WHO/FHE/MSM/95.15
Distr.: GENERAL

MATERNAL HEALTH
AND SAFE MOTHERHOOD PROGRAMME

VERBAL AUTOPSIES FOR MATERNAL DEATHS

Report of a WHO workshop
London, 10-13 January 1994

World Health Organization
Division of Family Health
Geneva

VERBAL AUTOPSIES FOR MATERNAL DEATHS

World Health Organization Workshop
Held at the London School of Hygiene and Tropical Medicine
10-13 January 1994, London, U.K.

Report prepared on behalf of the Maternal Health and Safe Motherhood Programme, World Health Organization, by:

Oöna Campbell & Carine Ronsmans
Maternal and Child Epidemiology Unit
London School of Hygiene and Tropical Medicine

Table of contents

1. INTRODUCTION

Information on the levels and causes of maternal mortality is critical in determining the public health importance of specific maternal health problems and in designing appropriate interventions to reduce maternal mortality. Accurate information on the nature and prevalence of causes of death is essential to guide policy-makers in setting priorities for Safe Motherhood programmes. High levels of death due to puerperal sepsis, for example, may indicate the need for improved management during and after delivery while deaths due to obstructed labour may emphasize the need for the detection and referral during pregnancy of mothers at risk of developing obstructed labour.

Data on causes of death are usually obtained through routine vital registration of deaths. When a death occurs, a physician fills out a death registration form, lists the conditions or diseases leading to the death and assigns one condition as the underlying cause of death. In situations where access to medical care is limited and where a significant proportion of the deaths occur at home in the absence of trained medical personnel, however, ascertainment of causes of death may be difficult. To facilitate the identification of causes of death in these settings, a new technique has been developed in which relatives of the deceased person are interviewed regarding the circumstances leading to the death. Information on the signs and symptoms preceding the death is used to reconstruct the illness leading to death and to assign the most probable cause of death (Garenne and Fontaine 1986; Zimicki 1986). This procedure is often referred to as "verbal autopsy".

The verbal autopsy method has been widely used to assess the causes of childhood deaths and maternal deaths (Gray, Smith and Barss 1990; Kwast, Rochat and Kidane-Mariam 1986; Walker et al. 1986; Fortney et al. 1986). The need to validate the diagnosis of a cause of death arrived at through a verbal autopsy against a more standard approach to medical diagnoses has been recognized (Kalter et al. 1990, Chandramohan et al. 1994). For maternal deaths, however, there has been no critical and systematic review of verbal autopsy methods.

A workshop was convened to bring together investigators from around the world with experience in the use of verbal autopsies for maternal deaths. The aims of the workshop were to share experiences and to move towards a consensus on methods. The workshop was held at the London School of Hygiene and Tropical Medicine, 10-13 January 1994, with support from the Safe Motherhood Programme of the World Health Organization. A list of participants is given in Appendix 1.

PROGRAMME

The format of the workshop consisted of an alternation of brief presentations by participants and small working groups.

The first part of the workshop aimed at arriving at a consensus on an appropriate classification for causes of maternal death identified through verbal autopsies. Classifications used to arrive at medical and contributing factors of maternal death in Ethiopia and India were presented. An afternoon was spent discussing classifications in smaller groups.

The next day was spent identifying a set of signs and symptoms for each cause of death. Minimal signs and symptoms for the identification of causes of maternal death were discussed in small groups. Indirect causes of maternal death in Laos and Bangladesh were described.

On the basis of the signs and symptoms identified, the groups developed flowcharts and briefly addressed the phrasing of the questions. The discussion on the format of the questionnaire was guided by an example from Jamaica. Further discussion on the classification of causes of maternal death was supplemented by a description of experience with confidential enquiries in Scotland. There was also

discussion of specific aspects of data collection. The workshop closed with a presentation of the main findings to other members of the London School of Hygiene and Tropical Medicine.

3. OUTPUTS OF THE WORKSHOP

3.1 Verbal Autopsy Versus Confidential Enquiry

There was a consensus among workshop participants that a post-mortem interview to ascertain causes of death should address the non-medical circumstances leading to death as well as the obstetric/medical causes of death. The description of all the events surrounding each maternal death is important because it serves as a basis for the development of more comprehensive strategies for prevention. The non-medical circumstances in which the woman dies - also called "avoidable" factors - help in identifying departures from accepted standards of care and include failure of the patient to use or cooperate with the services, as well as failure of the services to provide or offer adequate care.

The inclusion of non-medical factors in the causes to be ascertained through a post-mortem interview created some confusion as to the definition of the term "verbal autopsy". For some, the term should be restricted to the process of interviewing relatives of the deceased person in order to reconstruct the illnesses preceding death, while for others an analogy was drawn with the "confidential enquiry" or the "maternal death audit" as it is practised in the United Kingdom.

A confidential enquiry, as understood in the United Kingdom, consists of an audit of providers and care and is initiated by public health authorities to gather information about the circumstances leading to a maternal death. The audit of providers and care consists of an interview of providers and a review of medical records, laboratory results, prescriptions, x-rays and other data to determine the obstetric/medical causes of death and to ascertain non-medical factors contributing to the death. The report from the enquiry is reviewed by independent assessors who add their comments and opinions regarding the cause or causes of death. In order to ensure the confidential nature of the enquiry, reports are made anonymous before being provided to the assessors.

