GLOBAL HEALTH SECURITY

EPIDEMIC ALERT & RESPONSE

Investigating cause of death during an outbreak of Ebola virus haemorrhagic fever: *draft verbal autopsy instrument*

World Health Organization

Department of Communicable Disease Surveillance and Response

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1. Background

An essential component of control during outbreaks of Ebola haemorrhagic fever (EHF) is investigation of the causes of recent unexplained deaths. It is particularly important during the earliest part of the epidemic, in order to identify both individuals who have died of EHF and their contacts. Close contacts of individuals believed to have died of EHF can then be kept under observation and isolated if they develop disease, in order to interrupt further transmission.

Verbal autopsy consists of retrospective interviews with the next of kin. It is an alternative to autopsies, when cadavers are not available for examination, or when laboratory services for confirmation of cause of death are not accessible or feasible. Experience has shown that verbal autopsies work well for causes of death that have distinctive and noticeable features, not commonly found in other causes of death (WHO, 1995). The fact that cases of EHF have had exposures to other cases or to infected animals, coupled with the dramatic symptoms and signs of EHF, meets those criteria to some extent. Therefore, it should be possible to use verbal autopsy for investigating deaths during outbreaks of EHF. In fact, verbal autopsy instruments have been used in a number of past outbreaks, but each of these outbreaks used different instruments. To date, there is no standard, verbal autopsy instrument for use during outbreaks of EHF.

This document presents a draft verbal autopsy instrument based on best judgement and previous experience in a variety of settings including outbreaks and research. It has been circulated widely to professionals involved in previous outbreaks and revised accordingly. This questionnaire is a first attempt at developing a standard questionnaire. It is part of a wider effort by the Global Outbreak Alert and Response Network (GOARN) to develop tools for testing in advance of outbreak situations. The draft needs to be field tested, validated, and if necessary revised, before it can be considered as a standard questionnaire. A similar process was carried out in developing a standard verbal autopsy for investigating causes of death in infants and children (Anker et al., 1999).

To this end, the current document also contains information on how to carry out a validation study, which compares the results of a verbal autopsy questionnaire with the results of a "gold standard" – such as laboratory test or clinical diagnosis. The questionnaire itself can be used during an outbreak before a validation study is undertaken – since it is most likely to be needed during the early phases of an outbreak, for investigating causes of deaths that took place before EHF was recognized. However, the "gold standard" needed for a validation study would most likely be available either during the late stages of an outbreak (when cases are hospitalized) or after an outbreak is finished. A validation study is needed to identify those questions that differentiate EHF from other causes of death, and to evaluate the extent to which the instrument is able to accurately classify cause of death. The questionnaire should then be revised on the basis of the validation study.

The document is structured as follows. First, previous experience using verbal autopsy in a number of different settings is reviewed, providing the rationale for using verbal autopsy in outbreaks of EHF. This is followed by a discussion of practical issues related to carrying out verbal autopsy in outbreak settings. These issues include identification of deaths at different phases of the outbreak, selection of interviewers, adapting the questionnaire to the local situation, selecting respondents, rescheduling interviews, and coding the questionnaire. This is followed by the methodology for carrying out a validation study and a brief summary of the proposed questionnaire and its format, and by in-depth discussions and descriptions of the sections used for eliciting information on the cause of death. A practical instruction page, the draft questionnaire, and considerations for coding cause of death are annexed.

2. Review of previous experience with verbal autopsy

2.1 Instruments used in previous outbreaks of EHF

Available instruments from Gulu, Uganda, and Gabon were used in formulating the attached questionnaire. Retrospective interviews with families to evaluate causes of death have been used during the outbreak of EHF in Gulu, Uganda, 2000–2001 and in Kikwit, Democratic Republic of the Congo, 1995 (Roels et al., 1995). During the EHF outbreak in Gabon, 2001–2002, a section on contacts with infected animals was developed (but not implemented) in view of the importance of these exposures in the local setting. That section may be particularly relevant to some special groups of people or those with unique activities such as hunters, minors, tourists to caves, etc. and for establishing the index case or the first few cases.

2.2 Instruments used in other settings

Verbal autopsy has been used for many years to estimate cause-specific mortality in populations in which medical certification of causes of death is rare. In an attempt to evaluate how well this method works, a number of validation studies have compared the results of the verbal autopsy with medical evidence. These studies indicate that there is considerable variability in the ability of verbal autopsy to accurately classify deaths, and that causes of death with distinct features that are easily remembered by respondents are most suitable for verbal autopsy. Previous verbal autopsy instruments have focused mainly on common causes of death, and have developed algorithms based on symptoms and signs of illness.

