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DATA FOR HEALTH INITIATIVE

STRENGTHENING CRVS SYSTEMS

Technical guidance to D4H staff for the introduction of verbal autopsy into civil registration and vital statistics systems

Technical Report 2

November 2016

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Technical Reports

Technical reports describe the methods and findings of CRVS activities in partner countries implemented under the Data for Health Initiative. The series also reports on work in progress, particularly for large or complex initiatives, or on specific components of projects that may be of more immediate relevance to stakeholders.

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Acronyms and Abbreviations

COD	Cause of death
CR	Civil registration
CRVS	Civil registration and vital statistics
CSMF	Cause specific mortality fraction
D4H	Data for Health
DHIS-2	District health information system (2)
DOA	Dead on arrival
HDSS	Health and demographic surveillance site
HR	Human resources
ICD	International Classification of Diseases
ID	Identification
IT	Information technology
PCVA	Physician certified verbal autopsy
PHMRC	Population Health Metrics Research Consortium
PTSD	Post-traumatic stress disorder
SAVVY	Sample vital registration with verbal autopsy
SOPs	Standard operating procedures
SRS	Sample vital registration system
TAG	Technical advisory group
TOT	Training of trainers
TWG	Technical working group
VA	Verbal autopsy
VAI	Verbal autopsy instrument
WHO	World Health Organization

Introduction

Accurate cause of death (COD) information is fundamental to good public health practice. The principal sources of information are medical certificates of COD for deaths in hospitals and verbal autopsies for non-hospital deaths. A verbal autopsy (VA) is a process whereby relatives of the deceased respond to questions about the medical history and terminal illness of the decedent (i.e. the illness that led directly to death). These two sources of COD data are complementary. Medical certification and VA should each be linked to the notification and registration of deaths through a country's civil registration and vital statistics (CRVS) system. In general terms, medical certification will provide a more detailed and legally recognised account of COD; VAs will be more representative of patterns of mortality at the population level. The principal purpose of a VA is to describe the cause composition of mortality through the estimation of cause specific mortality fractions (CSMFs) in a population.

It should be recognised that the introduction of VA will depend on a careful analysis of, and response to, the structure and capacity of peripheral health and statistical services in each country.

This Technical Report has two objectives:

- To lay out the broad steps in the preparation, field testing, phase one implementation and eventual national roll-out of VA in CRVS; and
- To propose a generic approach to guide Data for Health (D4H) country leads in advising countries about the options available to countries for implementing specific VA methods.

Verbal autopsies, as a means to generate policy-relevant information on CSMF's in a population, consist of four elements:

1. A ***questionnaire*** to collect information from the family of the deceased about signs and symptoms preceding death, known as the verbal autopsy instrument (VAI);
2. A ***method to diagnose*** the most probable COD based on the responses recorded in the VAI. This was initially done by physicians, referred to as physician certified verbal autopsy, or PCVA. Today, automated algorithms are available to generate the probable cause of death, an approach that is more cost-effective, accurate and consistent across populations than physician review;
3. A ***target cause of death list***, which includes all causes that can be diagnosed with reasonable accuracy given 1 and 2 above.
4. Solutions for the efficient and sustainable integration of VA into CRVS systems.[1]

Improvements to the certification of deaths in hospitals and the introduction of VAs for community deaths are complementary and should proceed in parallel. It is desirable that VAs be collected either for all deaths for which medical certification was not available, or for a representative sample of these. This will include deaths in facilities, where there is no physician, as well as home deaths and deaths in the community generally.

The introduction and integration of verbal autopsies into CRVS systems is arguably the most complex and difficult challenge that the Bloomberg Data for Health Initiative faces. This document is intended to provide basic guidance to D4H country teams to guide dialogues with countries.

1 This topic is covered in the companion paper, *Integrating community based verbal autopsy into civil registration and vital statistics (CRVS): system-level considerations.* Submitted to Global Health Action for publication, August 2016

CRITERIA FOR THE INTRODUCTION OF VA INTO CRVS SYSTEMS

In making decisions about the introduction of VAs into low resource settings, three broad criteria need to be taken into account: efficiency, effectiveness, and cost.

Efficiency: The extent to which approaches for the introduction of VAs make the best possible use of scarce resources. A program needs to be sustainable, i.e. operate independently of external inputs, in the medium term.

Effectiveness: The extent to which the chosen VA and diagnostic method can accurately predict COD from a sufficiently large sample of all deaths to provide valid CSMFs for national and sub-national populations. Issues affecting effectiveness and validity are further described in Table 1.

Costs: Cost analysis is most useful in comparing the costs of ongoing collection of VAs with other strategies for the collection of COD data. Ministries of Health, which are the principal users of COD data, may wish to make comparisons with methods such as surveys for obtaining these data. Distinction needs to be made between the opportunity costs, say, of utilising existing health staff to collect data and the additional costs which are incurred by hiring survey staff for a specific purpose. It is also important to distinguish between start-up costs which could possibly be carried by D4H and ongoing operational costs.[2]

PROCESSES FOR INCORPORATION OF VA INTO CRVS

Registration of a death should precede VA in efficient systems. Introducing VAs outside of civil registration (CR) systems for the notification and/or registration of deaths may divert resources from efforts to strengthen those systems.[3]

Box 1 provides a simplified sequence of events that precede and follow the collection of VAs. The critical assumptions are: 1) there is a process for the notification of deaths in addition to family notification/registration; 2) there is an organisation or agency that will take responsibility for the collection of VAs. See Figure 1 for a simplified overview of the approach outlined in Box 1.

If such systems are in place then the processes for the collection on VA should build on them. If such systems are ***not*** in place they will need to be developed in parallel with the development of processes for the management of VA data.

2 Detailed guidance to assist countries to estimate the costs associated with the introduction of routine verbal autopsies into CRVS systems is under development. The tool is due for early release in late 2016

3 The trade-off is between the need for quality population COD data and the need for high levels of completeness through CR systems. The general approach to the availability of quality population COD data should begin with a review all of available sources of such data and to consideration of how best to obtain national estimates of COD. A compromise might be to introduce quality measurement of VA via a Sample Vital Registration System (SRS) on the one hand, and introduce notification and civil registration to the SRS on the other. The output should be line listings of individual deaths and not aggregated data

Box 1. Generic model of common processes for data collection, entry, and transmission for applying VAs within a CRVS system

1. Death of an individual
2. Civil registrar notified of death. This may be by the family, by an institution or by an individual empowered to notify deaths. Notification should require all identification (ID) legally necessary for registration
3. Registration number assigned and details entered into the civil register (ID data, place of occurrence, address)
4. Death certificate, i.e. of the fact of death, may be issued at this point
5. Where no medical certificate of COD available, e.g., due to non-facility death, dead on arrival (DOA), or other factor
6. Registrar requests VA from health facility and provides ID details and registration number
7. Health facility plans to collect VA ideally within a minimum of four and a maximum of 12 weeks of death
8. Collection (and entry) of VA data; uploading of data onto a computer
9. Assign COD to individual case using automated VA methods
10. Supervision and quality assurance
11. Transmission of COD to registrar; registrar records COD in register using registration number for linkage
12. Review distribution of CODs for plausibility and correct processes as necessary

Notes for Box 1

1. Death of an individual

Deaths may occur at home or away from the home. If it occurs in a health facility, the facility should notify the Civil Registrar. Jurisdictions vary in their rules about registering deaths in administrative areas away from the place of usual residence (e.g. in a different province or district). Some require the death to be registered in the area where the death occurred; others require the death to be registered in the area of usual residence. This is relevant, in particular, to the notification and registration of health facility deaths.

2. Civil registrar notified of death. This may be by the family, by an institution or by an individual empowered to notify deaths. Notification should require all identification (ID) legally necessary for registration

Systems for the notification of deaths assume the selection of an agency that has the capacity to identify a high proportion of all deaths and report them. The health sector is likely to be involved because of the need to register health facility deaths. If a country does not have a pre-existing structure for the notification of community deaths to build on, we recommend that in the early phases of introducing VAs, notification procedures be as straightforward as possible. It will simplify matters if the agency empowered to notify the CR of deaths is the agency that organises the collection of VAs.