The assessment process in a confidential enquiry includes determination of whether care was considered substandard. The term "substandard care" takes into account not only failure in clinical care, but also some of the underlying factors that may have produced a low standard of care to the patient. This includes situations produced by the action of the woman herself, or her relatives, which may be outside of the control of the clinicians. It also takes into account shortage of resources for staffing facilities, and administrative failure in the maternity services and the back-up facilities such as anaesthetic, radiological and pathology services.

The discussions led to the following clarifications. The workshop would focus on the components of a **post-mortem interview of the relatives and/or neighbours of the deceased** aimed at determining the **medical as well as contributing factors** of maternal death. Although it was recognized that health care providers can provide important information regarding the circumstances leading to death, and that medical records may be valuable in arriving at an accurate diagnosis of the cause of death, it was decided that the workshop should aim to reach a consensus regarding causes of death that are arrived at with the sole use of information elicited from the relatives or neighbours of the deceased.

In summary, the post-mortem interview should consist of:

a. Verbal autopsy:

Interview with relatives (neighbours) of the deceased to reconstruct events prior to death in order to reach a medically accepted, obstetric/medical diagnosis.

b. Verbal determination of the non-clinical causes of death:

This is a reconstruction of factors associated with care-seeking behaviour and access to and delivery of services.

c. Verbal reporting of background characteristics:

These include age parity, education and other social variables.

3.2 Classification of Causes of Maternal Death for Verbal Autopsies

3.2.1 Aims of disease classification

In general, classifications of causes of death can be used to: (1) establish the public health importance of different causes of death, (2) identify priorities and appropriate interventions, (3) study trends in cause-specific mortality over time, (4) make comparisons in cause-specific mortality between groups (e.g. regions and countries), and (5) evaluate the effect of interventions on cause-specific mortality.

Within the context of verbal autopsies for maternal deaths, the purposes of disease classification may be more restricted, owing to the small sample sizes involved and the inability to achieve some of the aims listed above. It may be difficult, for example, to study trends in mortality due to sepsis over time, or to compare the rates of eclampsia-related deaths between regions, simply because the number of deaths involved may be too small. Classifying maternal deaths by cause is therefore primarily aimed at identifying priorities for intervention, and the classification used should follow a format that facilitates the identification of appropriate interventions.

3.2.2 Obstetric/medical and contributing factors

Identifying priorities for intervention implies identifying "avoidable factors". Hence it is important to define a classification for contributing factors of death in addition to a classification of obstetric/medical causes.

3.2.3 Multiple versus single obstetric/medical causes of death

Advantages and disadvantages of a single versus multiple cause of death classification system were addressed extensively. The main arguments are listed here.

Support for a classification system indicating a single cause of death arose from a concern to abide by the international rules laid down in the International Classification of Diseases (ICD). According to the ICD, multiple causes of death are recorded in the sequence in which they occur and are classified as immediate, underlying or associated causes. In summary tabulations, however, only the single (underlying) cause of death is reported. A typical example for a maternal death would be antepartum haemorrhage caused by abruptio placentae, caused by pre-eclampsia. The last cause mentioned in this sequence, or the first condition to occur, becomes the underlying cause of death and the cause to be reported in a single cause of death classification (pre-eclampsia in the example above). Other causes would appear on the death certificate and could be elicited when needed.

Although the ICD gives clear definitions of what constitutes an underlying and what constitutes an immediate cause of death, there was marked concern about whether or not investigators would agree on the underlying cause. It was felt that attribution of a single underlying cause would remain very sensitive to subjective opinion. Throughout the workshop, terms such as underlying, contributory, immediate, associated, main, originating, single and multiple causes of death were used interchangeably, and it remained uncertain whether the terms consistently retained the same meaning.

The need to prioritize interventions also raised concerns about the use of a classification system identifying a single cause of death. Death is usually preceded by a series of events, each of them deserving attention in their own right **and** in combination. One may wish to know, for example, how many women died after a puerperal sepsis, how many women died after prolonged labour, and how many women died after a prolonged labour that was complicated by a sepsis. Sepsis alone may indicate the need for improved case management (e.g. treatment with antibiotics once sepsis has occurred), whereas if the majority of sepsis cases follow obstructed labour, primary prevention and detection of women at risk for developing prolonged labour may be of higher priority. A single cause of death classification will miss these important combinations and it was suggested that a classification should allow for categories of multiple causes of death in their own right. Analysis could still be performed by single cause of death if needed.

A final concern about the single-cause ICD classification was that the single cause listing would reflect the quality of the cause of death ascertainment rather than a meaningful set of causes. In the example above, where a woman dies of pre-eclampsia followed by abruptio placentae and haemorrhage, the underlying single cause reported will depend on the degree of detail achieved in the ascertainment of cause of death. In case A, where the woman dies at home unattended and verbal autopsies are performed, the underlying cause of death may be reported as ante-partum haemorrhage. In case B, the same woman may be listed as dying from abruptio placentae because the relatives are better informed than those in case A. In case C, where the woman regularly attended an antenatal care clinic and an antenatal card was available with the relatives, the underlying cause may be recorded as pre-eclampsia. A categorization of a single cause of death thus clearly raises issues of comparability between settings with different levels of cause of death ascertainment. A broad mortality classification encompassing a minimal list of causes that can be identified in all settings would overcome this problem. An example of such a classification is discussed in section 3.2.4.1.

