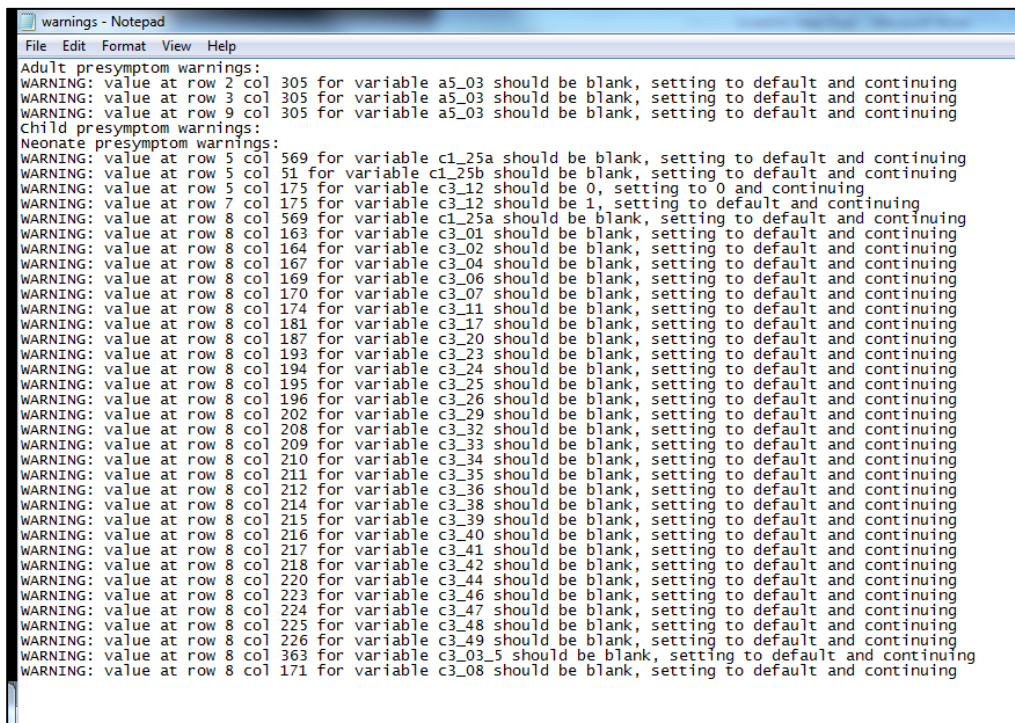
The other subfolders in the output folder contain intermediate files that the Tariff Method requires to run and graphs that show the CSMFs for each age and cause.

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.

The results are then assessed for prediction quality, and low-scoring predictions are marked as indeterminate for individual-level estimates. Cases with an indeterminate cause of death are redistributed to other causes based on country-specific cause fractions for population-level estimates. The final target cause list for adults, children, and neonates includes 34, 21, and six gold standard (GS) causes, respectively, plus stillbirths. This cause list can be mapped to ICD-10 codes (**see Appendix D**).

Smart VA produces several output files including raw data file and error logs. The file containing the individual-level cause of death assignments for your data are the files called “adult-predictions.csv,” “child-predictions.csv,” and “neonate-predictions.csv.” These data can be further processed into tables and graphs using Excel and other analytic software.

Figure 26 Example of warning while running SmartVA



```
warnings - Notepad
File Edit Format View Help
Adult presymptom warnings:
WARNING: value at row 2 col 305 for variable a5_03 should be blank, setting to default and continuing
WARNING: value at row 3 col 305 for variable a5_03 should be blank, setting to default and continuing
WARNING: value at row 9 col 305 for variable a5_03 should be blank, setting to default and continuing
Child presymptom warnings:
Neonate presymptom warnings:
WARNING: value at row 5 col 569 for variable c1_25a should be blank, setting to default and continuing
WARNING: value at row 5 col 51 for variable c1_25b should be blank, setting to default and continuing
WARNING: value at row 5 col 175 for variable c3_12 should be 0, setting to 0 and continuing
WARNING: value at row 7 col 175 for variable c3_12 should be 1, setting to default and continuing
WARNING: value at row 8 col 569 for variable c1_25a should be blank, setting to default and continuing
WARNING: value at row 8 col 163 for variable c3_01 should be blank, setting to default and continuing
WARNING: value at row 8 col 164 for variable c3_02 should be blank, setting to default and continuing
WARNING: value at row 8 col 167 for variable c3_04 should be blank, setting to default and continuing
WARNING: value at row 8 col 169 for variable c3_06 should be blank, setting to default and continuing
WARNING: value at row 8 col 170 for variable c3_07 should be blank, setting to default and continuing
WARNING: value at row 8 col 174 for variable c3_11 should be blank, setting to default and continuing
WARNING: value at row 8 col 181 for variable c3_17 should be blank, setting to default and continuing
WARNING: value at row 8 col 187 for variable c3_20 should be blank, setting to default and continuing
WARNING: value at row 8 col 193 for variable c3_23 should be blank, setting to default and continuing
WARNING: value at row 8 col 194 for variable c3_24 should be blank, setting to default and continuing
WARNING: value at row 8 col 195 for variable c3_25 should be blank, setting to default and continuing
WARNING: value at row 8 col 196 for variable c3_26 should be blank, setting to default and continuing
WARNING: value at row 8 col 202 for variable c3_29 should be blank, setting to default and continuing
WARNING: value at row 8 col 208 for variable c3_32 should be blank, setting to default and continuing
WARNING: value at row 8 col 209 for variable c3_33 should be blank, setting to default and continuing
WARNING: value at row 8 col 210 for variable c3_34 should be blank, setting to default and continuing
WARNING: value at row 8 col 211 for variable c3_35 should be blank, setting to default and continuing
WARNING: value at row 8 col 212 for variable c3_36 should be blank, setting to default and continuing
WARNING: value at row 8 col 214 for variable c3_38 should be blank, setting to default and continuing
WARNING: value at row 8 col 215 for variable c3_39 should be blank, setting to default and continuing
WARNING: value at row 8 col 216 for variable c3_40 should be blank, setting to default and continuing
WARNING: value at row 8 col 217 for variable c3_41 should be blank, setting to default and continuing
WARNING: value at row 8 col 218 for variable c3_42 should be blank, setting to default and continuing
WARNING: value at row 8 col 220 for variable c3_44 should be blank, setting to default and continuing
WARNING: value at row 8 col 223 for variable c3_46 should be blank, setting to default and continuing
WARNING: value at row 8 col 224 for variable c3_47 should be blank, setting to default and continuing
WARNING: value at row 8 col 225 for variable c3_48 should be blank, setting to default and continuing
WARNING: value at row 8 col 226 for variable c3_49 should be blank, setting to default and continuing
WARNING: value at row 8 col 363 for variable c3_03_5 should be blank, setting to default and continuing
WARNING: value at row 8 col 171 for variable c3_08 should be blank, setting to default and continuing
```