The verbal autopsy for EHF differs from previous work in several important ways. First, the questionnaire includes considerable information on previous exposure to EHF, in addition to the usual questions on symptoms and signs of illness. This should be an added advantage. Second, the EHF verbal autopsy can become of primary importance for tracing contacts during outbreaks, which means that the consequences and relative importance of high levels of sensitivity and specificity are different from the requirements of sensitivity and specificity for estimation alone. For example, when **estimating** cause-specific mortality rates, misclassification errors may be acceptable if they are counterbalancing, because the overall estimate will not be affected. However, counterbalancing errors are not acceptable when the verbal autopsy is being used as a tool for deciding whether the contacts of the deceased should be contacted and followed up. Nonetheless, the tool can still be used to quantify the impact of an outbreak.

3. Practical considerations for conducting verbal autopsy studies during Ebola haemorrhagic fever outbreaks

The EHF verbal autopsy instrument is meant to be used during and after outbreaks of EHF. Although the circumstances surrounding any death are always painful, and interviewers using verbal autopsy must be sensitive and sympathetic to the families of the deceased, verbal autopsies during an EHF outbreak have additional problems that non-outbreak settings do not have. First, many of the respondents who may need to be interviewed are fearful for their own health, as they could have been exposed to EHF. They may therefore be very reluctant to describe an episode during which they themselves may have been exposed to EHF. This makes the interview process more difficult during outbreaks of EHF than in post-outbreak situations when the respondent has survived and may be more willing to describe what happened. Another problem during EHF outbreaks is that of finding suitable respondents. Because EHF is often spread to family members, the next-of-kin of deceased persons may themselves have died. In this case it may be necessary to interview more that one respondent to obtain information on a case being verified. Third, the urgency of the outbreak makes speed of utmost importance. While in other circumstances it may be practical to return to the household several times in order to interview the ideal respondent, this may not be feasible during an EHF outbreak. Fourth, the purpose of verbal autopsy during EHF is somewhat unusual, as it is needed primarily for contact tracing. Its use for estimation purposes is secondary. This means that classifying a death as not caused by EHF when it actually was may have serious direct health

consequences. The sensitivity of the instrument needs to be high to avoid missing potential cases. On the other hand, since each EHF death might imply following up on many contacts, it is also important that deaths not due to EHF are correctly classified. However, given the direct health consequences of poor sensitivity, it is probably fair to say that high sensitivity is more important than high specificity in EHF outbreak investigation. This is in contrast to the typical use of verbal autopsy for estimation purposes, where specificity is more important than sensitivity in determining the accuracy of the estimation.

3.1 Identifying recent deaths

During an outbreak of EHF, deaths that require verbal autopsy investigation can be identified in a number of different ways during different phases of the outbreak including:

The initial phase

- Community-based – ask local key informants about recent deaths and funerals.
- Health facility-based, including hospitals and primary health care facilities – review records and ask health facility staff to identify recent deaths.
- Maternity wards – it is important to identify recent deaths in maternity wards because EHF often results in genital bleeding and in spontaneous febrile abortions.

During the investigation

- Some deaths may be identified during the contact history part of the verbal autopsy questionnaire itself.

Once surveillance activities are well established

- Deaths are routinely reported and investigated with the verbal autopsy questionnaire.
- Sometimes deaths of cases already reported may require further verification for clarity.

3.2 Adapting the verbal autopsy questionnaire to the local situation

The draft questionnaire included in this document is based on the literature and the best judgement of many individuals who were involved in previous epidemics. Since every epidemic is different, the questionnaire will need to be modified in each setting to capture the specific characteristics of the epidemic. In particular the section on contacts will need adaptation. Some questions, such as those about participation in unsafe funeral practices, or venturing into the forest, may be deleted if they are not relevant to the specific culture, and some questions relevant to the particular circumstances may need to be added.

Behavioural scientists, if available, can be very helpful in the adaptation of the verbal autopsy to local conditions. In particular, full use should be made of any ethnographic studies that have been conducted in the area. It is important to understand local belief systems, local practices surrounding illness and death, and local vocabulary with reference to illness. Note that the local commonly used categories of symptoms and signs of illness, and of illnesses themselves, may not correspond exactly to the biomedical model. Thus, understanding commonly used terms can be very helpful in adapting and interpreting verbal autopsy.

Ideally the questionnaire should be translated into the local language, and back-translated into the original language to ensure that translation of questionnaire is accurate. At the very least, someone who is familiar with the local language should suggest local words commonly used to describe the symptoms and signs of EHF, and these should be used during interviewer training.

The questionnaire should then be pretested in the local setting. This involves trying out the questionnaire in a small number of households. Any problems the respondents have in answering the questions should be noted, and changes to the questionnaire should be made as necessary. A list of changes and their justification would be helpful for future modifications.

3.3 Interviewers

Experience with verbal autopsy indicates that interviewers require a relatively high level of education. University medical students have often proved inexpensive and capable. Other health care workers might also be a good source of interviewers. Medical doctors are rarely used for verbal autopsy (although they were used in the 2000 Gulu EHF epidemic), since they are a scarce and valuable resource in developing countries, and other educated personnel are capable of being trained to do the interviews.