3.2.4 Suggestions for the classification of causes of maternal deaths

3.2.4.1 Direct obstetric causes

The International Classification of Diseases defines direct obstetric deaths as those resulting from obstetric complications of the pregnant state (pregnancy, labour, and puerperium), from interventions, omissions, incorrect treatment, or from a chain of events resulting from any of the above.

The workshop reached no consensus on the final classification for direct causes of maternal death, leaving three main options open: (1) the ICD classification of single causes of death, (2) a classification of dual causes of death, and (3) a classification of single causes of death **and** any of the combinations of the single causes.

a. *ICD classification of single causes of death.* The classification consists of the single underlying cause of death. If multiple causes are recorded, they can be listed separately or in combination.

b. *A classification of dual causes of death*, allowing for two levels of causes: an essential level and a specific level. The essential level identifies a minimum list of causes that can be identified in all settings, whatever the level of sophistication of the cause of death reporting. The list of specific causes improves the degree of detail achieved. The list of causes is shown in Table 1. All causes of maternal death have to be reported as dual causes (e.g. antepartum haemorrhage and placenta previa or antepartum haemorrhage and unknown). Some specific causes can be found under more than one essential cause. Retained placenta, for example, can be associated with haemorrhage or with sepsis. Although it was recognized that death can be the result of a complex and long chain of multiple events, and hence more than two levels can be determined, a dual cause listing was felt to be the most feasible approach.

Advantages are that dual causes are more meaningful, that comparisons between regions are standardized and that the potentially subjective qualification of a cause as underlying or contributory is avoided.

Table 1: Classification of dual causes of death[1]

Level 1 (essential)	Level 2 (specific)
HAEMORRHAGE (ANTEPARTUM/POSTPARTUM)	Placenta previa Abruptio placentae Atonic uterus Retained placenta Prolonged labour Prior fetal death Unknown
EARLY PREGNANCY DEATH	Sepsis and induced abortion Sepsis and spontaneous abortion Haemorrhage and induced abortion Haemorrhage and spontaneous abortion Haemorrhage and ectopic pregnancy Unknown
SEPSIS	Prolonged rupture of membranes Obstructed labour Retained placenta Iatrogenic factors Prior fetal death
ECLAMPSIA/CONVULSIONS	Pre-eclampsia
OBSTRUCTED LABOUR/ RUPTURED UTERUS	Malpresentation Cephalo pelvic disproportion Iatrogenic factors
SUDDEN DEATH	
UNKNOWN	

*c. A classification of single causes of death **and** any of the combinations of the single causes.* The minimum list of single causes includes:

[1] *The classification presented here was suggested by one of the working groups. If a classification of dual causes is to be standardized for widespread use, more thought will need to be given to the specific causes to be included.*

- induced abortion and sepsis
- induced abortion and haemorrhage
- ectopic pregnancy
- spontaneous abortion
- antepartum haemorrhage
- postpartum haemorrhage
- sepsis
- eclampsia
- prolonged labour

3.2.4.2 Indirect obstetric causes

The International Classification of Diseases defines indirect obstetric deaths as those resulting from previous existing disease or disease that developed during pregnancy and which was not due to direct obstetric causes, but was aggravated by physiologic effects of pregnancy.

Indirect maternal deaths are relatively few in number and meaningful categorizations are difficult to establish. It was agreed that the broad ICD classifications by organ system were not very useful. Classifications should list the causes of importance according to the local epidemiology of diseases. The diseases representing relatively large proportions should be listed as such rather than hidden in a broader category.

Indirect causes of maternal death perceived by the participants as being of importance are: hepatitis, malaria, TB, anaemia, heart disease, AIDS, tetanus, injuries (assault, suicide, accidents).

3.2.4.3 Contributing factors of death

Contributing factors of death include all the factors which influence the care sought and received during pregnancy and the puerperium.

Contributing factors of death are less easy to classify than medical syndromes or diseases for which large efforts of standardization have been made. Factors related to the availability of or access to care may be more site-specific than medical causes of death and arriving at a "minimal list of causes" may be less straightforward. Nevertheless, a group of broad issues have been listed which should be addressed in each post-mortem interview for the identification of causes of death. The broad groups of questions have to do with the delays in receiving treatment, the availability and quality of resources at the last level of the health services that was reached, and the availability and quality of the personnel at the last level of service reached. It was agreed that factors related to medical (mis)management, although recognized as a potentially important cause of death, could not be arrived at through a post-mortem interview of the family.

A minimal list of broad causes to be addressed includes:

DELAY

1. Delay in seeking care

2. Delay in arriving at appropriate level of care

3. Delay in receiving care at the institution

RESOURCES

PERSONNEL

3.3 Signs and Symptoms for Obstetric/Medical Causes of Maternal Death

The identification of the signs and the symptoms characteristic of specific causes of maternal death was primarily aimed at facilitating and standardizing the process of questionnaire development. A review of the questionnaires previously used for verbal autopsies for maternal deaths indicated that there was substantial variation in the number of questions asked (range from 19 to 200 questions) and in the signs and symptoms elicited. If a minimal list of signs and symptoms could be agreed upon, the formulation of a minimal and standard set of questions would follow easily.

The participants agreed that an initial list of signs and symptoms should be as comprehensive as possible. At a later stage, the signs and symptoms should be tested for their predictive value (see flowcharts below) and for their capacity to be correctly recognized or recalled by the respondents. Signs and symptoms were, where possible, qualified as essential, pathognomonic, differential and supportive.