Minimum information for notification of a death should include:

- Serial number of the notification form (for record linkage)
- Full name of the decedent
- Sex and nationality
- Date (if not known, age) and place of birth
- Date and place of death
- Place of usual residence.

3. Registration number assigned and details entered into the civil register (ID data, place of occurrence, address)

The registration number becomes the permanent number for linkage of records. (Alternatively, a notification number or national ID number may serve this purpose.)

4. Death certificate, i.e. of the fact of death, may be issued at this point

Whereas a medical certificate of COD may initiate the registration process, a VA will most likely be collected weeks or months after the death. It will not be possible to predict at the time of registration whether it will be possible to assign a cause of death (there may be insufficient information to do so) or even whether it will be possible to collect the VA. Therefore if certification of the fact of death is needed, that certificate is best issued at this point.

5. No medical certificate of COD available

In order to issue a certificate a physician should be familiar with the past medical history of the decedent and/or the terminal illness. Hospital physicians frequently declare themselves unable to issue a certificate for persons who are dead on arrival (DOA) or when the death has occurred within 24 hours of admission. In such cases we recommend a VA. We also recommend VAs be collected for all deaths in health facilities not staffed by physicians.

If physicians issue medical certificates for non-facility deaths, the quality of these will need to be evaluated. In countries where a medical certificate of COD is necessary for obtaining a permit for burial, physicians may be issuing a medical certificate based solely on the family account of the terminal illness as routine practice. We recommend the collection of a VA under such circumstances but acknowledge that operational research is required to establish best practice.

6. Registrar requests VA from health facility and provides ID details and registration number

The registration number should be the permanent number that provides the essential link between the civil register and the VA.

7. Health facility plans to collect VA, if possible, between four and 12 weeks after death

In general terms, government health facilities are the best placed agencies to take responsibility for the collection of VAs because of their ethos, staff experience and expertise.

The aim should be to collect VAs between four and 12 weeks after death. A delay of four weeks allows for a period of mourning. After 12 weeks the accuracy of the assigned COD will be increasingly affected by symptom recall. Nevertheless, it would be permissible to collect VAs for up to 12 months after death in order to maximise coverage. Under certain circumstances, such as death in a facility, it may be better to collect the VA immediately after death. Such a decision calls for understanding and judgement.

8. Collection (and entry) of VA data; uploading of data onto a computer

The interview should take place in a non-threatening environment where respondents can answer freely in accordance with local customs affecting confidentiality. Emotional support from the family or the interviewer may be necessary. It is common in village environments for more than one family member to be present. The decision about who should or should not be present at the interview should be left with the principal respondent. Given the need for at least a four-week delay and the likelihood of active follow-up by the interviewer, the most usual place of interview will be in the home. An acceptable alternative would be in a health facility.

If data collection is paper-based, data entry is an additional step with additional possibilities for error. We strongly recommend electronic collection because error can be reduced at the point of collection and the data can be automatically uploaded onto a computer. Training of field workers in electronic data collection should include instruction in how to upload data. If data collection is paper-based, we recommend data review by a supervisor as a quality check. The reduction of error in data entry requires double-entry. Start-up costs for electronic systems will be greater than for paper-based systems.

9. Assign COD to the individual case

Once data from an individual death has been uploaded or, in the case of paper-based systems, entered into a computer, automated methods will assign a COD which should appear as the outcome of the interview. The assigned COD should be linked to the ID data provided by the civil registry. The COD data generated through the use of VAs can be incorporated into a national vital statistics data base, but should always be separately identifiable.

Research indicates that the overall CSMF accuracy of VAs is ≥ 75%. The accuracy of assigned COD from VA for individual deaths is ~ 50% (Serina, et al., 2015b). As stated previously, the principal purpose of VA is to describe the cause composition of mortality through the estimation of CSMFs in a population.

Although COD can be provided to family members, we recommend that this ***not*** be done. Firstly, diagnosis is not sufficiently accurate at the individual level and secondly, the need for discussion about the implications of the diagnosis places too much of a burden on interviewers. We recognise that families have a right to know the diagnosis but recommend that the assigned COD be discussed with a trained health worker. Information about individual CODs is not only of value to families but the distribution of COD is of importance for guiding policy responses to avoid premature death in communities.

10. Supervision and quality assurance

Supervisors are responsible for ensuring that interviewers are adequately trained and supported, and ideally should have a background in health. It is important that all supervisors thoroughly understand the process of conducting a VA and are capable of effectively passing on this knowledge to the interviewers. We recommend that supervisors hold regular group meetings with interviewers to discuss issues and problems arising in the course of their work. Supervisors should be prepared to attend a small percentage of interviews as observers. The interviewers need to be able to establish an atmosphere in which respondents are prepared to confide sensitive information. This requires tact and understanding. Unreliable information may lead to a wrong diagnosis. Responses must be entered accurately. Electronic tablets should be programmed to ensure that responses fall within predetermined parameters. With paper-based instruments it is easier for supervisors to review responses in detail before computer entry where, again, the computer should be programmed to ensure that responses fall within predetermined parameters.

11. Transmission of COD to registrar; registrar records COD in register using registration number for linkage

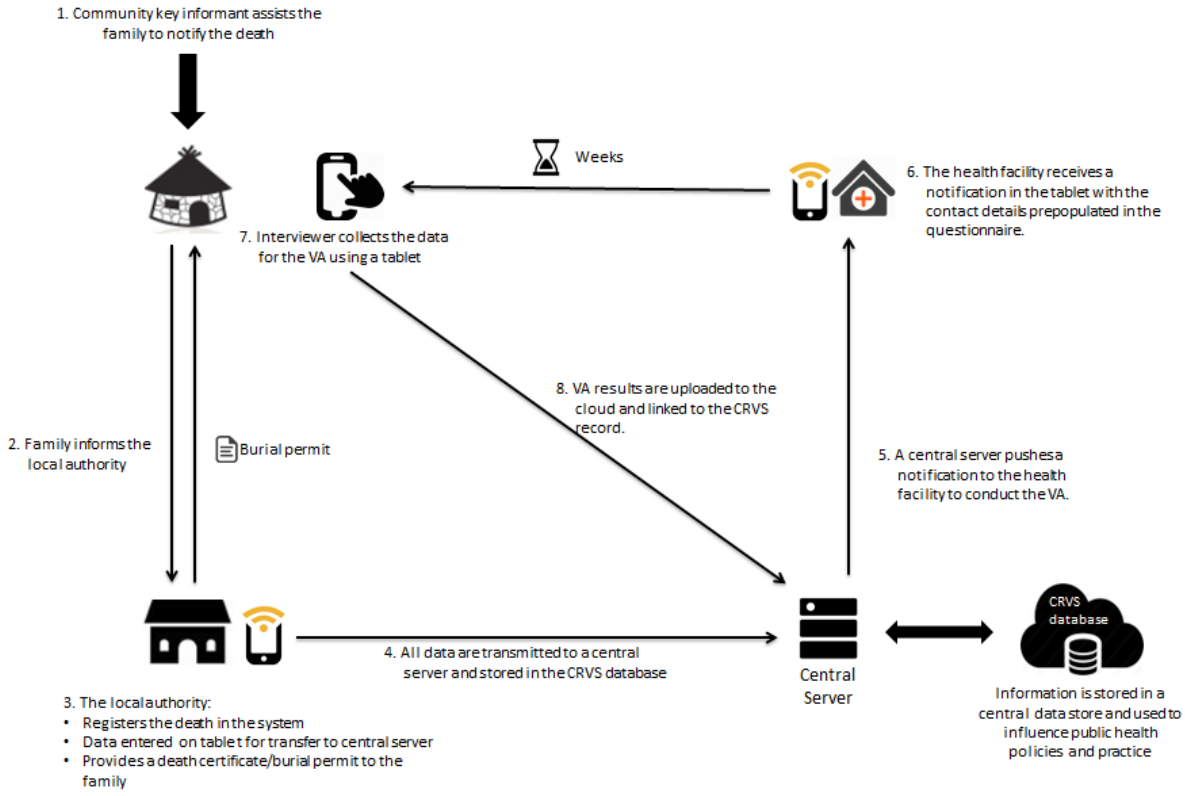
The integration of COD derived from VA into local systems will depend very much on the country information technology (IT) systems and capacity. This step will be collaboratively managed by D4H and countries so that, where necessary, suitable IT expertise will be recommended to manage integration. We will depend on IT staff familiar with local systems for this step.