4.4 Logistic issues in the use of Smart VA

SmartVA is suitable to collect and analyze information collected for different purposes (contribution to vital registration systems, surveys, epidemiologic studies, etc.). In this section we discuss some logistic issues that have to be considered for data collection.

4.4.1 Translation of the VA questionnaire to different languages

The PHMRC questionnaire was developed in English, and so far has been translated to eight different languages for application. Along with SmartVA, an interphase has been created to facilitate translation to different 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. A step by step process is described below for how to develop a local language questionnaire to be used in ODK Collect (Box 2).

Box 2: Developing a local language tool in Excel

Step 1: Translate all the text, from Excel file, under the caption, hint and label 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 into the excel file, and save the file.

Step 3: Convert the excel file to “xml Form” you need to go to <http://opendatakit.org/xiframe/>

Step 4: Click the “Browse...” button and select the Excel file from your computer hard drive and click the “Submit” button.

Step 5: After sometime (approximately one minute) it will show the “Download” button for downloading the “xml Form”. If the translated local language Excel file is ok 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

4.5 Data collection logistics and quality control

The quality of data collected is essential for an adequate estimation of causes of death 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 along the field work process. Although the VA questionnaire has been previously 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 can't 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
 - Hopefully the tablet will recognize the charger and begin to recharge the battery
 - If it does not, the battery may be defective and need to be replaced.

2. Screen Doesn't 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
 - Begin by pressing and holding 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

- **Safely Remove Your SD Card**
 - From the home screen, tap the Menu key, then tap Settings

- Once in Settings, scroll to and tap Storage. In Storage, scroll to and tap unmount SD card, then tap OK
- You can now safely remove the SD card.
- **Perform a Soft Reset**
 - A soft reset restarts your device and does not erase any of your content or data
 - Begin by pressing and holding 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 with PC using USB cable, you should see the odk folder in the list of folders with three subfolders within it
 - These are “forms, instances and metadata”
- If it does not show up, turn off tablet and PC and turn on again, eventually it would show up and you will be able to include xml form and unzipped media file.

6. What are the age cutoffs 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 standardized 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 dichotomized or 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 cause-specific mortality fraction (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.

5.1 Acronyms and abbreviations

CCC	Chance corrected concordance
COD	Cause of death
CRVS	Civil registration and vital statistics
CSMF	Cause specific mortality fraction
GS(C)	Gold-standard cause
HCE	Health care experience
ICD	International Classification of Diseases
IHME	Institute of Health Metrics and Evaluation
ODK	Open Data Kit
PCVA	Physician certified verbal autopsy
PHMRC	Population Health Metrics Research Consortium
Tab	Tablet
VA	Verbal autopsy
VAQ	Verbal autopsy questionnaire

Appendix A: Configuring Samsung Galaxy tablets

1. Setup with the project google account
 - This requires an email and password.
2. Google Services Screen:
 - Only uncheck the option underneath 'Communication'
 - This will be for 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
 - Hit the '>' button and proceed.
5. Name the tablet - D4H Initiative Tablet *
 - * = Tablet Number
 - You will be able to change the name of the tablet once the tablet has been configured.
 - Go to the 'Contacts' app and select the first contact.
6. Samsung Account Screen
 - Select 'Skip'
 - It will ask you to 'Verify Account' – Select 'Skip'.
7. Dropbox Screen
 - You will be offered to create a Dropbox account – Select 'Skip'.
8. Device Name Screen
 - Asking you what you will want to name the device
 - Name the device using – "D4H Initiative Ta*"
 - * = Tablet Number.
9. Once you arrive to the Home screen of the tablet, remove all apps from the screens
 - Press and hold 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 ODKCollect  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 slightly vary based on the device and current version of the operating system:
 - Google 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
- Planner
- 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 if required
4. Click on 'Configure platform settings'
 - Change the URL to: `https://<your server URL>` e.g. `https://example.aggregate-server.com`
 - Username: enter the username provided to you by your Aggregate server administrator
 - 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 the Admin Settings
 - Click on 'Admin Password'
 - Change Admin Password: enter the password provided to you by your Aggregate server administrator
 - Click ok
7. Go back to 'Admin Settings'