Essential or prerequisite symptoms are criteria which should be fulfilled but may not be sufficient to reach a diagnosis. Typically they will be present among most of the patients with a diagnosis of interest, but they may also be present among patients with other diagnoses.

Supportive symptoms are symptoms which, if present in combination with (an) essential symptom(s), help to differentiate a diagnosis of interest from misclassified diagnoses. They may or may not be present among most of the patients with the diagnosis of interest.

Potential misclassification (differentiating symptoms) help to exclude misclassified diagnoses from the diagnosis of interest. They are typically absent or less common among patients with the diagnosis of interest, but present among most of the patients with misclassified diagnoses.

Pathognomonic or confirmative symptoms are criteria which confirm a diagnosis either alone or in combination with essential symptoms. They may or may not be present among most of the patients with a diagnosis of interest, but they are typically absent among patients with misclassified diagnoses.

Signs and symptoms were listed by syndrome category. Four working groups addressed different syndromes or diseases. A list of the signs and symptoms by syndrome group follows.

3.3.1 Direct causes of maternal death

3.3.1.1 Early pregnancy death (Flowchart I, Appendix 2)

It was agreed that in order to rule out early pregnancy deaths verbal autopsies should be conducted for deaths of **all women of reproductive age**, not just those with a recognized pregnancy. It was felt that many early pregnancy deaths would be missed if the presence of pregnancy was ascertained first.

The following signs and symptoms apply to induced abortion.

Essential symptoms
women age 12-50
vaginal bleeding

Supportive symptoms
history of induction
pregnancy suspected or diagnosed
contraceptive failure
pregnancy undesired
bleeding includes product of conception
history of fever

Potential misclassification (differentiating symptoms)
ectopic pregnancy (no fever and acute abdominal pain), spontaneous abortion.

3.3.1.2 Hypertensive disorders of pregnancy

a. Eclampsia (Flowchart II, Appendix 2)

Essential symptoms
pregnancy for more than 22 weeks or within 72 hours of termination of pregnancy
convulsions

Supportive symptoms
generalized oedema
increased blood pressure
epigastric pain
visual disturbances
proteinuria
unconscious for more than one hour
convulsions did not improve up to death
prior eclampsia

Potential misclassification (differentiating symptoms)
tetanus (convulsions more than one week after delivery), malaria (high fever), encephalitis (high fever), meningitis (high fever), epilepsy (history of fits outside of pregnancy).

b. Pre-eclamptic coma (Flowchart III, Appendix 2)

Essential symptoms
pregnancy for more than 22 weeks or within 72 hours of termination of pregnancy
unconsciousness for more than one hour

Supportive symptoms
generalized oedema
increased blood pressure
epigastric pain
visual disturbances
proteinuria

Potential misclassification (differentiating symptoms)
aneurysm, homicide (history thereof), suicide (history thereof), accident (history thereof), meningitis (high fever), encephalitis (high fever), malaria (high fever), brain tumour (history of chronic severe headaches).

3.3.1.3 Haemorrhage associated with placenta previa, abruptio placentae, ruptured uterus, trauma, retained placenta or unspecified

Essential symptoms
pregnancy for more than 22 weeks or within 42 days of termination of pregnancy
severe bleeding *per vaginum*.

Supportive symptoms

a. Antepartum haemorrhage: occurs before the birth of the baby (Flowchart IV, Appendix 2).

Placenta previa	-	painless vaginal bleeding
	-	history of spotting during pregnancy
	-	history of vaginal exam that increased the bleeding
Abruptio placentae	-	painful vaginal bleeding
	-	hypertension
	-	the woman died undelivered
Ruptured uterus	-	prolonged/obstructed labour[2] with sudden collapse
-	-	painful bleeding[3]
	-	history of caesarean section and labour with sudden collapse
	-	use of oxytocics (drugs or herbs) with sudden collapse
Traumatic	manipulations by birth attendant in order to accelerate the birth	

b. Postpartum haemorrhage: occurs after the birth of the baby (Flowchart V, Appendix 2)

Atonic uterus	-	prolonged labour and placenta delivered
Retained placenta	-	placenta delivered more than one hour after delivery
Traumatic	-	instrumental force to deliver baby

[2] *Prolonged labour: duration of labour more than 24 hours for a nulliparous woman and more than 18 hours for a multiparous woman. Obstructed labour: prolonged labour ended with a cesarean section, undelivered baby and/or ruptured uterus.*

[3] *Painful bleeding around the time of labour may be difficult to assess since it is uncertain whether the relatives can distinguish between labour pain and pain starting before labour.*

Potential misclassification (differentiating symptoms)
none, since few other conditions would cause severe vaginal bleeding during delivery.

Pathognomonic symptoms
ultrasound for placenta previa and abruptio placentae, examination under anaesthetic or during c-section.

3.3.1.4 Puerperal sepsis (Flowchart VI, Appendix 2)

Essential symptoms
fever for a duration greater than 24 hours after the delivery of baby

Supportive symptoms
prolonged labour
premature/prolonged rupture of membranes
foul-smelling lochia
retained placenta
manipulation during delivery

Potential misclassification
malaria, meningitis, hepatitis, pneumonia, TB, urinary tract infection

Pathognomonic symptoms
blood culture, uterine culture or culture from secondary suppurative sources.