12. Review distribution of CODs

The VA Technical Working Group[4] should play a major role in the review process. It is usual to compare results from VAs with data from other sources. This will be necessary both at local and national levels to ensure cause of death results coming from automated VA align with known distribution patterns in the country. Where there are little data on cause of death distribution from routine or other sources (such as large scale surveys), expert opinion may need to be employed to assess the feasibility of the cause of death patterns (Serina, et al., 2015b).

4 This working group has been established as part of the CRVS D4H Initiative to provide technical assistance to D4H countries on VA implementation

Figure 1 Verbal autopsy processes in a civil registration system



Source 1 de Savigny, D, et. al. *Integrating community based verbal autopsy into civil registration and vital statistics (CRVS): system-level considerations.* Accepted for publication in Global Health Action, November 2016

THE STATUS OF COD DERIVED FROM VA WITHIN CRVS SYSTEMS

The purpose of collecting birth and death data including COD is to establish a national vital events register. In addition to COD data, each entry will contain ID covariates. VA COD data and medical certificate COD should both be entered along with ID covariates but the source of each needs to be identified so that each can be analysed separately. National COD statistics will depend on harmonising results from the two data sources using advanced statistical techniques. We recommend that COD data from both sources be included in the national vital events register and that COD data derived from medical certificates and VAs not be separated where the quality of VA COD has been established.

Civil Registries will need to process COD data from VA separately from COD data contained in a medical certificate. The medical certificate of COD is commonly used to initiate registration and in almost all countries will be referenced in legislation. Because VA data should not be obtained until a month or more after death it will need to be linked to the record of the death after the death has been registered and a certificate of the fact of death has been issued.

We recommend that field interviewers do not disclose an individual COD based on an automated diagnosis to a family. We recommend that the diagnosis only be disclosed to the family by a health worker at a formal interview.

Should a COD based on VA be entered onto a death certificate? In other words: what is the legal status of COD assigned by an automated process within a civil registration system? On the one hand, the COD assigned by VA could be manifestly erroneous. On the other it can be argued that a family may have a compelling reason such as an insurance claim to have an official death certificate that includes the COD. In line with the above, we suggest that a death certificate including the COD be issued only if authorised by a registered physician or panel of physicians following review of the record of VA interview.

In addition to ID data and an assigned COD, the record of interview will contain background on the circumstances of the interview, responses to symptom questions and the open narrative. We recommend that the entire VA record have the same status as any other medical record and it should be retained for a set period of time: 1) to respond to any legal issues that may arise including family request for information; 2) to respond to later questions about the most probable diagnosis; 3) for data quality checking; or 4) for subsequent research. The health department should decide how they will do this, where the record will be retained and what the processes for access should be.

The Technical Basis of Verbal Autopsy

VERBAL AUTOPSY INSTRUMENTS AND DIAGNOSTIC METHODS

Currently available VA tools are described below. It must be appreciated that the development of automated diagnostic methods, and their corresponding instruments, remains an active area of research. The tools will continue to be refined, and new ones will be introduced. In establishing a system of routine VA in countries, focus should remain on creating a flexible platform that can support the VA structure (i.e., death notification, VA interview, and automated analysis), while accommodating updates to the tools in use.

A VAI comprises: 1) an introductory section that provides ID data and gives the context of the interview; 2) symptom question items; and 3) an open-ended narrative in which the respondent gives their own account of the terminal illness and events leading to death. The introductory section is, or should be, common to all instruments. Symptom question items vary in terms of content, wording of the question, and order. Work is ongoing to harmonise these elements in the two principal instruments. Instruments vary as to whether they do or do not incorporate elements of the open-ended narrative into their analysis.

Over the past two decades or so, there has been considerable research carried out on the optimal methods for, and comparative performance of, various approaches to collecting and analysing data via the use of verbal autopsy. Two VAIs are available for consideration for routine data collection in national CRVS systems: the 2016 World Health Organization (WHO) Verbal Autopsy Instrument (WHO 2016), and the shortened version of the Population Health Metrics Research Consortium (PHMRC) instrument, which, along with an automated diagnostic method known as Tariff2.0, forms an integrated data collection and analysis package known as SmartVA. Conversely, the WHO VAI is intended to be applicable to several automated diagnostic methods, including InterVA, InSilicoVA, and Tariff2.0. Table 2 compares the characteristics, strengths and weaknesses of these two instruments according to the principal criteria for introduction of VA into routine CRVS systems (see above). The table also compares the performance of the two most commonly used automated diagnostic methods, InterVA and Tariff 2.0.

WHO 2016 is derived from three preceding instruments: WHO 2007, WHO 2012 and WHO 2014, which had been designed to facilitate VA use in routine vital registration systems to improve national cause-specific mortality data. The new version of the WHO instrument, WHO 2016, is in the final stages of release as of November 2016. This will incorporate all SmartVA variables. The intention is that it will be possible to apply the WHO 2016 to both InterVA and Tariff analytic systems, and that it could be coupled with mobile phones and hand-held electronic devices. The WHO instruments have been developed on the basis of expert opinion and harmonisation of WHO 2016 and Smart VA has been completed, with a publication detailing the process currently in development.

SmartVA was developed specifically for routine use in CRVS systems in developing countries and was intended for global use. It was based on the Population Health Metrics Research Consortium VAI which, in turn, had been based on WHO 2007. The PHMRC VAI had the specific purpose of developing and validating automated methods for the analysis of VAs: these methods were to be based on empirical evidence and not on expert opinion. The PHMRC study led to the establishment of a *Validation Data Base* which contains 12,500 verbal autopsies paired with gold standard hospital deaths where the COD was known as accurately as possible under the conditions of developing country hospital practice. The Tariff Method was among the most effective of a number of diagnostic methods, including PCVA. A short form of the PHMRC VAI was created by a formal item-reduction process which took into account the contribution each question made to diagnosis. This analysis utilised the PHMRC Validation Data Base. The code for the short form of the PHMRC VAI was rewritten as *SmartVA* for use on electronic tablets; it is automatically analysed by the Tariff2.0 Method. Both the electronic VAI (short form) and the *SmartVA* application can be found at: **http://www.healthdata.org/verbal-autopsy/tools**

The InterVA (Interpreting Verbal Autopsy) diagnostic program uses a probabilistic model based on Bayes' theorem and has been widely used in association with the WHO VAI's. It is available in the public domain at **http://www.interva.net/** . It was developed using an expert panel and was, like *SmartVA*, designed for general purposes and is not country-dependent.

Two other diagnostic methods are available but are not described further in this document. The quality of the first, Physician Certified Verbal Autopsy (PCVA), depends on the intensity of training and supervision and is not considered to be sufficiently cost-efficient in low resource settings. Under routine conditions it did not perform as well as Tariff (Murray, et al., 2014). Experience from long-running mortality surveillance systems such as Matlab in Bangladesh is that it is difficult to maintain a cadre of physician certifiers over the medium term. At the time of writing there is insufficient information about, or experience with the second method, InSilicoVA, to draw any conclusions.

OPTIMAL CHARACTERISTICS OF VA FOR ROUTINE USE IN CRVS SYSTEMS

Recommended optimal characteristics of a VA for use in CRVS systems are:

1. The shortest possible instrument that could provide valid cause of death information

The maximum period for asking symptom questions should be 30 minutes or less, including the open narrative, but not including time needed for introductions, collection of ID data etc. (The open narrative is described below; it is a non-structured description by the respondent of the sequence of events/symptoms leading to death, including results of any contact with health services).The benefits lie not only in the amount of time that staff need to devote to interviews but in efficiencies for training and supervisory programs.