Deselect the following:

 - Delete Saved Form
 - Platform
 - Platform Settings
 - Username
 - Password
 - Google account
 - Delete after send
 - Show splash screen
8. Go back to the ODK Collect Main Menu
9. Select 'Get Blank Form'
 - Connect with auto filled credentials
 - You should now see the name of the survey: "PHMRC_Shortened_Instrument_8_20_2015"
 - Select "Get Selected"
 - If it successfully downloads the survey, you should see -
PHMRC_Shortened_Instrument_8_20_2015 - Success
 - Click 'OK'

Appendix C: Translation of the SmartVA instrument

Last updated May 2016

1. Download the excel file and media folder for the VA questionnaire⁴.

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 28 and Figure 29). 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.

⁴ Pending what version you are using, these may be called ‘ODK version of PHMRC shortened questionnaire’, ‘PHMRC_Shortened_Instrument’, 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 label 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. Submit your excel document to convert XLS into XForm. This can be done on the ODK website here: <http://opendatakit.org/use/xlsform/>
6. Download XForm 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 30).

For further assistance:

Many of users’ 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

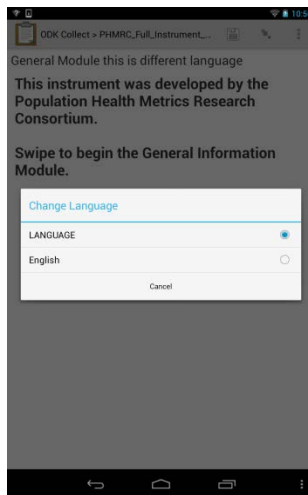
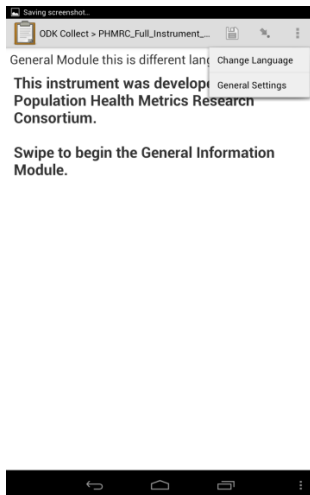
Fill translations into this column

Survey tab

Figure 28 XLS Form (choices tab)

1	list_name	name	label:English	label:LANGUAGE	image
2	yesno		1 Yes		
3	yesno		0 No		
4	yesno		8 Refused to answer		
5	yesno		9 Don't know		
6	monthDayNoAnswer		2 Months (enter on next page)		
7	monthDayNoAnswer		4 Days (enter on next page)		
8	monthDayNoAnswer		8 Refused to answer		
9	monthDayNoAnswer		9 Don't know		
10	yearMonthDayHourNoAnswer		1 Years (enter on next page)		
11	yearMonthDayHourNoAnswer		2 Months (enter on next page)		
12	yearMonthDayHourNoAnswer		4 Days (enter on next page)		
13	yearMonthDayHourNoAnswer		5 Hours (enter on next page)		
14	yearMonthDayHourNoAnswer		8 Refused to answer		
15	yearMonthDayHourNoAnswer		9 Don't know		
16	dayNoAnswer		4 Days (enter on next page)		
17	dayNoAnswer		8 Refused to answer		
18	dayNoAnswer		9 Don't know		
19	rashlocation		1 Face		
20	rashlocation		2 Trunk/Abdomen		
21	rashlocation		3 Extremities		
22	rashlocation		4 Everywhere		
23	rashlocation		5 Other (specify)		
24	rashlocation		8 Refused to answer		
25	rashlocation		9 Don't know		
26	sex		1 Male		
27	sex		2 Female		
28	sex		8 Don't know		
29	sex		9 Refused to answer		