3.3.2 Indirect causes of maternal death

3.3.2.1Hepatitis (Flowchart VII, Appendix 2)

Essential symptoms
pregnancy or within 42 days of termination of pregnancy
jaundice

Supportive symptoms
onset of jaundice for more than one week
dark urine
itching
third trimester death or early postpartum period
contact with jaundiced person
spontaneous bleeding

Potential misclassification (differentiating symptoms)
puerperal sepsis (long labour, onset more than 4 days after delivery, foul-smelling vaginal discharge), eclampsia (fits), malaria (high fever), relapsing fever (high fever) haemolytic anaemia, hepatoma or other cancer, other liver disease, antepartum haemorrhage, postpartum haemorrhage, haematemesis, haemoptysis

Pathognomonic symptoms
laboratory findings.

3.3.2.2 Severe anaemia[4]

Essential symptoms
breathlessness on exertion and pallor

Supportive symptoms
tiredness
dizziness
palpitations
recent history of bleeding
recent history of malaria

Potential misclassification
preeclampsia, amniotic fluid embolism, pulmonary embolism, rheumatic heart disease, HIV, tuberculosis

Pathognomonic symptom
low haemoglobin, low haematocrit.

3.4 Flowcharts for Identifying and Coding Causes of Maternal Death

A flowchart for use in verbal autopsy diagnoses consists of a standard set of pre-defined criteria that lead to the determination of the cause of death. The criteria are based on a sequence of symptoms and/or signs with qualifications of severity and duration where needed. The flowchart usually starts with a very sensitive sign or symptom (to ensure that very few of the true cases are missed), progressively adding symptoms and signs to increase the specificity of the diagnosis. The larger the number of symptoms and signs included in the chart, the lower the sensitivity and the higher the specificity. One usually aims at a trade-off between sensitivity and specificity.

Flowcharts were constructed using the signs and symptoms listed above. Examples of some of the flowcharts produced during the workshop are shown in Appendix 2. Although it was acknowledged that the flowcharts developed were at a very preliminary stage, needing further refinement and future validation, the exercise of thinking through an developing the charts was perceived as extremely useful by the participants.

The advantages and uses of flowcharts were summarized as follows:

a. Flowcharts make the cause of death assessment more objective.

b. Flowcharts increase the repeatability and comparability of cause of death ascertainment

c. The use of pre-defined flowcharts may allow non-medical people to code the cause of death.[5] In future, computers may facilitate the coding process.

d. The process of constructing a flowchart ensures that all relevant questions for arriving at a final diagnosis are included in the questionnaire.

e. The validity (specificity and sensitivity) of the ascertainment of cause of death can be assessed objectively and the degree of uncertainty can be estimated

[4] *The Group did not feel a flowchart was necessary for deaths due to anaemia.*

[5] *The participants expressed uncertainty, however, as to whether diagnostic flowcharts could ever reach the level of accuracy required for lay coders or computers to code the cause of death.*

The perceived limitations of diagnostic flowcharts were:

a. The sequence in which symptoms and/or signs occur may be difficult to incorporate in a flowchart.[6]

b. Part of the information reported may be lost in a standardized flowchart when strict criteria are used. This may lead to a larger number of undetermined cases than would be achieved without the use of flowcharts.

c. The use of an flowchart may be restricted to specific areas, given the large variability in endemic disease patterns and cultural factors. Universal flowcharts may have to be modified to suit local conditions.

In conclusion, it was recognized that diagnostic flowcharts for causes of maternal death had a potential for being very useful in the future. This workshop was a first step towards their development. Further steps to be taken are:

verification of whether some of the signs and symptoms included are identifiable by verbal autopsy (e.g. hypertension, history of haemolytic blood disease)

refinement and simplification of the flowcharts (the flowcharts may have lost sensitivity by aiming at too high specificity)

testing some of the flowcharts on existing data

validating the flowcharts in a variety of settings.

3.5 Questionnaire Design

The participants agreed that the following should be included in all questionnaires:

Identification of respondent
Identification of deceased
Time since death
Place of death
Cause of death as reported by respondents
Place of delivery
Socioeconomic characteristics of the household
Maternal age
Prior birth history (parity, gravida)
Attendants at delivery
Outcome of the pregnancy
Care received before illness (use of antenatal care)
Care received during illness
Mode of delivery.

The following aspects of the content or format of the questionnaire were specifically addressed.

[6] *The participants agreed that an open narrative of the circumstances leading to death was essential to arrive at causes of maternal death, and particularly to elucidate the sequence of events preceding the death*

3.5.1 Should there be an open history? Where should it be in the questionnaire?

Everyone agreed that the open narrative (verbatim, open history) was an essential component of the questionnaire.[7] The open narrative should come before the structured part of the questionnaire to allow the establishment of a rapport with respondents ("breaking the ice").

It was suggested that the open enquiry (without prompting) could be completed with a "time-line", i.e. seeking the order of the symptoms and their duration and seeking the order of the actions taken before death. It was felt that such a design would be optimal to arrive at the sequence of events leading to death. Interviewers would need careful training and supervision, however, for a time-line to be recorded correctly.

3.5.2 Should the questionnaire be divided into modules relating to time of pregnancy (pregnancy, delivery, postpartum)?

Separate modules would have to be constructed in a sequence that makes sense to the respondent rather than to the interviewer or coder. A set of questions relating to the pregnancy, followed by questions related to delivery, ending with questions related to the postpartum was felt to be the most appropriate sequence. These modules could then serve as filters, i.e. if the woman died in pregnancy there would be no need to proceed to the next sections.

There was a suggestion to structure the questionnaire by time of death (early pregnancy, late pregnancy, delivery and postpartum), and to construct a separate list of questions for each time period. This model had been used successfully in Nicaragua.