It can be argued that under certain circumstances travel time for an interviewer is a more important consideration than the duration of interview, but travel is a constant which cannot be changed, whereas the length of time that the respondent is asked to respond to questions can be altered by using a shorter, but still robust, instrument. *SmartVA* was designed so that progressive removal of questions had minimal effect on its performance (Murray, et al., 2014) (Serina, et al., 2015b). In other words, with *SmartVA*, there is no compelling reason to use the longer instrument.

2. Age-specific criteria

VAIs should have separate modules for neonates, children and adults. It has been proposed that the lower limit for adults be reduced from 15 to 12 years. Effectively, this reduces the lower limit of the reproductive age range in women so as not to miss maternal deaths. The response to this proposal is likely to vary from country to country.

3. Data collection on electronic tablets

Data collection of electronic tablets is less cumbersome than paper-based collection which has a greater need for supervision and review. The advantages of tablets include:

- Shorter interviews because of automated skip patterns
- No need for checking for missing data post-interview
- Ability to demonstrate signs and symptoms through audio and visual aids
- Ability to upload directly to a server.

However, some countries will opt for paper-based collection, most probably because of lack of infrastructure and lack of technical support for IT at the periphery. It should be remembered that there is more room for error in recording the interview; secondly, either data will need to be entered separately into a computer for automated diagnosis or PCVA, or paper forms will need to be transferred to a central site for PCVA.

4. Automated diagnosis

The development of InterVA, *SmartVA* and InSilico over the last decade or more reflects general dissatisfaction with inefficiencies associated with PCVA.

Arguments against PCVA relate to the difficulty of retaining an effective cadre of certifiers over extended periods of time and the associated salary costs. It should be recognised that in large systems that delays are to be expected with PCVA and results may not available in a timely manner; this will translate into a greater length of time being required to generate policy-relevant data. If PCVA is introduced because of lack of support for IT systems, it will need to be paper-based.

If countries wish to adapt VAIs to meet particular interests, it should be stressed that this will compromise their amenability to automated coding.

5. Inclusion of open narrative

The open-ended narrative gives respondents the opportunity to tell their own story in their own words. Spontaneous recall of symptoms often carries more diagnostic weight than does prompted recall (Serina, et al., 2015a).

SmartVA utilises a screen-based check list of symptoms which serves to extract information from the open-ended narrative. InterVA makes no use of open narrative in assigning COD. Open narrative is essential for PCVA. WHO 2016 positions the open narrative at the start of the interview. *SmartVA* positions it at the end so that the narrative does not influence responses to individual question items.

NEED FOR NATIONAL COMMITMENT

There is a risk that countries will agree too readily to the introduction of VA into CRVS systems and not appreciate the level of commitment that will be required. Before committing, countries should understand that they will need to:

1. Review the institutional setup and business processes for the notification, registration and certification of deaths in order to identify the most effective and efficient strategy for identifying the maximum number of deaths at community level;
2. Be prepared to train and supervise health workers or other community-based workers in VA interviews;
3. Establish that interviewers, if they have not been recruited for the specific purpose of collecting VAs, have sufficient time to collect VAs in addition to their routine duties: they must have the capacity to collect VAs and the means to visit families;
4. Be assured that means of data transfer exist between civil registries and health facilities;
5. Be prepared to develop processes for strengthening collaboration between staff of civil registries and health facilities.

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Preparation for the Introduction of VA into CRVS Systems: Recommended Guiding Principles

The Technical Advisory Group (TAG) lead will need to communicate with both a national CRVS committee and local experts with knowledge of mortality patterns. The TAG lead will need to define a series steps necessary before introducing VAs into national CRVS systems. This will involve: 1) establishing a national mortality technical working group; 2) defining the initial tasks for that group; and 3) choosing appropriate VA data collection and analytic methods. These steps are described in more detail below.

STEP 1: ESTABLISH A NATIONAL MORTALITY TECHNICAL WORKING GROUP

A national mortality technical working group should be established with the overall aim of improving cause of death statistics. This group may be a subgroup of the larger CRVS stakeholder group that already exists in many countries. It should review mortality data from all available sources. It needs to be broadly representative of data users (Civil Registry, National Statistics Office, and Ministry of Health) and of medical professional organisations relevant to the implementation of improvements in COD. It should become a vehicle for communication with different agencies and institutions.

Sub-groups may be established to oversee and review the implementation of two major interventions:

- For the introduction of the International Classification of Diseases (ICD) and improvements to the quality of medical certification of COD in hospitals
- For the development of a fully-fledged VA function as part of a national CRVS system

The technical working group will need to review the consistency of COD data obtained from these two sources and integrate the findings into a single report which estimates the distribution of COD by age and sex, and by administrative area.

The technical working group ***should review legislation*** concerning medical certification of COD and any associated rules and regulations. These are likely to include rules affecting who is licensed to issue medical certificates, the recording and retention of data in the national civil registry, and entitlements of families to confidentiality. There may be obligations for families to report deaths and obtain a medical certificate of death before cremation and burial.

All of the above should be distinguished from an obligation to participate in a VA interview. Legislation and regulation affecting the need for informed consent before a VA, and the question of access by the family to the COD assigned by the VA and to the record of VA interview need to be established. It is suggested that these be equivalent to legislation and regulation affecting informed consent in hospital and the access of families to hospital records.

STEP 2: PRIORITY TASKS TO BE IMPLEMENTED BY THE NATIONAL MORTALITY TECHNICAL WORKING GROUP

These would best be done in consultation with the D4H VA Working Group:

1. **Consider the need to review and if necessarily revise legislation and rules relevant to verbal autopsies as part of CRVS**. First make certain that there are no legislative barriers to the integration of VA into civil registration systems. It may be necessary to revise rules and regulations so they clarify and facilitate integration.

2. **Review national experience and resources for the collection and interpretation of VA data**. This will include reviewing results of Health and Demographic Surveillance System (HDSS) sites and Sample Vital Registration with Verbal Autopsy (SAVVY) to examine what has and has not worked. It may be necessary to determine the role of physicians in providing medical certificates of COD in cases where they are not personally familiar with the medical history of the decedent. It will be important to identify the expertise that exists for VA in-country or in other countries in the region and the value that earlier efforts can bring but, recognising at the same time that routine application of VA differs from VA for research purposes in terms of the availability of support systems.

3. **Develop a detailed enterprise architecture map delineating the processes that lead to registration of deaths and assigning COD.**[5] Detailed process maps are a pre-requisite for designing the integration of verbal autopsy into CRVS systems. These maps should depict all major steps, processes and activities related to notifying, registering and certifying deaths in the CRVS system and requirements, rules, and information flows concerned with capturing the mortality event. This "blueprint" of the CRVS architecture allows all stakeholders to have a common understanding of the current system "As-Is". These maps are necessary to enable effective participation in designing how the CRVS and VA steps (declaration, notification, registration, certification, VA interview, VA analysis, linking COD and fact of death, validation, quality control, data transfer, production and dissemination of vital statistics and reports, etc.) are to be integrated into the CRVS system.

4. **Decide on the cadre of workers that will collect VA data**. The accuracy of assigned COD from VA is heavily dependent on the quality of the interview. The advantages of collecting VAs through health services include their ethos and staff experience in dealing with matters of death and disease. The skills necessary for the day-to-day functioning of a selected cadre of health workers should at a minimum be consistent with the skills required to collect VAs. Interviewers may experience burnout and may require emotional support; grieving families need to be handled carefully and appropriate de-briefing and other support should be provided to interviewers.

5. **Identify an appropriate cadre of supervisors.** This is essential for the success of this intervention and to ensure that adequate quality control is maintained. A preferred ratio of supervisors to interviewers should be identified that takes into account the country context, previous skills and experience of both supervisors and interviewers, and estimated number of VAs to be conducted. Supervisors may have pre-existing supervisory roles. The more qualified the interviewers, the less supervision will be needed. However, a robust and reliable communication mechanism will need to be established between interviewers and supervisors. Given the range of supervisory tasks related to VA, the capacity of potential supervisors to conduct these activities will need to be thoroughly investigated.