Figure 29 ODK language selection screen



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

ADULT CAUSES			
	SmartVA	Code to ICD-10	WHO ICD definition and comments
GBD Cause Group A: Communicable, maternal, neonatal and nutritional disorders			
AIDS	B20	B24	Unspecified human immunodeficiency virus [HIV] disease
Diarrhea/Dysentery	A09	A09	Other gastroenteritis and colitis of infectious and unspecified origin
Malaria	B54	B54	Unspecified malaria
Maternal	O67	O95	Obstetric death of unspecified cause: Maternal death from unspecified cause occurring during pregnancy, labour and delivery, or the puerperium
Other Infectious Diseases	ZZ21	B99	Other and unspecified infectious diseases
Pneumonia	J12	J22	Unspecified acute lower respiratory infection
TB	A15	A16	Respiratory tuberculosis, not confirmed bacteriologically or histologically
GBD Cause Group B: Non-communicable diseases			
Acute Myocardial Infarction	I21	I24	Other acute ischaemic heart diseases (as for WHO 2014)
Asthma	J45	J45	Asthma
Breast Cancer	C50	C50	Malignant neoplasm of breast
COPD	J33	J44	Other chronic obstructive pulmonary disease
Cervical Cancers	D05	C53	Malignant neoplasm of cervix uteri (WHO VA has C55 for all female reproductive neoplasms)
Cirrhosis	K71	K74	Fibrosis and cirrhosis of liver
Colorectal Cancer	G18	C18	Malignant neoplasm of colon
Diabetes	E10	E14	Unspecified diabetes mellitus
Epilepsy	G40	G40	Epilepsy
Esophageal Cancer	C15	C15	Malignant neoplasm of oesophagus
Leukemia/Lymphomas	D91 (G96)	C96	Other and unspecified malignant neoplasms of lymphoid, haematopoietic and related tissue
Lung Cancer	C34	C34	Malignant neoplasm of bronchus and lung
Other Cardiovascular Diseases	ZZ23	I99	Other and unspecified disorders of circulatory system
Other Non-communicable Diseases	ZZ25	R99	Other ill-defined and unspecified causes of mortality
Prostate Cancer	H61	C61	Malignant neoplasm of prostate
Renal Failure (due to renal disease)	N17	N19	Unspecified kidney failure
Stomach Cancer	A16	C16	Malignant neoplasm of stomach
Stroke	I64	I64	Stroke, not specified as haemorrhage or infarction
Other Cancers	ZZ22	C76	Malignant neoplasm of other and ill-defined sites
GBD Cause Group C: Injuries			
Bite of Venomous Animal	X20	X27	Contact with other specified venomous animals
Drowning	W65	W74	Unspecified drowning and submersion
Falls	W00	W19	Unspecified fall
Fires	X09	X09	Exposure to unspecified smoke, fire and flames

Homicide (assault)	Y00	Y09	Assault by unspecified means
Other Injuries	Z227	X58	Exposure to other specified factors
Poisonings (accidental)	T36	X49	Accidental poisoning by and exposure to other and unspecified chemicals and noxious substances
Road Traffic	V99	V89	Motor- or nonmotor-vehicle accident, type of vehicle unspecified
Suicide (intentional self-harm)	X70	X84	Intentional self-harm by unspecified means
CHILD CAUSES			
GBD Cause Group A: Communicable, maternal, neonatal and nutritional disorders			
AIDS	B20	B24	Unspecified human immunodeficiency virus [HIV] disease
Diarrhea/Dysentery	A09	A09	Other gastroenteritis and colitis of infectious and unspecified origin
Encephalitis	A83	G04	Encephalitis, myelitis and encephalomyelitis
Hemorrhagic fever	A91	A99	Unspecified viral haemorrhagic fever
Malaria	B54	B54	Unspecified malaria
Measles	B05	B05	Measles
Meningitis	A39	G03	Meningitis due to other and unspecified causes
Other Infectious Diseases	ZZ11	B99	Other and unspecified infectious diseases
Pneumonia	J12	J22	Unspecified acute lower respiratory infection
Sepsis	R20	A41	Other sepsis
GBD Cause Group B: Non-communicable diseases			
Other Cancers	ZZ12	C76	Malignant neoplasm of other and ill-defined sites
Other Cardiovascular Diseases	ZZ13	I99	Other and unspecified disorders of circulatory system
Other Defined Causes of Child Deaths	ZZ16	R99	Other ill-defined and unspecified causes of mortality
Other Digestive Diseases	ZZ15	K92	Other diseases of digestive system
GBD Cause Group C: Injuries			
Bite of Venomous Animal	X20	X27	Contact with other specified venomous animals
Drowning	W65	W74	Unspecified drowning and submersion
Falls	W00	W19	Unspecified fall
Fires	X09	X09	Exposure to unspecified smoke, fire and flames
Poisonings	T36	X49	Accidental poisoning by and exposure to other and unspecified chemicals and noxious substances
Road Traffic	V99	V89	Motor- or nonmotor-vehicle accident, type of vehicle unspecified
Violent Death	V05	Y09	Assault by unspecified means
NEONATE CAUSES			
Birth asphyxia	P21	P21	Birth asphyxia
Congenital malformation	Q00	Q89	Other congenital malformations, not elsewhere classified
Meningitis/Sepsis	P351	P36	Bacterial sepsis of newborn
Pneumonia	P353	P23/J22	Congenital pneumonia/Unspecified acute lower respiratory infection
Preterm Delivery	O601	P07	Disorders related to short gestation and low birth weight, not elsewhere classified
Stillbirth	Z37	P95	Fetal death of unspecified cause

Appendix E: Deployment options for local ODK Aggregate server

1. Server Specifications

Operating System: Windows or Linux

RAM: 512kb minimum. Increase for more performance.

Disk: 20Gb free space. Increase as required as dataset grows

For more detailed information, please review the Deployment Planning guide on the ODK website:

<https://opendatakit.org/use/aggregate/deployment-planning/>

2. Installing VM (Local or Cloud)

The ODK Aggregate VM is a fully-configured install of Aggregate that you can run on any computer. It requires very little setup, works well without Internet connectivity, and gives you complete control over your data collection campaign. Download the [ODK Aggregate VM](#) to begin.

Notes from VM install guide:

Please read all instructions for installing this Virtual Machine (VM) before installing the VM.

Doing so will save you a lot of time and effort.

Warning: *This VM has very weak default passwords. Please change them.*

Basic Usage

1. Download and install VirtualBox from <http://www.virtualbox.org>.
2. Double-click ODK-Aggregate-VM-1.4.11.0.ova to import the VM. Accept the default settings.
3. After the import completes, start the VM. If asked, disable auto-capture before starting.
4. After the VM configures and reboots, wait for a web address to be shown (e.g., http://12.34.56.78).
5. Do not login into the black and white screen of the VM. Instead on your computer, open a web browser.
6. Go to the web address shown in the VM boot screen. You will see the Aggregate login screen.
7. Click "Login" at the top right of screen and then select "Sign in with Aggregate password" and login with username and password shown below.