3.4 Respondents

In a verbal autopsy for EHF, the respondent should ideally be an adult caregiver who was present during the final illness, such as a spouse, who is likely to know about contacts with infected people or animals to which the deceased might have been exposed before becoming ill and other contacts of the deceased during illness. If the deceased were a child, the mother would usually be the best respondent. This may not always be possible in an EHF outbreak. A retrospective survey in Kikwit (Roels et al., 1999) used a hierarchical approach to selection in order of preference:

"1. Individuals residing in the same household (i.e. sharing the same cooking fire) and who knew the deceased well (e.g. the deceased patient's spouse or oldest child).
2. Individuals from a different household who knew the deceased well (e.g. the deceased patient's parents or grandparents).
3. Individuals residing on the same parcel of land as the deceased (e.g. the deceased patient's landlord or closest neighbour)."

It is useful to have criteria for choosing respondent(s) and these should be used during interviewer training. The criteria should be tailored to each situation, balancing the advantages and disadvantages of getting the "best respondent" with the reality of field conditions. The respondent should ideally be an adult present during the final illness.

The hierarchical approach presented above is a good model, which could be adapted to the local situation and used for training interviewers.

Another problem that may be faced is the possible need to interview multiple respondents to find the information necessary for any one case. This contingency needs to be considered during the adaptation of the instrument to the local setting, and should be part of interviewer training.

It should be noted that kinship terminology might differ from group to group. For example, in Gulu "all lineage males in a speaker's generation (brothers and father's brother's sons) are called 'brother' (omera) and all lineage females in a speaker's generation (sisters, father's brother's daughters) are called 'sister' (lamera)" (Hewlett, 2001). This caused difficulties when investigators were trying to establish the relationship between the respondent and the deceased during the verbal autopsy interviews (Werker, Andraghetti & Kandebure, personal communication). The local kinship terminology needs to be investigated before the interview begins, and the questionnaire should be adapted accordingly, so that the exact relationship of the respondent to the deceased can be clearly established.

3.5 Rescheduling an interview if the respondent is not available

If the ideal respondent is not available, *and if it is feasible*, a new interview should be scheduled. Only after repeated failure to interview the respondent of first choice should a respondent of second choice be selected. However, the approach to scheduling re-interviews should be worked out within each field situation. In many field situations, it may not be practical to come back for interviews. Depending on the field situation, the questionnaire should contain instructions on who the respondent should be, and what to do if the respondent is not there at the time of the visit. For example:

Instructions to interviewer:

Introduce yourself and explain the purpose of your visit. Ask to speak to an adult caregiver who lives in the same house as the deceased and was present during the illness that led to death. If this is not possible, arrange a time to revisit the household when the caregiver will be available.

3.6 Coding the questionnaire

Completed questionnaires need to be coded according to whether the death was from EHA or from another cause. A consistent method of coding cause of death is a crucial part of a verbal autopsy tool. This can be done in two different ways.

1. One method of coding uses physician coders – usually two independent physician coders, with a third deciding on discordant cases. Physician coders have been shown to be at least as accurate as algorithms for coding verbal autopsy for other causes of death. It will be necessary to use physician coders if the instrument is used in an outbreak before validated algorithms are available.

   As far as possible the same physician coders should be used to evaluate all questionnaires. To ensure consistency, the physician coders should, as far as possible, use explicit criteria for coding. These criteria should be a combination of epidemiological links and symptomatology consistent with the clinical presentation of EHF. The criteria should cover most situations. The physicians would have leeway, however, to use their expert judgement to interpret situations that have not been foreseen in the development of criteria. Appendix C provides some guidance on characteristics that are indicative of EHF and those that are indicative of another cause of death.

2. The second method is based on developing algorithms for coding verbal autopsy based on the questionnaire. This involves specifying a set of conditions based on the answers to the questions that would enable an automatic coding of the questionnaire – without the need for physician judgement. If the conditions were met, the death would be considered to have been caused by EHF; otherwise, the death would be considered to have another cause. Algorithms offer the advantages of being objective and not requiring the input of physicians, whose time might be better used for other tasks during the outbreak. Algorithms need to be tested before they can be used with any confidence: physician coding will therefore be required during an outbreak until validated algorithms are available.

4. Validation study

4.1 What is a validation study?

A validation study consists of testing a draft questionnaire by comparing the results with a "gold standard". The preferred gold standard would be laboratory testing. However, if that is not possible, clinical diagnosis could be used when available.

4.2 Possible settings for a validation study

The questionnaire can be validated either at the time of an outbreak investigation itself or after the outbreak is over. Since a gold standard is required to compare with the results of the verbal autopsy, the validation study should ideally be based on deceased patients for whom a diagnosis is available. The next of kin are then interviewed with the verbal autopsy questionnaire.