6. **Review existing ICT services in relationship to the distribution of local civil registries and peripheral health facilities.** It will be necessary to consider in detail: 1) the distribution and availability of computers in peripheral health facilities which could be used for the uploading or entry of VA data; 2) processes and procedures for reporting of health information by peripheral health facilities (e.g. through DHIS-2) and the level(s) at which local reports are collated and prepared for reporting central authorities; 3) processes for data entry and data transfer among local civil registries; and 4) capacity for electronic communication between health facilities and civil registries.

7. **Consider other workforce issues for routine VA in CRVS.** In particular, consider current functions and capacity for support of IT services at the periphery and the number and functions of staff available in civil registries.

8. **Select the VA instrument and diagnostic method**. Selection should be based on the general and specific criteria outlined in this document. The choice is essentially between the WHO 2016 Instrument (fully compatible with InterVA automated diagnostic method) and *SmartVA* (fully compatible with Tariff 2.0). It may well be that countries will need to resolve how they wish to trade-off between criteria, e.g. of efficiencies associated with the retention of a specific method against the effectiveness of another. While the TAG lead can and should provide informed guidance, the choice of method must be made by the country (see Step 3 below).

9. **Decide on the data collection method**. D4H recommends collection of data on electronic tablets as the most cost-efficient approach. A decision to continue with a paper-based approach requires more time to be spent on data collection and entry. A decision to introduce electronic tablets, however, should consider the distribution of and support for IT services.

10. **Agree about output**. The primary purpose of VAs is to provide a basis for estimating the patterns of CSMFs likely to prevail in a given population. However, the committee will also need to make recommendations about how families will be informed about diagnosis, the circumstances and methods (e.g. doctor does VA interview and then certifies death) under which COD derived from VA will be included in a formal death certificate, and about the status of COD derived from VA on a national vital events register.

11. **Consider the final model for VA the country will be working towards**. We strongly recommend that the final model be based on the collection of VA either from all registered deaths that lack an assigned COD, or from a representative sample of those deaths. The linkage of VA to death registration will help define and strengthen civil registration generally which is a primary objective of the D4H initiative

5 This topic is covered in the companion paper, *Integrating community based verbal autopsy into civil registration and vital statistics (CRVS): system-level considerations.* Submitted to Global Health Action for publication, August 2016

12. **Establish means of integration of VAs with civil registration.** This relates to notification of deaths to a civil registry, to requests from the civil registry to field staff to collect a VA, and to the subsequent reporting of the results back to the civil registry (as described in Box 1). Process maps developed during the CRVS Baseline Evaluation indicate the flexibility needed to accommodate the characteristics of the CRVS systems of a particular country and the possible entry points. The legal basis for these links needs to be established.

13. **Develop support systems for IT.** This will involve the development of standard systems for software infrastructure, support for the introduction of software systems, and protocols for communications, the interoperability of data and for conforming to the governance and rules and expectations of digital information.

14. **Make recommendations about sampling.** Sampling will be necessary if a country lacks the capacity to collect VAs from all home deaths. It could be based on administrative units nationally or on individual deaths locally. Administrative units might be provinces, districts or sub-districts. The level will be determined by health and civil registry structures, by supervisory systems, and/or by the levels at which data is reviewed, collated and transferred. Sampling of administrative units might be necessary because of lack of sufficient national support to cover the country as a whole or perhaps as part of a phased introduction of VAs. A sampling frame for administrative units could be based on unit population and would most likely be treated as a cluster sample with selection proportional to size. An alternative would be to stratify administrative units by geographic area. Local sampling would be predetermined by an estimate of the total number of deaths that could be covered over a period of time, e.g. monthly. The simplest approach would be to treat this as a fraction of the total number of expected deaths either with random selection of deaths or by selection of every n^{th} death.

STEP 3: PROVIDE ADVICE ABOUT THE CHOICE OF VA METHODS

Before proceeding further, a country will need to make a choice between alternate methods for the collection and analysis of VAs, which have been described above. With this in mind, we have prepared a summary table of the strengths and weaknesses and advantages/disadvantages of the two main VAI available for VA roll out (WHO 2016; *SmartVA*) and the two main automated diagnostic methods (InterVA; Tariff2.0) as shown in Table 2.

It is recommended that:

1. TAG leads ensure that the points made in the Table are adequately raised with the country before any final decision by the country on choice of method has been made. (WG7 are available to respond to any queries or clarify any issues raised by the country in this dialogue). TAG leads should provide advice on methods as they see fit, and as requested.

2. Once the decision on a particular method has been made by the country, the chair of WG7 should be contacted to ensure that the appropriate technical support **for implementation** is available to the country. In the case of *SmartVA* or for Tariff analysis of the WHO instrument, this will be provided by the University of Melbourne/IHME. In the case of the WHO 2016 instrument, used in conjunction with InterVA, this will be provided by other D4H partners or possibly by other partners such as INDEPTH.

It is important to remember that the D4H TAG is a technical advisory group for countries. The TAG cannot and should not make decisions for countries. That is not our role. Rather, as a technical group, it is incumbent on us to be aware of the strengths and weaknesses of various VA methods (i.e. VAI and diagnostic approaches) and to advise countries accordingly. However, we must accept that countries may or may not decide to settle on one particular approach over another on the basis of purely scientific considerations. That is their prerogative. Rather, it is important for the D4H technical leadership that the technical strengths and weaknesses/limitations of various available options for VA have been appropriately discussed with/brought to the attention of countries before they make any decision on implementation options.

As the tools used in VA remain in a dynamic state of development, we also need to ensure a flexible platform that can support the general VA structure (i.e., death notification, VA interview, and automated analysis), while accommodating improvements to the tools. See below for comments on the development of long-term support.

STEP 4: FIELD TESTING THE INSTRUMENT

There needs to be careful time-tabling of this phase. The accuracy of VA depends heavily on the quality of the interview. The success of the subsequent roll-out will depend on how well the field testing is done. In countries where instruments have already been tested, the Working Group should consider moving directly to Phase 1 Implementation.

1. **Review manuals.** Three manuals to accompany the introduction of VA into CRVS systems will be made available: 1) General and Technical Manual covering technical aspects of data collection, editing, and transmission and automated diagnostic methods for cause of death analysis; 2) Interviewer manual covering interview techniques and ethics and all the questions within the VA questionnaire; and 3) Manual for the Training of Interviewers. Each of these will need to be reviewed to ensure that they are relevant to the circumstances of a particular country; they may need to be translated.

2. **Translate verbal autopsy instrument/manuals** if required into a local language. Prepare a dictionary of local names and meaning for common signs, symptoms and diseases used in the verbal autopsy instrument. Undertake cognitive testing. There are many issues associated with translation (especially those using non-Latin script) and sufficient time should be allocated for this purpose.

3. **Arrange with WG7 for assistance to download the translated instrument onto tablets. It will be very important to** establish mechanisms for field support and trouble-shooting in D4H countries, irrespective of which VAI and diagnostic method they choose.

4. **Organise the training program.** It is intended that staff who take part in the field testing will subsequently become trainers and supervisors, i.e. key staff in the implementation of VAs.

5. **Decide on the number of deaths**. We suggest that the field test cover a minimum of 60 adult, 20 child and 20 neonate deaths. More deaths (e.g., 200 or 300) will provide more information on the applicability of the VA methods being considered. Procedures for the uploading of data onto a local computer for allocation of COD are covered in technical manuals.

6. **Select a field site.** Selection of a field site should take local circumstances, such as the presence of pre-existing mortality surveillance, into account. The site should be large enough to collect sufficient numbers of deaths and there should be good access to households. There will need to be a mechanism for identifying deaths. This is likely to involve household surveillance. Verbal autopsies are sufficiently accurate to be collected up to 12 months after a death.