Aggregate username: aggregate

Aggregate password: aggregate

8. Optional: Configure Network to allow access from the internet. See section C below in the ***Installing on Tomcat (Local or Cloud)*** deployment guide for further information on Network and setup information

Advanced Usage

If you need to log into the VM itself (e.g., using the Ubuntu command line to administer Tomcat), use the VM credentials (username/password) shown below.

Ubuntu user: user/aggregate

Ubuntu admin: root/aggregate

Tomcat admin: tomcat/aggregate

MySQL user: user/aggregate

MySQL admin: root/aggregate

Notes

If you have an older version of VirtualBox, make sure you upgrade to the latest version. If the newest versions of VirtualBox do not install, then try the next version down. If you are using Windows, you can also try the free VMWare Player at <http://www.vmware.com/products/player>. VMWare Fusion on the Mac also works.

If after unzipping the installer and launching the VM, a "File is busy" or "File access error" message is reported on Windows, it is likely due to improper unzipping or write permissions. Try right-clicking the zip file, then select Extract All and save the files to a folder on the Desktop.

If on Linux you get an error message about "PAE: Unable to boot", make sure VirtualBox has PAE/NX enabled. That setting is usually under System/Processor.

The speed of the VM depends on the speed of the host computer. The first boot will often take a few minutes. Please be patient.

If the VM reports "Network did not assign this VM an IP" error on startup, it means that the VM is on a network that did not assign it an IP. Make sure the upstream router assigns IPs via DHCP. Alternatively, switch the networking in the VM from Bridged to NAT, but then configure port forwarding on the local computer to enable external connections to it. Tomcat in the VM listens on port 80.

The VM address (e.g., <http://12.34.56.78>) is the server URL that you should enter into ODK Collect or ODK briefcase if you want to download blank forms or send completed forms.

In order to have external servers (e.g., Fusion Tables) or applications (e.g., CSV export) see your form images, you have to make your VM publicly accessible on the Internet with a static IP or fully-qualified domain name. Doing this requires a fair amount of technical skill and we instead recommend you install ODK Aggregate on App Engine. Alternatively, export your data using ODK Briefcase.

The ova file is the installer. Once the VM has imported, the ova file and the zip file can be deleted. It is a good idea to keep the readme (this file).

When all fails, shutdown the VM, reboot the host computer, and restart the VM.

1. Installing on Tomcat (Local or Cloud)

To run on ODK Aggregate on a Tomcat server backed with a MySQL or PostgreSQL database, see [Aggregate Tomcat Install](#).

NOTE: The Visualization and Mapping features of ODK Aggregate do not work when the server is configured to run under certain non-US, non-English locales. We believe this occurs because, in those locales, numbers are formatted

with a comma as the decimal point, and that this confuses the visualization software we are using. If you are having issues with these features not working, reconfigure your Tomcat server to run in the US English locale.

Installation Overview

The general sequence for setting up a Tomcat server is as follows:

- a. Define your server requirements and install your server. (See Section 1. Server Specifications above)
- b. Install Tomcat on your server.
- c. Configure your server and network devices so that laptops or Android devices connecting to the internet from an external access point (e.g., Starbucks) can access your server. You may wish to restrict access to your server to devices directly connected to your local network. In this case, ODK Collect would not be able to access your server (to download forms or upload finalized forms) until the ODK Collect device returns to your site and establishes a direct connection to your local network.
- d. Obtain and Install an SSL certificate if you need secure (https:) access.
- e. Select and Install your database server (MySQL or PostgreSQL).
- f. Download and install ODK Aggregate.

b. Install Tomcat

The overall steps are:

- I. Install Java 7 or Higher
- II. Configure PATH variable
- III. Download and Install Tomcat 6

The particulars follow.

I. Install Java 7 or Higher

Make sure Java 7 or higher is installed on the computer you plan to use. If it is not, [download and install it](#).

Note that you generally need to launch installers with *Run as administrator* privileges (available under the right-click menu).

Accept all the defaults.

II. Configure PATH variable

Add the installed Java bin directory to the PATH variable. This is described here: <https://www.java.com/en/download/help/path.xml>. On Windows:

Go to *Start* menu. Right-click on *Computer*, select *Properties*.

Select *Advanced system settings* (on the left in Windows 7).

This should open a *System Properties* dialog, with the *Advanced* tab selected. You can also get here via the *System* app on the *Control Panel* page.

Choose the *Environment Variables...* button. This opens up an environment variables dialog.

Now open a Windows file explorer, and browse to the 'bin' directory under the 'jdk...' directory of the Java software. This defaults to something like `C:\Program Files\Java\jdk1.7.0_25\bin` Click into the text box at the top of the Windows file explorer, and copy this directory path into the cut-and-paste buffer.

Return to the environment variables dialog. Scroll down the *System variables* list and select the 'Path' variable, double-click. This opens up the *Edit System Variable* dialog. Click on the 'Variable value:' text field. Hit your 'End' key, then type a semicolon and paste in the 'bin' directory path. Don't forget the semicolon before the paste! Hit OK.

Exit out of all the dialogs.