4.3 The sample

The sample should include people who died from EHF and well as those who died from other causes, in order to test whether or not the questions can differentiate EHF deaths from other deaths. The number of EHF deaths in the study will determine the size of the confidence interval

around the estimate of sensitivity. For example, a sample size of 100 EHF deaths will provide a 95% confidence interval of, at most, 10 absolute percentage points around the sensitivity. Likewise, the number of deaths from causes other than EHF will determine the size of the confidence interval around the estimate of specificity.

If the validation study takes place after an outbreak, care must be taken to select a sample of deaths from other causes that would be typical of those likely to occur during the weeks before the outbreak – and that require investigation. If possible, they should include some cases of pregnancy – since cases of premature abortion and genital bleeding would normally be investigated during the early phases of an outbreak.

4.4 Developing algorithms

Algorithms could be based on the best judgement of experts and then tested against the gold standard during the analysis stage of a validation study. It would also make sense to test algorithms that have already been suggested or used elsewhere. The retrospective verbal autopsy study in Kikwit (Roels et al., 1999) used the following algorithm which should be tested during the validation study:

> Presence in region during outbreak
> *plus*
> fever and unexplained haemorrhage
> *or*
> fever and previous contact with another EHF-infected person
> *or*
> fever and any three of the following – headache, nausea, vomiting, anorexia, intense fatigue, abdominal pain, myalgia, arthralgia, dysphagia, dyspnoea, or hiccups.

Alternatively, there are statistical methods, such as discriminant analysis, for developing and testing "data-derived" algorithms in validation studies. Using data-driven methods to derive algorithms may be useful to identify the most important characteristics; however, derived algorithms sometimes include spurious relationships – therefore, only algorithms that make clinical sense should be used.

4.5 Analysing the data from the validation study

The purpose of analysing the data from the validation study is to refine the questionnaire and the coding techniques so that they reliably distinguish EHF deaths from other recent deaths.

The most important analysis would be to compare the gold standard with the coding method used in the study by computing the sensitivity and specificity of the study method. The sensitivity is the proportion of all deaths due to EHF (according to the gold standard) that are correctly classified by the verbal autopsy as EHF, and specificity is the proportion of deaths due to other causes (according to the gold standard) that are correctly classified by the verbal autopsy as not due to EHF.

It is also useful to develop and test a number of alternative algorithms (combinations of answers to questions) based on expert judgement for their sensitivity and specificity to assess whether any of them performs as well as the algorithm used in the study. If physician coding was used to determine cause of death, it should also be compared with the gold standard diagnosis.

In reporting on sensitivity, specificity and predictive values, the number of cases coded positive and negative from the verbal autopsy questionnaire, and the number of patients with positive and negative gold standard diagnosis, should be provided, as well as confidence intervals.

Questions that do not add to the differentiation between EHF deaths and deaths from other causes should be deleted from the questionnaire. Other reasons for dropping questions from the questionnaire might be respondents' difficulty in understanding or answering the question, and too many cases with unknowns.

5. The questionnaire

5.1 Order of questions

The questionnaire is divided into sections and comprises:

- A cover page with administrative information about the deceased and the interview that should be completed before the interviewer goes to the field.
- Section 1 contains information about the respondent and his or her relationship to the deceased. This is needed to identify the respondent if there is need for additional follow-up. In addition, it may be interesting to look at the reliability of the responses according to the relationship of the respondent to the deceased.
- Section 2 contains demographic information about the deceased and the place of death.
- Section 3 focuses on contacts that the deceased may have had with infected animals and people before becoming ill and contacts during illness. It is unusual for a verbal autopsy to include such a section, but establishing a chain of transmission is a key part of outbreak control activities, and a key decision point for coding cause of death for EHF. This section will need to be adapted to each local situation.
- Section 4 consists of an open history question, to allow the respondents to talk about events surrounding the death in their own words. This is standard on verbal autopsy questionnaires.
- Section 5 contains a series of questions on symptoms and signs of illness and, sometimes, on their timing (when timing is considered to be a distinctive feature that would distinguish EHF from other causes of death). This section comes relatively late in the interview: it was felt that some questions in this section would be sensitive for some of the respondents, particularly if they were worried about their own exposure to EHF.
- Section 6 contains questions on chronic illness to rule out other potential causes of death.

5.2 Contacts

Physical contact with someone who was ill with or who died from EHF, or with their clothing or bodily fluids, during the three-week period before symptoms appeared is important for identifying EHF as the cause of death. Because of this, a fairly detailed history of contacts with ill persons, or with persons who died, is included in the attached questionnaire.

This section needs careful review and adaptation to the specific local conditions at hand. For example, traditional funeral ceremonies may involve unsafe practices, such as ritual washing of the body. It is important to understand what happens during the traditional funeral ceremonies, in order to design appropriate questions on the participation of the deceased in associated risky activities. Similarly, it is important to have a good understanding of practices related to visiting and caring for the sick, in order to adapt the questionnaire appropriately.

The section also contains a detailed history of contact with animals that were possibly contaminated with EHF, and with the forest. Here again an understanding of local conditions is paramount.