3.5.3 Should actions and care be interspersed with signs and symptoms, or should they be separated?

The group working on the contributing factors of death agreed that the questions on avoidable factors should be addressed at the end of the questionnaire in a separate module. Concern was raised, however, that some care factors were specific to the underlying medical condition and that they would be easier to be remembered by the relatives if asked within each medical module. Some of the questions may thus have to be incorporated in the questionnaire.

Ideally, questions related to care-seeking should be asked for each major illness preceding the death. Detailed information should be obtained on all the places where care was sought (i.e. own home, someone else's home, hospital, clinic, health centre), on who provided the care (i.e. relative, traditional birth attendant, obstetrician, midwife, general practitioner), on the type of care received, and on the delays in reaching the care facility and receiving the care. Since different types of care may have been sought for the same illness, and many illnesses may have preceded the death, inclusion of these questions would make for a very long questionnaire. The participants' experience in this had been to compromise for a reduced set of questions on care-seeking. In doing so it was felt, however, that the information collected often became rather meaningless and that it would in fact be worthwhile to invest in a lengthy questioning of all the actions taken before the death occurred.

3.5.4 Do we need to ask questions about problems in the previous pregnancy (e.g. previous retained placenta)?

The questions to be asked depend on the minimum signs and symptoms that were identified to arrive at a diagnosis of cause of death. There should be no enquiry about signs and symptoms that did not

---

[7] *An open questionnaire is a blank page on which the trained interviewer records all the events leading to death (medical and non-medical) as they are reported by the respondents.*

appear in this list. Prior ectopic pregnancy, or prior eclampsia, for example, did not appear in the minimum signs and symptoms and thus there should be no inquiry about it. A previous caesarean section, on the other hand, is a supportive symptom for ruptured uterus, so a question on previous caesarean section should be included.

Finally, specific questions were developed that can serve as examples of how to arrive at the signs, symptoms or circumstances preceding death. Examples are given in Appendix 3. An attempt was made to list the questions by major syndrome group, producing syndrome-specific modules. Hence the repetition of some questions in separate modules. This approach ensures that all relevant questions are included. When a final questionnaire is produced, however, the questions have to be listed in a sequence that appeals to the respondent rather than to the investigator. A suggestion for a questionnaire is given in Appendix 4.

3.6 Specific Aspects of Data Collection

Before the start of the workshop the participants were asked to specify some aspects of data collection regarding their study. A summary of the characteristics of selected studies can be found in Appendix 5.

The following aspects of data collection were addressed specifically:

a. Interviewers

There was a strong emphasis on avoiding an *a priori* definition of who the interviewer should be. The local culture will determine, for example, whether a male or a female interviewer will be more appropriate. Factors influencing the choice are mobility (in some settings women are not mobile), acceptability (male interviewers may facilitate the initial introduction with the family in some settings), and availability.

It was strongly felt that the interviewer's medical skills and attitude towards the family were more important than the person's sex. The interviewer needs extensive training and should be observed in field conditions.

The majority of participants thought that lay interviewers were preferred since they would be more likely to record the answers as reported by the respondents. It was recognized, however, that the medical community should be involved with the verbal autopsy process through regular feedbacks of the findings.

Interviewers need to speak the local language.

b. Respondents

The general rule was: "get it from whom you can get it". Although it was agreed that ideally the person should be identified who can give the most reliable information (e.g. the person who was with the deceased during the whole process, etc.), it was obvious that this was not always possible in practice, and that it should be up to the interviewer to decide whom to question. Interviews usually attract a large group of people and it was felt that it was impossible to exclude some people from the group.

c. Comments on getting information from health providers

The general experience was that medical records were usually incomplete and lacked standardization. The reliability of medical records was doubtful and their use in verbal autopsies was questioned. It was suggested that verbal autopsies should be constructed and causes of death

coded in the absence of medical records. The influence of medical records on the coding of causes of death should be tested.

The difficulty in obtaining access to medical records, particularly from larger hospitals, was acknowledged.

d. Recall period

The recall period in the various studies ranged from one month to 10 years. The main concern about a long recall period was migration, and hence the impossibility of tracing the relatives of the deceased. In practice, a maximum recall period of five years was suggested. It was believed that the quality of the recall would not decline over this period since a maternal death was an unforgettable event.

e. Validation of specific aspects of data collection

In general, it was felt that although one should not be too rigid about practical aspects of data collection, many of the points listed above needed testing. Observational studies were suggested to identify the most appropriate interviewer and respondent.

4. REFERENCES

Chandramohan D, Maude GH, Rodrigues LC, Hayes R. Verbal autopsies for adult deaths: Issues in their development and validation. *Int J Epid* 1994, 23:213-222.

Fortney JA, Susanti I, Gadalla S, et al. Reproductive mortality in two developing countries. *Am J Publ Health* 1986, 76:134-138.

Garenne M, Fontaine O. *Assessing probable causes of death using a standardized questionnaire: A study in rural Senegal*. Seminar on comparative studies of mortality and morbidity: old and new approaches to measurement and analysis 1986. International Union for the Scientific Study of Populations and the Institute of Statistics, University of Siena, Siena, Italy.

Gray HR, Smith G, Barss P. *The use of verbal autopsy methods to determine selected causes of death in children.* Baltimore, The Johns Hopkins University School of Hygiene and Public Health, Institute for International Programs, 1990, (Occasional paper No 10).