III. Download and Install Tomcat 6

Download Tomcat 6 from here: <https://tomcat.apache.org/download-60.cgi>

If using the Windows installer, change to use port 80 for the HTTP/1.1 port. If you are going to set up an SSL certificate, change the HTTPS/1.1 port to 443. Use all other defaults.

Verify that Tomcat 6 is running by opening a browser on this server to <http://localhost/> You should see the Apache Tomcat administration page. If you didn't request port 80 during the install, you will need to specify the port you chose (`http://localhost:port/`). If you didn't configure a port, the default port is 8080 (and 8443 for HTTPS).

Before continuing, apply or change the administrator password for Tomcat; the administration functions should be secured before advancing to *Configure for Network Access*.

IMPORTANT: If your system is running in a locale that uses commas for decimal points, there is a known issue that prevents ODK Aggregate from using the Map Visualization. The work-around is to configure your Tomcat server to run in a locale that uses periods for decimal points (e.g., `en_US`, `en_GB`). This can be done with Tomcat configuration settings independently of the locale of your computer.

Note: We only test and support Tomcat 6.

Linux Installs

For people who are using Linux. one user recommended Ubuntu 12.04 LTS because it comes with tomcat6 rather than tomcat7. On that system:

- I. `sudo apt-get install tasksel`
- II. `sudo tasksell install tomcat`
- III. `sudo apt-get install java7-jdk`
- IV. open `/.bashrc` with your editor and add: `export JAVA_HOME=/usr/lib/jvm/java-7-openjdk-amd64` at the bottom of that file. Change this to whatever path is appropriate for your java installation.
- V. `sudo -E /etc/init.d/tomcat6 restart`

The 'E' flag on the last command is critical. It forces Ubuntu to reload the environment settings for the service, causing it to pick up the new JAVA_HOME setting.

Unsupported Webserver Configurations

Tomcat 7, Glassfish and Jetty require additional configuration steps to run ODK Aggregate; we don't support either Tomcat 7 or Glassfish or Jetty. All of these webserver require configuration settings to enable cookies under HTTPS. Otherwise, ODK Aggregate uses no special Tomcat features and it should operate correctly within any compliant Servlet 2.5 web container. From user's efforts on these other webserver:

Tomcat 7 (unsupported)

Edit context.xml (under Tomcat 7's conf directory) to have the attribute 'useHttpOnly' set to false. I.e.,

```
<Context useHttpOnly="false">
```

...

Tomcat 8 (unsupported)

From a user:

My ODK Aggregate file is installed as /var/lib/tomcat8/webapps/ODKAggregate.war

The following content needed to be placed in the *file* webapps/ODKAggregate/META-INF/context.xml (this is within the expanded content of the war file, once the Tomcat 8 server has exploded it).

```
<Context path="" useHttpOnly="false" />
```

Glassfish 4 (unsupported)

Add glassfish-web.xml under ODK Aggregate's WEB-INF directory with the content:

```
<?xml version="1.0" encoding="UTF-8"?>
<glassfish-web-app>
  <session-config>
    <cookie-properties>
      <property name="cookieHttpOnly" value="false" />
    </cookie-properties>
  </session-config>
</glassfish-web-app>
```

Jetty (unsupported)

Add jetty-web.xml under ODK Aggregate's WEB-INF directory with the content:

```
<?xml version="1.0" encoding="ISO-8859-1"?>
<!DOCTYPE Configure PUBLIC "-//Jetty//Configure//EN" "http://www.eclipse.org/jetty/configure.dtd">

<Configure class="org.eclipse.jetty.webapp.WebAppContext">
  <Get name="sessionHandler">
    <Get name="sessionManager">
      <Set name="secureCookies" type="boolean">true</Set>
    </Get>
  </Get>
</Configure>
```

c. Configure for Network Access

The high-level network configuration steps are:

- I. configure your server firewall
- II. make your server visible on the internet (optional)
- III. establish a DNS name for the server

If your organization has a network or systems administrator, contact them for assistance.

I. **Configure your Server Firewall**

To allow tablets other computers to access ODK Aggregate, you need to configure the server firewall to allow access.

On Windows, open the command window (*Start*, search for 'cmd'. Right-click, choose 'Run as administrator'). Assuming you configured Tomcat to use port 80, within this command window, type:

```
netsh firewall add portopening TCP 80 "ODK Aggregate"
```

If you will have an SSL certificate (required for https:), repeat this command after changing 80 to 443. Or, if you used other ports, perform the command using the specific port number(s) you selected during the Tomcat install.

To verify that other computers can now access Tomcat, on Windows, from a 'cmd' window and type:

```
ipconfig /all
```

This will list all the Ethernet adapters and WiFi adapters on your system. Beneath each, you will see an IP address and other information. e.g., there will be entries like this:

Ethernet adapter Local Area Connection:

```
Connection-specific DNS Suffix . : opendatakit.org
```

```
IPv4 Address. . . . . : 192.168.15.121
```

```
Subnet Mask . . . . . : 255.255.255.0
```

```
Default Gateway . . . . . : 192.168.15.100
```

Go to another computer on your local area network, open a browser, and enter the IP address for your server's entry similar to the one shown above. You should see the Tomcat administration screen. For the above example, you would type this into the browser:

```
http://192.168.15.121
```

If you used a port other than port 80, you must append a ':' followed by the port on which Tomcat is running (e.g., `http://192.168.15.121:8080`). If you don't see the Tomcat administration page, double-check that Tomcat is running and that your firewall and antivirus software have the port open.