5.3 The open history section

It has been found useful to precede the sections of the verbal autopsy that deal with symptoms and signs of illness with an open history section, allowing respondents to describe events leading to death in their own words. This helps to establish rapport, stimulate the respondents' memory, organize their thoughts, etc. and allows unexpected events to be considered. It also allows for an understanding of the timing of events, which may not be easy to establish through a questionnaire. A question that has proved successful on other VA is:
"Could you tell me about _____'s illness that led to death?" When the respondent finishes talking, the interviewer should prompt "Was there anything else?" until the respondent says that there is nothing else.

Answers to the open history question should be recorded on the verbal autopsy form. Answers mentioned spontaneously in response to open history questions are thought to be more specific than answers to pre-coded questions – however, the answers to the pre-coded questions are thought to be more sensitive.

On the rest of the form, the interviewer should tick the appropriate answers to questions that were answered spontaneously during the open history question. This is to avoid giving the impression that the interviewer was not listening to the respondent's answers to the open history and to ensure that the interview does not become laborious and boring to the respondent. Occasionally, when questions that had already been answered were asked again, there was some resentment. (Henry Kalter, 2002, personal communication), which is why it is important for the interviewer to check the questions that are spontaneously answered during the open history.

If the questionnaire requires probing for additional details about symptoms and signs mentioned spontaneously, the interviewer might refer to the spontaneous answer, and then ask for more detail. For example, suppose bleeding was mentioned spontaneously during the open history. Question 5.20 (see Appendix B) should be introduced by saying:
"You have already mentioned that _____ had bleeding. Could you tell me from which part of the body the bleeding occurred?"

5.4 Specific questions on symptoms and signs of EHF

Verbal autopsy works by asking respondents to recall distinctive features of the death of interest that are not commonly found in other causes of death in the same setting. It is therefore useful to review the distinctive features of EHF in terms of symptoms and signs and their timing, as well as possible contacts with potential sources of infection and their timing. It is also useful to consider likely concomitant outbreaks of diseases with similar features.

EHF is a progressive disease. The early phase is characterized by nonspecific symptoms and signs, including fever or chills, severe weakness, loss of appetite, diarrhoea, nausea and vomiting, abdominal pain, headaches, sore throat or pain on swallowing, muscle or joint pain, pain in back, chest pain, cough and shortness of breath, which become increasingly severe during the early period.

Symptoms typically appearing during the latter part of the first week include red eyes (usually both eyes), blood in stool, vomitus and/or sputum, bleeding from nose, gums, injection sites, and/or vagina, and a rash. These signs are not normally seen during the first three days of illness: their appearance during the first three days may indicate that the illness is not EHF.

By and large, the symptoms mentioned above, as well as the symptoms included in the verbal autopsy questionnaire from Gulu, have been included in this questionnaire together with the number of days after illness began that the symptom first appeared.

This section of the questionnaire will probably be reduced after field testing and data analysis. However, without information on which questions discriminate best between EHF and other causes of death, it is impossible to select the minimum set of symptoms and signs. It was therefore decided that, for the first field test, it would be useful to include a more comprehensive list of symptoms, which will be pared down.

5.5 Pregnancy

Symptoms and signs of complicated pregnancies have considerable overlap, and may be confused, with symptoms and signs of EHF. Pregnant women frequently have spontaneous abortions with EHF. In Kikwit, for example, 67% of pregnancies in women with EHF ended in abortion. Only one of 15 pregnant women delivered a full-term baby – which subsequently became ill and died. Because of this overlap, EHF cannot be ruled out in pregnancy-related deaths. However, it may be

possible to develop exclusion criteria based on the survival of a healthy baby delivered during the final illness.

5.6 Diseases with similar features occurring at the same time

Yellow fever was also occurring in Gabon during the 1994–1995 outbreak of EHF (George et al., 1999). It therefore makes sense to include a question about jaundice, which is a common feature of yellow fever but not of EHF, in order to rule out deaths due to yellow fever.

5.7 Chronic diseases

The Gulu questionnaire contains information on medical history, including chronic diseases and weight loss. Since EHF is an acute rather than a chronic condition, these questions may distinguish between EHF and certain chronic conditions. There are also questions on whether the death took place in hospital. These may provide useful information to supplement that provided by the verbal autopsy.

6. References

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Appendix A: Instruction page for carrying out a verbal autopsy study

Before the field work begins

1. Adapt forms to local conditions. This includes, deciding on who the respondents should be, reviewing the questions and making sure they are applicable and appropriate to the local situation. Particular questions that might require local adaptation are:
   - Question 1.4 on relationship to main respondent
   - Section 3 on contacts. Local practices related to care and treatment of the sick, as well as local funeral practices, need to be examined from the point of view of the risks posed. The questions should be adapted accordingly. Local informants are key to this exercise.
2. List recent events for a time line to help in determining when events took place
3. Translate the questionnaire into the local language.