7. **Ensure quality assurance**. Supervisors and trainers should observe interviews and debrief interviewers. This should be included in the initial training; the task could be rotated among trainees for practice. CSMFs should be reviewed for plausibility.

8. **Design and evaluate a field test of the VA procedures and make recommendations for implementation.** The aims of this evaluation should be to identify problem questions, revise translation as necessary, modify training and training materials including instructions for uploading, evaluate adequacy of external support for trouble shooting, and to estimate the average person hours necessary for completion of a VA including uploading of VA interview data by staff category. These results should be formally evaluated by the VA Working Group.

STEP 5: PHASE ONE - IMPLEMENTATION IN A LIMITED NUMBER OF AREAS

The aims of this first phase of national implementation are to:

1. Develop, review and revise procedures for the collection of VAs in the context of CRVS, i.e. as outlined in Box 1

2. Determine the capacity of the selected cadre of interviewers to collect VA in addition to their assigned duties and responsibilities; it is assumed that interviewers will not be recruited specifically for the purpose of collecting VAs

3. Improve the completeness of death notification and registration through collaboration with local civil registries

4. Maximise the proportion of all registered deaths in a given area lacking a death certificate that are assigned a COD from VA

5. Ensure that IT and communications systems that support the VA function of the CRVS system are acceptable and running smoothly

6. Demonstrate the usefulness of COD data derived from VAs.

The working group should review the results of the field test of the instrument and the implications for resourcing, and should provide guidance in developing and implementing Phase One. It should set a clear time-table for the completion of Phase One Implementation, typically three months or so.

1. **Select sites**. The national mortality working group should, if possible, select a minimum of two sites for full implementation. Implementation may be phased between the two sites. This will necessitate obtaining local support and establishing local management. The selection of sites may be determined by demand, capacity or existing activities for VA. Health service staff should be fully informed about activities in their area and involved in the design of the implementation.

2. **Decide target number of deaths.** The national mortality working group should establish indicative targets for the number of deaths that need to be collected as a basis for achieving the aims of the exercise as outlined above. The actual numbers of deaths collected will be dependent on mortality rates and the population size of catchment sites, as well as on the efficiency of procedures to notify and register deaths, and on staff and financial capacity, but should be of the order of 1,000 – 1,200 deaths for this phase. Staff capacity relates to the level of worker who will be collecting VAs, the average number of deaths to be collected by each worker over a set time period, and on their capacity to add VA collection to their existing workload. It also relates to the availability of supervisors. Financial capacity relates, in particular, to travel costs. There will also be the initial costs of purchasing electronic tablets or IT infrastructure improvements.

3. **Review and revise manual of procedures for field sites.** Manuals will need to include standard operating procedures (SOPs) for linkage of VAs to the notification and registration of deaths, planning of home visits, quality control through observation of interviews and review of output, regular reporting, staff management, as well as SOPs for quality control for data management: uploading data, storage, transmission, analysis, output, and reporting. Mechanisms for field support and trouble-shooting should be included.

4. **Evaluation.** The results of Phase One implementation will determine how the national roll-out will proceed. We need to have clear indicators to evaluate different aspects of the process and of the data arising from the implementation.[6]

5. **Evaluate Implementation (Step 3) and make recommendations for national roll-out.** The implementation should be fully reviewed and a report made to the WG and the stakeholders about requirements for resources and the feasibility and extent of a national roll-out.

6. **Review role in implementation.** The working group should decide whether its own membership is sufficient for the implementation of a national program and report to the National Stakeholder Group.

7. **Implement program.** A fully functioning program can then be implemented.

STEP 6: PHASE TWO - IMPLEMENTATION OF A NATIONAL PLAN

The plan will have been revised as a consequence of Phase One. An incremental scale-up will need to be designed with inbuilt monitoring and evaluation.

Plans to provide ongoing technical/troubleshooting support to countries will need to be established, and resourced. This will involve close collaboration between the members of WG7 and the country TAG leads.

6 Working Group 7 has drafted terms for evaluation

Training Materials and Support Systems

TRAINING MATERIALS

Currently available teaching materials have been based on *SmartVA*. Manuals for use with WHO 2016 and InterVA are currently in development.

The following list of training materials to support roll-out of VA into CRVS systems are currently available, or in preparation (in English):

- *SmartVA* Technical Manual
- *SmartVA* Interviewer manual
- VA Trainers Manual
- Electronic version of *SmartVA* instrument and media file (English)
- Paper version of *SmartVA* shortened questionnaire (English)
- Power Point slides on Tablets and use of parts of tablets
- PowerPoint Slides on troubleshooting for Tablet
- Power Point Slides on how to download and install ODK software, XML instrument and media file onto Tablet (step by step process)
- Power Point slides on training of trainer (TOT) skills
- PowerPoint slides to support TOT VA schedules including interview techniques, ethics, how to operate tablets, saving and editing data, and transfer of data
- Assistance to countries in interpretation of outputs and the most useful ways of resolving indeterminate outputs.

Similar materials are currently under development for WHO 2016.

D4H will support, in collaboration with local authorities, the translation of these materials into local languages, as required and where translation is essential to support national VA implementation.

TECHNICAL SUPPORT

It will be necessary to determine which of the following activities a country will be able to manage from its own resources and which will require external support:

- Purchase of tablets
- Preparation of VA questionnaire (local language) in Excel sheet (using mapping provided for *SmartVA* and WHO 2016 instruments)
- Conversion of local language VA questionnaire Excel sheet into electronic form of questionnaire; this may involve change of script
- Downloading and installation of ODK software onto tablet
- Downloading and installation of VA electronic questionnaire onto tablet
- Downloading and installation of VA media file onto tablet
- Development of processes for data transferring and uploading from tablet to central server
- Develop communication between health facilities and civil registries
- Training for IT personnel to support VA.

ONGOING SUPPORT

The focus of this document has been on the initial phases in the introduction of VAs into CRVS systems. The next phase will be the roll-out of national programs. The TAG and working group will need to reassess the need for support during this phase and prepare for continuation after the Bloomberg D4H Initiative. In the next phase more attention will need to be paid to scale-up and sustainability issues including the availability of technical and implementation expertise in-country or in the region. We will need to think in terms of establishing a community of best practice. In this next phase the TAG should consider collaborative planning with regional CRVS partners such as UNECA/ADB, UNESCAP, UNICEF, WHO and World Bank. They should be informed of D4H plans and encouraged to participate in collaborative activity in building local and regional capacity.

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Table 1: Preparation for the Introduction of VA

	DETAILS AND CONSIDERATIONS
GENERAL	Convene a national Mortality Technical Working Group (TWG) concerned with improving the quality of COD. Establish a **VA sub-group** to oversee the preparation for and implementation of verbal autopsies. **Define the composition of the Mortality Technical Working Group and the VA sub-group.** The national TWG should have representation from all agencies involved in the collection and use of data for registration of births and deaths, COD and the compilation of vital statistics (usually civil registry, statistics office, and ministry of health at a minimum). The VA sub-group may need to be led by the Ministry of Health but with involvement for other sectors involved in the CRVS system. Since the broad stakeholder group is concerned with mortality information from all sources, there should be links between the WG for VA and WG for other related interventions (such as improvement in COD through hospitals) and both should report back to the broad stakeholder group. Links and data flow between VA and CRVS ■ Need to establish the **basis on which we are implementing VA** in terms of links with the CRVS/health sector/other relevant agencies ■ The notice to conduct VA would ideally come from CR. links between CR and health sector for reporting COD (including through medical certificates) ■ We assume collection of VAs will be supervised through the health sector. Allows for expertise related to supervision for training, quality assurance, counselling for family members etc. (See below under HR capacity needs). ■ To establish the likely links (and possible barriers) to integration of VA into the CRVS system, we can review the ***Box 1: Simplified model of processes of data collection, entry, and transmission for VAs within a CRVS system*** against the enterprise architecture developed for the baseline evaluation. ■ In some countries there may be no existing system and it may need to be established. ■ Ideally the health sector would be responsible for notifying community deaths (and ultimately conducting VA to identify COD) as well as reporting on COD from facility deaths in order to streamline the link for this data to the CRVS system.
1.	**Consider the need to revise legislation to cover VA as part of CRVS** The working group in consultation with the national stakeholder group should review legislation in-country to identify changes needed to facilitate the integration of VA within CRVS. Primary concerns are i) authority to collect, ii) confidentiality, data sharing and data security, and iii) access to data by family and next of kin. Legal requirements for physicians to certify or assign likely COD need to be considered.
2.	**Review national experience and resources for the collection and interpretation of VA data** ■ This is critical to understand the current environment under which we will be implementing VA. This might include: ■ Learning lessons from HDSS/SAVVY – what has worked and not worked from previous experience? ■ What existiTng expertise is there in country? ■ The level of program support for VA for research purposes will be higher than can be expected for routine VA. ■ What value from earlier efforts can be applied to routine VA? ■ What tools (instrument and diagnostic methods) have been used in country previously? ■ For instance what materials are currently available in the local language? ■ Understanding capacity in terms of HR/supervision/sustainability ■ What other institutional support is available? What other agencies have been involved and how can we foster links? ■ WHO, INDEPTH, MEASURE Evaluation, others ■ Implementation of other (similar) questionnaires (for e.g. related to maternal/child deaths) might also reflect the acceptability of VA to the population