Kalter H, Gray RH, Black RE, Gultiano SA. Validation of postmortem interviews to ascertain selected causes of childhood death in children. *Int J Epidemiol* 1990, 19:380-386

Kwast BE, Rochat RW, Kidane-Mariam W. Maternal mortality in Addis Ababa, Ethiopia. *Stud Fam Plann* 1986, 17:288-301.

Snow RW, Armstrong JRM, Forster D et al. Childhood deaths in Africa: uses and limitations of verbal autopsies. *Lancet* 1992, 340:351-355.

Walker GJA, Ashley DEC, McCaw AM, Bernard GW. Maternal mortality in Jamaica. *Lancet* 1986, i:486-488.

Zimicki S. *Old and new approaches to assessment of the causes structure of mortality: a case study from Bangladesh*. Seminar on comparative studies of mortality and morbidity: old and new approaches to measurement and analysis 1986. International Union for the Scientific Study of Populations and the Institute of Statistics, University of Siena, Siena, Italy.

Appendix 1: List of participants

Dr Nagiba Abdulghani, Ministry of Health, Sana'a, Yemen Republic

Mrs Martha Anker, Epidemiology Surveillance and Statistical Services, World Health Organization (WHO), Geneva, Switzerland

Dr Oona Campbell, Maternal and Child Epidemiology Unit, London School of Hygiene and Tropical Medicine, London, United Kingdom

Dr Luis Cataño, Universidad de Antioquia, Medellin, Colombia

Dr Daniel Chandramohan, Tropical Health Epidemiology Unit, London School of Hygiene and Tropical Medicine, London, United Kingdom

Dr Susan Cole, National Health Service in Scotland Management Executive, Information and Statistics Division, Edinburgh, United Kingdom

Dr Isabella Danel, Centers for Disease Control, Atlanta, USA

Ms Nicola Dollimore, Women's Health Group, Liverpool School of Tropical Medicine, Liverpool, United Kingdom

Dr Vincent Fauveau, Save the Children Fund (UK), Vientiane, Laos

Dr Fariyal Fikree, The Aga Khan University, Karachi, Pakistan

Ms Véronique Filippi, Maternal and Child Epidemiology Unit, London School of Hygiene and Tropical Medicine, London, United Kingdom

Dr Judith Fortney, Family Health International, Research Triangle Park, USA

Dr Bela Ganatra, KEM Hospital Research Centre, Pune, India

Dr Richard Guidotti, Responsible Officer, Maternal Health and Safe Motherhood Programme, World Health Organization, Geneva, Switzerland

Dr Mohamed Hefni, Ministry of Health, Cairo, Egypt

Dr Rajesh Kumar, Postgraduate Institute of Medical Education and Research, Chandigarh, India

Dr Barbara Kwast, MotherCare, Arlington, USA

Dr Ana Langer, Instituto Nacional de Salud Publica, Morelos, Mexico

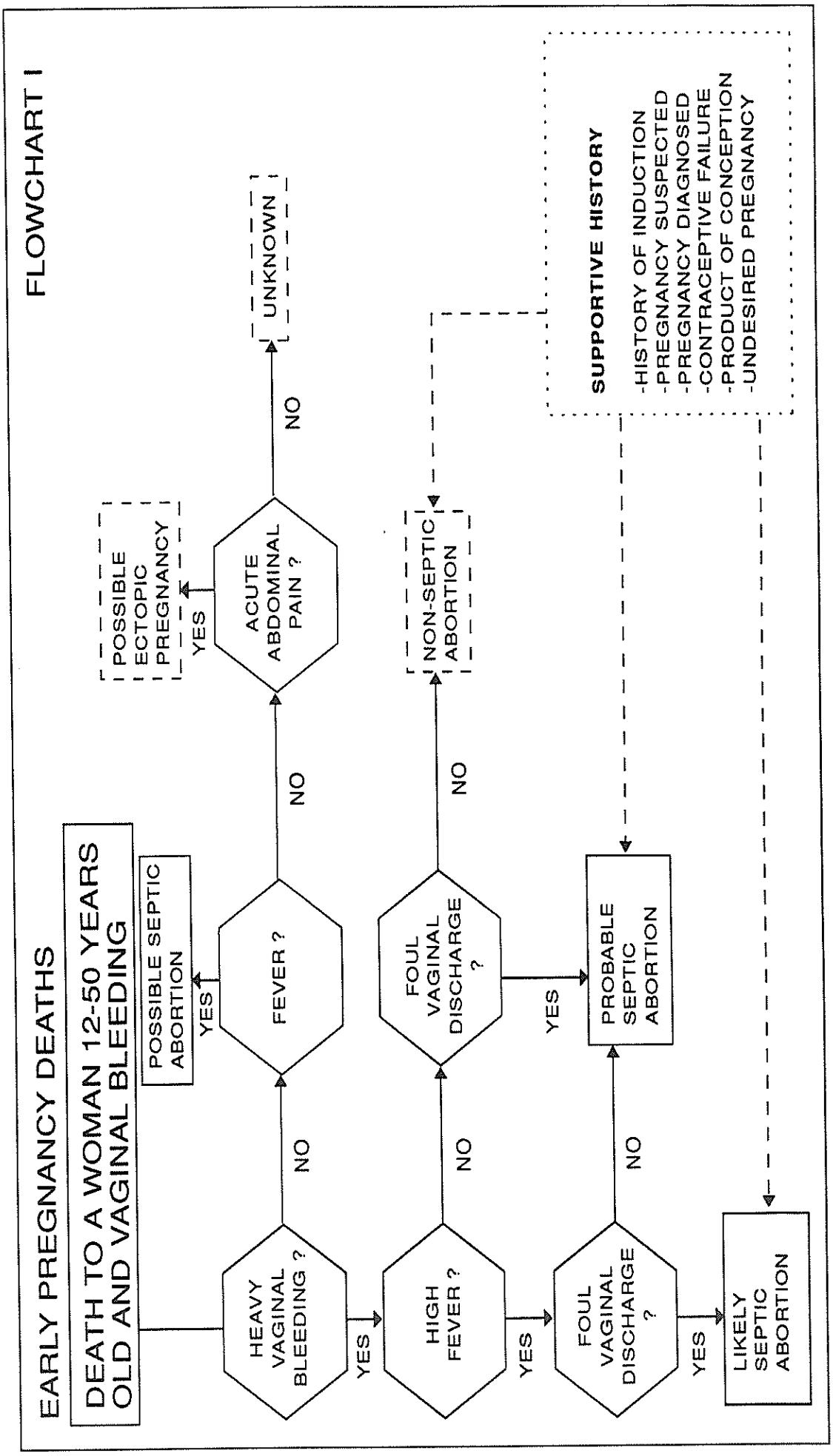
Dr Affette McCaw Binns, Tropical Metabolism Research Unit, Kingston, Jamaica