Before the interview

4. Fill out the information on the name and address of the deceased on the cover page.

At the interview

Introduce yourself and explain the purpose of your visit. Ask to speak to the respondent, such as spouse, mother, or another adult who was present during the illness that led to death. (Who the respondent should be ideally should be discussed and decided before the field work begins – in step 1 above.) If this is not possible, ask to speak to another person who would know the events surrounding the death. Before you begin the interview, explain why the information is being collected and how such information can help to contain the outbreak.

After the interview

5. Thank the respondent for cooperating.
6. Take a minute to look over the questionnaire. Make sure that all the applicable questions were answered and that nothing was left out.
7. Add any additional remarks in the space at the end of the form. This can be useful for the interpretation of results.

Appendix B: Verbal autopsy questionnaire

Information on deceased and household (The information about the deceased and the household should normally be filled out before the interview)

Name of deceased:_____

Address of household _____

Village_____

Name of head of household _____

Case number_____

Optional: Unique identifier _____

Optional: Ethnic group _____

Optional: Nationality _____

Interviewer's name _____

Date of interview Day __ Month __ Year___

Section 1: Information about respondent(s)

1.1 What is the name of the main respondent? _____

1.2 What is the sex of main respondent? Male __ Female __

1.3 How old is the main respondent? _____ (age in years)

1.4 To the main respondent: What was your relationship to ***<deceased's name>*** ?

Parent __ Spouse __ Sibling __ Child __ Son-in-law or daughter-in-law__ Parent-in-law__
Co-wife__ Adopted/foster child or step child __ Other relative (specify)_____
Friend or neighbour __ Community leader __ Health care worker __
Other (specify)_____

1.5 To the main respondent: Where were you staying during ***<deceased's name's>*** illness?

Same house__ Different house but same compound __
Same village but different compound __ Different village __

1.6 Who was the main caregiver during the illness that led to death?

The respondent __ Someone else__

1.7 Others present during interview?

Main respondent only __Others present __

Section 2: Information about the deceased

2.1 What was the sex of ***<deceased's name>*** Male ___ Female ____

2.2 How old was ***<deceased's name>*** ?

Years ___ DK*___

For infants record the most appropriate: Months __ Weeks__ Days __ DK __

2.3 What was the occupation of ***<deceased's name>*** ? _____

IF DECEASED WAS A HEALTH CARE WORKER, ASK: Where did ***<deceased's name>*** work?

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* Throughout this questionnaire, DK = don't know

2.4 What was the date of ***<deceased's name's>*** death? Day __ Month __ Year __

NOTE: If the exact date is not known, the date should be estimated using local events list.

2.5 Where did ***<deceased's name>*** die?

Home ___Hospital (specify)_____ Other health facility (specify) _____ Other (specify)_____

2.6 If the deceased was a child

Are both parents of ***<deceased's name>*** healthy? Yes __ No __ DK __

If not both healthy, specify why not _____

Section 3: Contacts

INTERVIEWER: Now I am going to ask you some questions concerning ***<deceased's name's>*** activities during the three weeks before illness began and during the illness.

3.1 When did the illness that led to death begin? Day __ Month __ Year __ DK __

NOTE: It is important that the date of onset is as accurate as possible. If the exact date is not known, the date should be estimated using local events list or question **3.2**

3.2 How long ago did the illness begin? Days __ Months __ DK __

3.3 Did ***<deceased's name>*** sleep in the same house as any person who was ill or who died during the three weeks before the illness that led to death? Yes__ No__ DK __

3.4 Did ***<deceased's name>*** have physical contact with any person who was ill or who died during the three weeks before the illness that led to death? Yes __ No __ DK __

3.5 Did ***<deceased's name>*** touch clothing, linens or body fluids from any person who was ill during the three weeks before the illness that led to death illness? Yes __ No __ DK __

IF YES TO 3.3, 3.4 OR 3.5: For each contact mentioned ask:

3.6 Who was the contact with? **Contact's name**	**3.7** Type of contact	**3.8** When did the contact take place? **DD/MM/YY**	**3.9** Did contact have fever? **Yes, No, DK**	**3.10** Did contact have bleeding? **Yes, No, DK**	**3.11** Is contact still alive? **Yes, No, DK**	**3.12** Did contact have Ebola? **Yes, No, DK**

INTERVIEWER: After obtaining information for each contact ask: "*Was there anyone else?"* Continue asking until the respondent says that there was no other contact.

3.13 Was ***<deceased's name>*** hospitalized at any time in the three weeks before becoming ill?

Yes (specify name of hospital and date of admission) _____

No __ DK __

3.14 Did ***<deceased's name>*** visit anyone in the hospital at any time in the three weeks before becoming ill?

Yes (specify name of hospital and date of visit) _____

No __ DK __

3.15 Did ***<deceased's name>*** have contact with a traditional healer during the three weeks before becoming ill or during illness?