	IMPLICATIONS AND RECOMMENDATIONS FOR D4H
GENERAL	This step is to establish the principle of integrating VA within the CRVS system. It ensures the basis of the critical link between VA and CRVS is understood and agreed. ■ Technical issues for implementation of VA into CRVS might be left to the working group but wider issues such as changes in legislation, links and data-flow between VA and CRVS should be decided by the national stakeholder group. The issue of data flow is a broader issue than VA – it also relates to hospital COD information within CRVS. It is imperative that there is a mechanism for flow between different sectors and stakeholders. ***Implication is if there is no mechanism or political will to create a mechanism to connect VA and CRVS we should not implement VA in the country.***
1.	
2.	Whether VA has been used in country and in what format needs to be considered in the design. For example field testing of instruments may not be necessary if this has already been done in-country. If there is capacity (through HDSS or SAVVY) for VA, D4H might be able to use this capacity for training of trainer purposes. However, routine VA within CRVS (versus VA for research purposes) should not be seen as a scale-up of these programs. This does not rule out finding new ways of working with SAVVY or SRS that will fit within the new system of integration with CR. ***The extent to which we can/should utilise existing HR, materials and expertise from other initiatives will need to be discussed/negotiated with the relevant stakeholders.***

Table 1: Preparation for the Introduction of VA

	DETAILS AND CONSIDERATIONS
3	**Model for national roll-out** If a country does not have the capacity to collect VAs from all registered deaths without a medical certificate of COD, it will be necessary to design a method of sampling. This could either be a random sample of all such deaths within an administrative area or a sample of administrative areas. ■ Need to decide the appropriate administrative level on which samples will be based. ■ Stratification. Again will be country dependent – identifying key characteristics affecting variability in mortality and COD. We can then sample from within strata ■ We need to consider also in- and out-migration (especially in large cities) ■ To be useful at a population level, there need to be sufficient deaths to be able to understand the distribution of COD. However – **we can expect operational and political considerations to affect plans for roll-out**. Staged implementation may involve pragmatic decisions that do not provide representative sample in the early stages. ■ These early stages will be used to clarify the scale of the roll-out with regard to the need and availability of resources (HR, financial, infrastructure inputs) ■ Purposive sampling may be necessary (we start where there is demand or political acceptability) ■ May start in areas where capacity is greatest (due to previous VA work) ■ Implementation (and benefits) may initially be on a sub-national level. As far as possible need to ensure that the results are representative at least within that sub-national level.

4.	**Decide on the cadre of workers that will collect VA data**
	
	■ Characteristics will be country dependent although optimal characteristics include secondary education and formal link the health sector (other factors, such as proficiency in various languages may take priority in some countries).
	  ■ We need to identify the level of health or community worker technically capable of conducting VA. A simple guide to technical capacity is to relate the complexity of collecting VAs to workers' current clinical responsibilities
	  ■ For routine VA the cadre of worker that has both the skills and time availability needs to be considered, as well as the preferences of the country. (For example, regardless of what we believe to be the 'ideal' interviewer, some countries will prefer doctors or medical aides to conduct VA whereas others will rely on a more peripheral health worker)
	  ■ Then we need to assess whether it is feasible to introduce this task. Some questions are: What are the opportunity costs/absorptive capacity of this cadre? What are the total set of tasks assigned to this person (e.g. interview, downloading information onto the computer) in addition to other roles. Also need to factor in travel time and costs

5.	**Identify appropriate cadre of supervisors and the supervisory mechanism for routine VA**
	
	THIS IS CRITICALLY IMPORTANT AND NEEDS TO BE EMPHASISED.
	
	■ Ideally supervisors need to have capacity (skills and time) to
	  a. train interviewers
	  b. assess quality of interviewers and make necessary changes
	  c. sensitively allocate most appropriate interviewers to conduct VA (e.g. experienced woman for neonatal and child deaths)
	  d. schedule home visits (2-3 months post-death)
	  e. provide mechanism for counselling of interviewers (to prevent PTSD)
	  f. provide a mechanism for family to attend health facility for counselling on probable COD
	  g. oversee the mechanism by which VA results are fed back through the health system to the CRVS.
	■ Supervisory mechanism – a reliable and sustainable means of communication between interviewers and supervisors – is essential. We need to avoid the situation of heavy reliance on external assistance (things work only until this support is withdrawn and then it falls apart)
	■ Supervisor travel to directly oversee interviewers is only one mechanism. Another is to use a key meeting (e.g. government pay-day) where all VA interviewers would come to a facility/central point as a way to provide supervision/address queries and problems. A further one is to take advantage of internet communications. These meetings might also provide an opportunity for de-briefing (group or individual counselling for interviewers) and for downloading VAs to computers from tablet

	IMPLICATIONS AND RECOMMENDATIONS FOR D4H
3	***Implementation of VA through D4H assumes that VAs will be based on either a sample or a full set of notified or registered deaths and not on household surveillance.*** It does not consider the application of VAs in supplementing COD data for hospital deaths where death certificate is inadequate. VA will be implemented on an incremental basis; the long-term intention for scale-up will be developed through these earlier efforts. ***The way VA is implemented will determine how the information can (and cannot) be used at different phases of the implementation.*** VA can be seen as complementing other COD data and providing additional information to these other sources (e.g. medically certified COD). ***Therefore the strategy for VA roll-out will need to be considered alongside interventions to improve other information on COD and on the links between health and CR.***
4.	Also relates to point 2 above. What capacity already exists in-country. ***The current capacity of the workforce in country related to VA has implications for the speed of the roll-out and the extent of the training and on-going support needed.*** Choice of cadre of workers for VA in routine CRVS needs careful thought and will vary by country. The 'ideal' interviewer may not have the time for the task. The choice of instrument and data collection method (see below) will also be a factor since it may require different skill-sets and tasks. ***Remembering that this is our model for routine VA, the sustainability and potential burn-out of workers needs to be considered.***
5.	**The supervisory role and mechanism is critical to the success of this intervention.** This is a significant task and supervisory capacity needs to be carefully thought through particularly at peripheral levels of the system with few available staff. ***The more qualified the staff undertaking the VA interviews, the less supervision is required. However, there needs to be a reliable and sustainable mechanism for communication between VA interviewers and supervisors.*** ***Some resistance to an increase in tasks can be anticipated. An assessment of absorptive capacity of both interviewers and supervisors is essential. Once a national strategy is identified, tasks can be institutionalized in training programs and incorporated as routine tasks for future staff.***