Congratulations, your server is visible on your local area network!

II. **Make your Server Visible on the Internet**

If you are using a web hosting service, your server is already visible to the internet (unless the web hosting service itself requires further configuration steps).

Otherwise, once you can see Tomcat from other machines on your local area network, you have the option of making this server visible from the internet. If the server is not visible from the internet, ODK Collect will only be able to reach your server when it is connected to your local area network or to a WiFi access point on your network (when the ODK Collect device has returned to your premises). If your server is visible from the internet, ODK Collect will be able to use the phone carrier's network or connect to any WiFi hotspot (e.g., Starbucks) and submit or download forms from your server.

If you decide to not make your server visible on the internet, you should still assign your server a static IP address as detailed below, but do not set up port forwarding.

If you choose to make your server visible, the general steps are to set up port forwarding on any networking equipment (your routers and the Internet Service Provider (ISP)'s boxes) upstream of your computer until you reach the piece of equipment assigned the IP address through which your server will be visible on the internet. Open a browser to this site to find out what that internet-visible IP address is:

<http://www.whatismyip.com/>

Begin with the router to which your server is directly connected and work upwards. If your server's IP address is 192.168.15.121, you can typically access your router's configuration page by browsing to `http://192.168.15.1` -- i.e., change the last number to a one. Search the web for the user manual for your router. Cable modems generally don't have an administration page (and don't need to be configured).

Most routers are configured to be DHCP servers (to assign IP addresses to the devices connected to the router) and to have NAT (Network Address Translation) enabled (to be a firewall for the devices connected to the router). If your router has no administration page or is configured in "Bridging Mode", it does neither of these things and can be ignored; proceed to the next piece of network equipment.

Once connected to the router administration screen, you should first go to the DHCP configuration screens and configure your server (or the router to which your server is connected, if you're working up the chain of equipment) to be assigned a static (non-changing) IP address. Follow the user guide to do so.

For a system configured with a router chain with 4 routers, two acting as DHCP servers, the end result is:

router 4 - configure to assign a static IP to router 2

|

v

router 3 - running in Bridging mode

|

v

router 2 - configure to assign a static IP to server

|

v

router 1 - without any administration page

|

v

Server

Next, if NAT is enabled, there should be a screen to configure port forwarding. You should forward the Tomcat ports to the server (using the static IP address you just assigned to it). Or, to the router to which your server is connected, if you're working up the chain of equipment. If you will have an SSL certificate, you need set up forwarding of both port 80 and 443 (or the port numbers used when configuring Tomcat, if different).

For a system configured with a router chain with 4 routers, two with NAT enabled, the end result is:

```

router 4 - configure to forward port 80 (plus port 443 if SSL) to router 2
|
V
router 3 - running in Bridging mode
|
V
router 2 - configure to forward port 80 (plus port 443 if SSL) to server
|
V
router 1 - without any administration page
|
V
Server

```

Once these configurations are complete, return to the administration screen of the final piece of networking equipment that you changed (e.g., *router 4*, above). Find the network status page for this router. It should show two IP addresses. One will be the IP address you used to get to the administration screen and the other will be labeled as either the "Internet Port" or "WAN Port" IP address (or something similar).

If this does not match the IP address reported by <http://www.whatismyip.com/> then you will need to contact your ISP for further configuration.

Assuming the IP address matches, you now must consider how stable you need your connection to the internet to be. Unless you purchase a static IP address from your ISP, this IP address may change. For example, every time my laptop is restarted, it gets a different IP address (because it isn't assigned a static IP address). The same is true for this last piece of equipment (*router 4*). The IP address can occasionally change unless you purchase a static IP address from the ISP (it is most likely to change when rebooted or power cycled — an infrequent event for these devices).

If you need data security (e.g., an SSL certificate) or require a highly-available ODK Aggregate server, you should obtain a static IP from your ISP and configure that network equipment (*router 4*) to use that static IP address. Otherwise, if you don't need SSL and can tolerate periods of inaccessibility or if your surveyors can call or text when they have problems reaching the server from the field, and you will have someone with server access that is able to respond, you should be able to operate with a dynamic IP address.

To verify the settings so far, ensure that Tomcat is running, venture to a WiFi hotspot (e.g., Starbucks) outside of your organization, and browse to this IP address. You should see the Tomcat administration screen.

Congratulations, your server is visible to the internet!

III. Establish a DNS name for the Server

If you've completed the above configuration, your server is now reachable from anywhere in the world — provided you know its visible IP address. Or, if you have decided to only expose your server within your local area network (LAN), you have given it a static IP address (albeit one that only identifies your server when resolved in the context of your LAN).

DNS services maintain mappings of names to IP addresses; the next step is to give your server a name and assign that name to this IP address.

If your organization already has a domain name (e.g., `opendatakit.org`), speak with your network administrator. You will want to create a CNAME underneath this domain name (e.g., `myserver.opendatakit.org`, under the `opendatakit.org` domain) that will point to the IP address of the network equipment you configured earlier.

If you do not have a domain name, there are many free "Dynamic DNS" services. These offer the ability to give your server a domain name. You can purchase a domain name (e.g., `opendatakit.org`), or create a free subdomain under one of the dynamic DNS service's predefined domain names (e.g., `myserver.dnsdynamic.com`, under the `dnsdynamic.com` domain). In either case, you would then assign the IP address of the network equipment you configured earlier to this name.