IF YES

3.16 What was the name of the traditional healer _____

3.17 When and where did the contact take place?

Place _____ Date: Month __ DK __; Day __ DK __

3.18 Did ***<deceased's name>*** attend a funeral during the three weeks before the illness that led to death?

Yes __ No __ DK __.

IF YES: Ask questions below:

3.19 Whose funeral was it? Record name	Funeral 1	Funeral 2	Funeral 3	Funeral 4
3.20 Funeral place				
3.21 Funeral date				
3.22 Do you know what caused the death? **Y, N,DK** **IF YES:** Record cause				
3.23 Did the person, who's funeral it was, have fever before death? **Y, N, DK**				
3.24 Did the person, who's funeral it was, have bleeding before death? **Y, N, DK**				
3.25 Did the person, who's funeral it was, have Ebola before death? **Y, N, DK**				
3.26 Did ***<deceased's name>*** join communal hand-washing? **Y, N, DK**				
3.27 Did ***<deceased's name>*** touch the dead body? **Y, N, DK**				
3.28 Did ***<deceased's name>*** wash the dead body? **Y, N, DK**				

3.29 Did ***<deceased's name>*** have contact with an animal (non-human primate) that was found dead or sick in the bush or an animal that was behaving abnormally during the three weeks before the illness that led to death?

Yes __ No __ DK __

IF YES: Ask questions below:

3.30 What type of animal was it? **Animal**	**3.31** What was the date of contact? **Date**	**3.32** Where did this contact occur? **Place**	**3.33** Did the deceased touch the animal? **Y, N, DK**	**3.34** Did the deceased prepare the animal for cooking? **Y, N, DK**	**3.35** Did the deceased eat the animal without cooking? **Y, N, DK**

3.36 Did ***<deceased's name>*** go into the forest during the three weeks before becoming ill?

Yes __ No __ DK __

Section 4: Open history question:

4.1 Could you tell me about ***<deceased's name's>*** illness that led to death? Prompt: Was there anything else?

INSTRUCTIONS TO INTERVIEWER: Allow the respondent to tell you about the illness in his or her own words. Do not prompt except for asking whether there was anything else after the respondent finishes. Keep prompting until the respondent says there was nothing else. Pay particular attention to the timing and sequencing of symptoms.

INSTRUCTIONS TO INTERVIEWER: Take a moment to go through the questionnaire and tick all the items mentioned spontaneously during the open history.

Section 5: Characteristics of illness that led to death

INTERVIEWER SAY "*Now I am going to ask you some questions about the specific symptoms of illness that led to* ***<deceased's name>*** *death."* If the symptom was mentioned spontaneously during the open history section, you should not repeat the question. If more information about the symptom is needed, say "*You mentioned that* ***<deceased's name>*** *had* ____*,"* before asking for additional information.

During the illness that led to death …	YES	NO	DK
5.1 Did ***<deceased's name>*** have fever (hot body)?			
5.2 Did ***<deceased's name>*** have a normal appetite?			
5.3 Was ***<deceased's name>*** intensely weak or tired?			
5.4 Did ***<deceased's name>*** have pain in muscles or joints?			
5.5 Was ***<deceased's name>*** skin or eyes yellow?			
5.6 Did ***<deceased's name>*** have a sore throat and pain on swallowing?			
5.7 Did ***<deceased's name>*** have chest pain?			
5.8 Did ***<deceased's name>*** have a rash (perhaps fine raised spots, similar to measles)?			
5.9 Did ***<deceased's name>*** have fast and difficult breathing?			
5.10 During the illness that led to death did ***<deceased's name>*** have a cough?			
5.11 Did ***<deceased's name>*** have pain in the stomach?			

During the illness that led to death…	YES	NO	DK	Time since onset of illness	Days
5.12 Were ***<deceased's name's>*** eyes red?				How long after illness began did ***<deceased's name's>*** eyes become red?	
IF YES **5.13**: Were both eyes red or only one eye? Both__ One__ DK __					
5.14 Did ***<deceased's name>*** have hiccups?				How long after illness began did ***<deceased's name's>*** hiccups begin?	
5.15 Did ***<deceased's name>*** have a headache?				How long after illness began did ***<deceased's name's>*** headache begin?	
5.16 Did ***<deceased's name>*** have vomiting?					
IF YES: **5.17** Was the vomit red or black stained? ?				How long after ***<deceased's name>*** became ill did the vomit become red or black?	
5.18 Did ***<deceased's name>*** have diarrhoea or frequent loose or liquid stools?					
5.19 Were ***<deceased's name's>*** stools stained red or black?				How long after illness began did the stools become stained?	