	DETAILS AND CONSIDERATIONS
6.	**Consider other workforce issues for routine VA in CRVS** ■ **HR Capacity for IT** – if using technology need to identify (and train) which staff will be responsible for managing the system (uploading VA interviews to computer/running automated diagnostic methods/compiling and disseminating information/trouble-shooting). Also need to ensure adequate infrastructure (in some cases electricity) for this to happen ■ **CR workforce**. They will be responsible for requesting VA from the health system. What training/orientation will they need? Do we expect there to be more deaths notified once a robust system is in place to notify from health facilities?
7.	**Select the VA instrument and diagnostic method(s); (InterVA, Tariff, InSilico, physician review)** See Table 2.
8.	**Decide on data collection method: electronic tablet or paper** ■ Both PHMRC-shortened and WHO 2016 are designed for use with electronic tablets. This provides other benefits such as ability to show pictures and use sounds to aid symptom recall. It may also facilitate the link between CR and VA. ■ In an ideal system, registration details of the deceased may be pre-populated into the VA form on the tablet by the CR before being sent to the health facility to conduct a VA. This ensures a unique identifier is assigned and that the COD information from the VA can be linked to the death registration file of the deceased once it is sent back to the CR. ■ Questionnaires from PHMRC-short and WHO 2016 can also be replicated in paper form if necessary. This is not optimal but may be necessary in remote locations. Some believe paper format is more personal and acceptable to interviewees. However, data collection by tablets has been done in various locations and found to be feasible and acceptable. Degree of acceptability may be country-dependent. If using paper format, there needs to be an efficient way to transfer this data onto computer.
9.	**Agree on output** ■ Use of VA data (CSMFs with or without individual COD for families) ■ The primary purpose for VA is to provide a basis for COD Vital Statistics through the output of Cause Specific Mortality Fraction (CSMF) which for VA has it has an accuracy ≥ 75%. As previously noted, the uses of information in the implementation phase may be limited by the site and representativeness of the data. ■ With respect to the aggregation of COD from hospital records and VA for the purposes of calculating population statistics, this is essential and achievable using appropriate modelling techniques. However, given the different methods for calculating UCOD, the means to identify where the information originated (i.e. in hospital record or through VA) needs to be retained. This is a technical issue and should be part of the quality assurance process. ■ The accuracy of assigned COD from VA for individual deaths is approximately 50%. The question arises about families' right of access to an individual diagnosis. D4H recommends that if a family requests an individual diagnosis they be given an appointment with a health professional who can review the VA report and discuss its implications.
10.	**Establish a means of integration of VA with CRVS** ■ Following a consideration of all the above aspects of implementation of VA, a plan for integration of VA in CRVS can be presented to the national stakeholder group for consideration and approval.
11.	**Develop support systems for ICT** ■ The capacity of IT systems to accommodate the various steps of VA needs to be established. This should cover internet connectivity, interoperability between agencies (health and civil registry), availability of necessary hardware, installation and trouble-shooting of software, and the availability of IT personnel
12.	**Review work plan timelines and costings**. ■ Develop a detailed implementation plan. Establish timelines for field-testing and the phased introduction of the intervention. This plan should also be considered alongside plans to improve COD data through hospitals since there may be synergies or efficiencies for some activities.

	IMPLICATIONS AND RECOMMENDATIONS FOR D4H
6.	
7.	***Given the on-going compatibility issues, the implication is that the choice of instrument will determine the diagnostic tool (and vice-versa).*** Countries may have their preference based on political/practical considerations that will override technical considerations. Logically PHMRC-short should be used with Tariff 2.0 (PHMRC-short + electronic collection methods + automated coding through Tariff 2.0 = *SmartVA*). WHO 2014 may in the future be compatible with Tariff 2.0 (it is not currently) but will utilise only a fraction of the questions. However, it is fully compatible with InterVA. PCVA is not ideal for both technical and efficiency reasons. For some countries we might need to accommodate for legal reasons (physicians must assign COD). ***The cost implications of PCVA for physician training and salary support would need to be taken into account.***
8.	***Technical benefits and efficiencies of electronic format make it the best option for roll-out of VA in CRVS especially when using automated diagnostic methods.*** ***Using electronic format has implications for HR (IT) and for resources (need to purchase tablets and establish IT infrastructure for uploading and transferring information).*** ***When testing the instrument, acceptability of the data collection format by the interviewers should also be assessed.***
9.	***The D4H advocate the use of VA in CRVS for the purpose of providing better population metrics on cause of death for public health/population level application.*** ***One needs to be careful when using VA at an individual level and we are not advocating the use of VA to allocate individual COD for legal reasons.***
10.	
11.	***This is also related to the information flow for VA COD between health and CR. It implies a level of integration/collaboration between agencies and their information systems. It also implies a basic level of IT infrastructure to run software, power tablets, upload information, analyse and interpret.***
12.	***Development of an implementation plan for Phase One is likely to follow field testing and analysis of resources needed/available.***

Table 2: Comparison Between the PHMRC Shortened and the WHO 2016 Questionnaires

Criterion	PHMRC-short questionnaire (SmartVA)			WHO 2016 questionnaire		
	Characteristics	**Strengths**	**Weaknesses**	**Characteristics**	**Strengths**	**Weaknesses**
Content	Contains four modules – general, neonate (0-28 days), child (29 days – 11 years) and adult (>11 years)	SmartVA has been developed specifically to provide COD information in Civil Registration systems Includes only questions directly relevant to identifying underlying cause of death therefore shortest number for this purpose.	Information for other purposes (e.g. health service delivery) is minimal.	Three modules – neonate (0-28 days), child (29 days – 12 years) and adult (>12 years)	Contains CRVS section, with detail compliant with UNSD recommendations, social autopsy section, external cause and pregnancy sections agreed with WHO programmes, Can provide information on other areas of interest such as health service delivery)	More questions than SmartVA.
Time	From field tests: on average <25 mins to complete, including open narrative section, not including introductions and formalities.	Minimal time to administer		Assumes that skip patterns will reduce duration of interview		Field data on duration of interview not available
Method of delivery	Designed for electronic data collection using tablet and automated diagnostic methods	Electronic data collection most efficient	Functional IT systems prerequisite	Electronic data collection using tablet and automated diagnostic methods is available	Electronic data collection most efficient	Functional IT systems prerequisite
Diagnostic method	Tariff 2.0	Validated against gold standard (GS) hospital data from six sites in three continents.	Performance in other settings still being evaluated	Compatible with InterVA (following data preparation stage).	Allows users to apply InterVA, Tariff 2.0 or InSilico	InterVA appears to perform less well than Tariff 2.0 or physician-coded VA
Cause list	Based on GBD categories. Can be ICD-10 coded	Differentiates more cancer types than WHO 2014	Does not discriminate between maternal causes. No category for malnutrition.	Compatible with ICD-10 short list	Differentiates between maternal causes.	Fewer types of cancer than SmartVA
Open narrative	Open narrative is mandatory and includes a checklist of 'words of interest' for interviewer to tick.	The open narrative contributes significant information for assigning underlying cause of death through the checklist	Extends VA interview by an additional 3-5 minutes	Open narrative is recorded as free text; checklist will be included in WHO VA 2016	Open narrative can be analysed by Tariff 2.0 through the checklist	Open narrative not utilized in assigning underlying cause of death using InterVA
Experience	Full PHMRC VA questionnaire tested in Tanzania, India, Philippines, Papua New Guinea, Mexico. SmartVA field tested in Sri Lanka, Philippines, and Bangladesh	SmartVA on tablets well accepted in field tests. Paper questionnaire available if needed		Extensive use of WHO instruments in HDSS field sites and through INDEPTH network	Paper questionnaire available if needed	
Technical support	Training materials and operational manuals; trouble-shooting; data interpretation			Support through CDC, Bloomberg based on experience in HDSS and INDEPTH		

*Includes general questions common to all age-groups

**Does not account for 'skip patterns'

*** This added feature of allowing users a choice of diagnostic methods accounts for the longer length and time required for the WHO questionnaire

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DATA FOR HEALTH INITIATIVE

Australian Government
Department of Foreign Affairs and Trade

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

Civil Registration and Vital Statistics partners:

Vital Strategies

CDC FOUNDATION
Helping CDC Do More, Faster

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