Some WiMax and DSL routers (network devices supplied by your ISP or carrier), have partner DNS services that the router can continually inform of IP address changes. If you do not have a static IP address, one of these partner DNS services should be considered, as this continual update would eliminate your need to monitor and manually update the IP address of your DNS name.

Once you have set up this name and assigned it to your internet-visible IP address, you should then be able to venture to a Wi-Fi hotspot, enter this name in a browser (e.g., `http://myserver.dnsdynamic.com`), and see your Tomcat administration page.

d. Obtain and Install SSL Certificate

Refer to the documentation on the Apache Tomcat site and on a Certificate Authority site (e.g., Verisign) for how to do this. Configuration of SSL is beyond the scope of this document, but David Dyck has a [two part tutorial](#) for assistance.

e. Select and Install Database Server

ODK Aggregate works with either a MySQL or a PostgreSQL database server.

A database server manages one or more databases. The database server stores and retrieves data from tables within these databases. Tables are organized as columns and rows (similar to an Excel worksheet). ODK Aggregate parses and stores submissions as individual rows in a data table, one data value per column within that table.

MySQL is a defacto standard for open source development, so there are many database administrators and software professionals that understand and use it.

PostgreSQL is less common, but has found a large following in geographical information systems (GIS) applications.

Both are free and open source.

Despite MySQL's overwhelming prevalence, PostgreSQL should be considered for GIS applications or if you require very large forms. MySQL imposes a limit of 4096 columns per table and 65536 bytes per row. The later limitation is the most severe. If you have a form with more than 256 select1, string or barcode questions, it will likely require two or more tables to store all the data values because the 65536 byte limit will have been exceeded (unless you use the `odk:length`

attribute to shorten the maximum length of these fields to less than the default 255 characters). Even when large forms are split across tables, ODK Aggregate can store and publish them; however, filtering by column value will be impacted. Only columns in the first table can be used in filters during visualization and when exporting to CSV or KML; columns in the second and subsequent overflow tables will cause the filter to fail.

For MySQL, download and install MySQL Community Server 5.1 or higher from [MySQL download site](#). Be sure to set a root password for the database. Stop the MySQL database server, then configure the database (via the "my.cnf" or the "my.ini" file) with these lines added to the [mysqld] section:

```
character_set_server=utf8
collation_server=utf8_general_ci
max_allowed_packet=1073741824
```

and restart the MySQL databaseserver. Then, download the MySQL Connector/J, unzip it, and copy the mysql-connector-java-x.x.x-bin.jar file into the Tomcat server's libs directory. After copying it into that directory, you should stop and restart the Tomcat server. The max_allowed_packet setting defines the maximum size of the communications buffer to the server. The value used in the snippet above is 1GB, the maximum value supported. For ODK Aggregate 1.4.11 through 1.4.7, and 1.2.x, the maximum media (e.g., image or video) attachment is limited to the value you set for max_allowed_packet minus some unknown overhead -- e.g., a storage size of something less than 1GB. For ODK Aggregate 1.4.6 and earlier (excluding 1.2.x), the maximum media attachment is unlimited and the setting for max_allowed_packet does not need to be specified. For ODK Aggregate 1.4.12 and later, the max_allowed_packet value should be set to a value greater than 16842752 (this is the minimum value that should be used -- 16MB plus 64kB); with that setting, media attachments of unlimited size are once again supported. If you are upgrading to a newer ODK Aggregate, you must continue to use the setting you already have, or 16842752, whichever is greater. If you experience problems uploading large attachments, change this setting to its maximum value, 1073741824.

For PostgreSQL, download and install the appropriate binary package from [PostgreSQL download site](#). Be sure to set the password for the postgres (root) user. And set the default character set and collation sequence.

For either database, you should ensure that the default character set is configured to be UTF-8 and that the collation sequence (dictionary order) is set appropriately for your circumstances. If it isn't, any non-Latin characters may display as question marks. Refer to the character set and collation sections of your database's documentation for how to do this.

If you need high-availability, consult with a database administrator as to whether or not you require slave databases or database clusters.

f. Install ODK Aggregate

Download [ODK Aggregate v1.N.N](#). Select the latest Featured release for your operating system. These downloads are wizard-based installers for the various operating systems. If you are running OSX, you must unzip the downloaded file before running the installer within it. Consider using a non-Featured release during forms development (to help us identify issues prior to a production release).

The installer does not install anything, but will guide you through configuring ODK Aggregate for Tomcat and MySQL/PostgreSQL. It can be run on any machine. The installer will produce a WAR file (web archive) containing the

configured ODK Aggregate server, a *create_db_and_user.sql* script for creating the database and user that ODK Aggregate will use to access this database, and a *Readme.html* file with instructions on how to complete the installation.

When asked for the fully qualified hostname of the ODK Aggregate server, you should enter the DNS name you established above. The install also asks for a database name, user and password. The user should not be root (MySQL) or postgres (PostgreSQL). ODK Aggregate will use this user when accessing this database (and it will only access this database). By specifying different databases and users, you can set up multiple ODK Aggregate servers that share the same database server, store their data in different databases, and operate without interfering with each other.

If you are upgrading to a newer version of ODK Aggregate, as long as you specify the same database name, user and password, you do not need to re-run the *create_db_and_user.sql* script (it only needs to be executed once).

See [here](#) for information on logging onto your ODK Aggregate instance and changing the access permissions of the server

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