5.20 Did ***<deceased's name>*** have bleeding from the nose, gums, wounds on the skin, the rectum, the vagina, or any other bleeding during the final illness? Yes __ No __ DK__

IF YES: From which part of the body did the bleeding occur? (Tick box below)

Symptom	Days
5.21 If bleeding from nose __ How many days after ***<deceased's name>*** became ill did the nose begin to bleed?	
5.22 If bleeding from gums__ How many days after ***<deceased's name>*** became ill did the gums begin to bleed?	
5.23 If bleeding from rectum__ How many days after ***<deceased's name>*** became ill did the rectum begin to bleed?	
5.24 If bleeding from vagina__ (does not include normal menstruation) How many days after ***<deceased's name>*** became ill did the vagina begin to bleed?	
5.25 If bleeding from skin wounds__ How many days after ***<deceased's name>*** became ill did these sites begin to bleed?	
5.26 If other bleeding, specify place on body and days ill until onset _____	

FOR FEMALES

5.27 Was ___ pregnant when she became ill? Yes __ No __ DK__

IF YES: **5.30**. Did ***<deceased's name>*** have a miscarriage, or a live birth or a stillbirth during the illness?

Miscarriage__ Live birth __ Stillbirth __ None of these __ DK __

IF LIVE BIRTH: 5.31 How was the baby's health during the six weeks after birth?

Healthy ___ Not well ___ Died ___ DK __

IF BABY HAD NOT DIED: 5.32 How is the baby now?

Healthy ___ Not well ___ Not alive ___ DK __

Section 6: Chronic illness

INTERVIEWER SAY: *"Now I am going to ask you some questions about* ***<deceased's name's>*** *health during the year before death."*

6.1 Was ***<deceased's name>*** sick for more than one month during the two months before death?

Yes __ No __ DK __

6.2 Did ***<deceased's name>*** have noticeable weight loss during the one month before becoming ill

Yes __ No __ DK __

6.3 I am going to read a list of diseases, please tell me if you think that ***<deceased's name>*** had any of these diseases:

TB__ liver disease__ kidney disease__ diabetes__ sickle-cell disease__ heart disease__

lung disease __ HIV/AIDS __ other disease (specify):_____

THANK THE RESPONDENT FOR HIS OR HER COOPERATION AND NOTE ANY ADDITIONAL REMARKS HERE

_____

_____

Appendix C: Coding cause of death*

In coding cause of death, both positive and negative indications of the presence of EHF should be considered. For the validation study itself, physician coders should be used rather than an algorithm, especially if the study takes place during an outbreak. Lists of positive and negative indications of EHF are included here as checklists for coders to use in scoring.

Absence of contact with EHF

If there are good indications that there was no contact with EHF preceding onset, it is very unlikely that EHF was the cause of death. Indications of absence of contact are:

- deceased was not in infected area during the weeks preceding illness
- deceased was a child of two healthy parents and was not hospitalized (this would mean that contact with EHF was unlikely).

Negative symptoms and signs

The following symptoms and signs below could contribute to the conclusion that EHF was unlikely to have been the cause of death:

- presence of chronic disease
- report of clinical malaria or meningitis
- no weakness at all
- normal appetite
- signs of jaundice
- signs of respiratory illness, such as the presence of a productive cough
- symptoms and/or signs of a different acute illness.

Symptoms and signs that appear on day four or later

The symptoms listed below are rare early in the illness and their appearance before day 4 should therefore count as a negative indication for EHF, while their presence from day 4 onwards should count as positive indications for EHF. Considerable care should be taken in ruling out Ebola based on the presence of haemorrhagic symptoms before day 4. Respondents may mistakenly report earlier appearance of haemorrhagic symptoms, partly because these symptoms are very dramatic and easily remembered. Also note that not all cases of EHF have haemorrhagic symptoms.

- Red eyes
- Rash
- Hiccups
- Blood in stool
- Blood in vomitus
- Bleeding from nose
- Bleeding gums
- Blood in sputum
- Bleeding from skin wounds and/or injection sites
- Bleeding from vagina (other than menstruation).

Positive contact

Contact with cases of EHF increase the likelihood that the death was due to EHF. Evidence of contact includes:

- presence in high risk-area three weeks before illness
- household contact
- in hospital where there were EHF patients before illness began
- health care worker in hospital/health care centre with EHF patients

* This section was adapted from a diagnostic instrument under development by Simon Mardel

- caregiver to person with EHF
- attended funeral ceremony(if such ceremony was not a safe ceremony)
- contact with primate that may have been sick.

Positive symptoms and signs that can appear early during the illness

The following symptoms are indications of EHF:

- history of fever, chills or sweats
- severe weakness
- loss of appetite
- diarrhoea
- nausea or vomiting
- pain in head
- pain in muscles or joints
- pain in back
- pain in throat or on swallowing
- pain in chest
- cough
- shortness of breath
- breathing fast
- abortion or miscarriage.

Duration of illness

Fatal illness rarely lasts longer than two weeks. Of 43 patients who died in Gulu for whom there are hospital data, only one lived for more than two weeks. That patient died 20 days after onset. In Kikwit, the mean number of days from onset to death was 9.6, with a median of 9 and a range of 0–34 days.

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