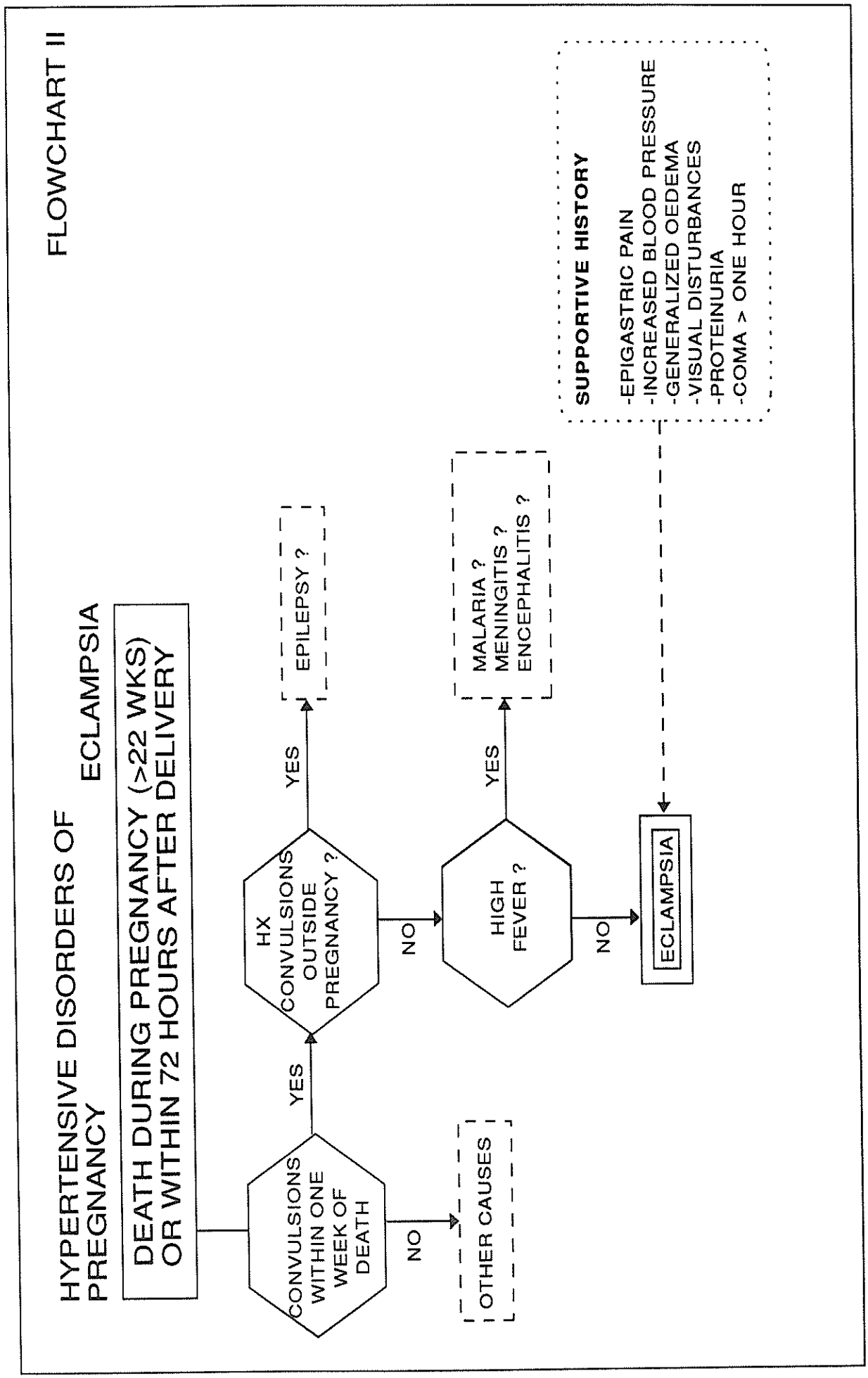
Mrs Margret Oosterbaan, World Health Organization, Manila, Philippines

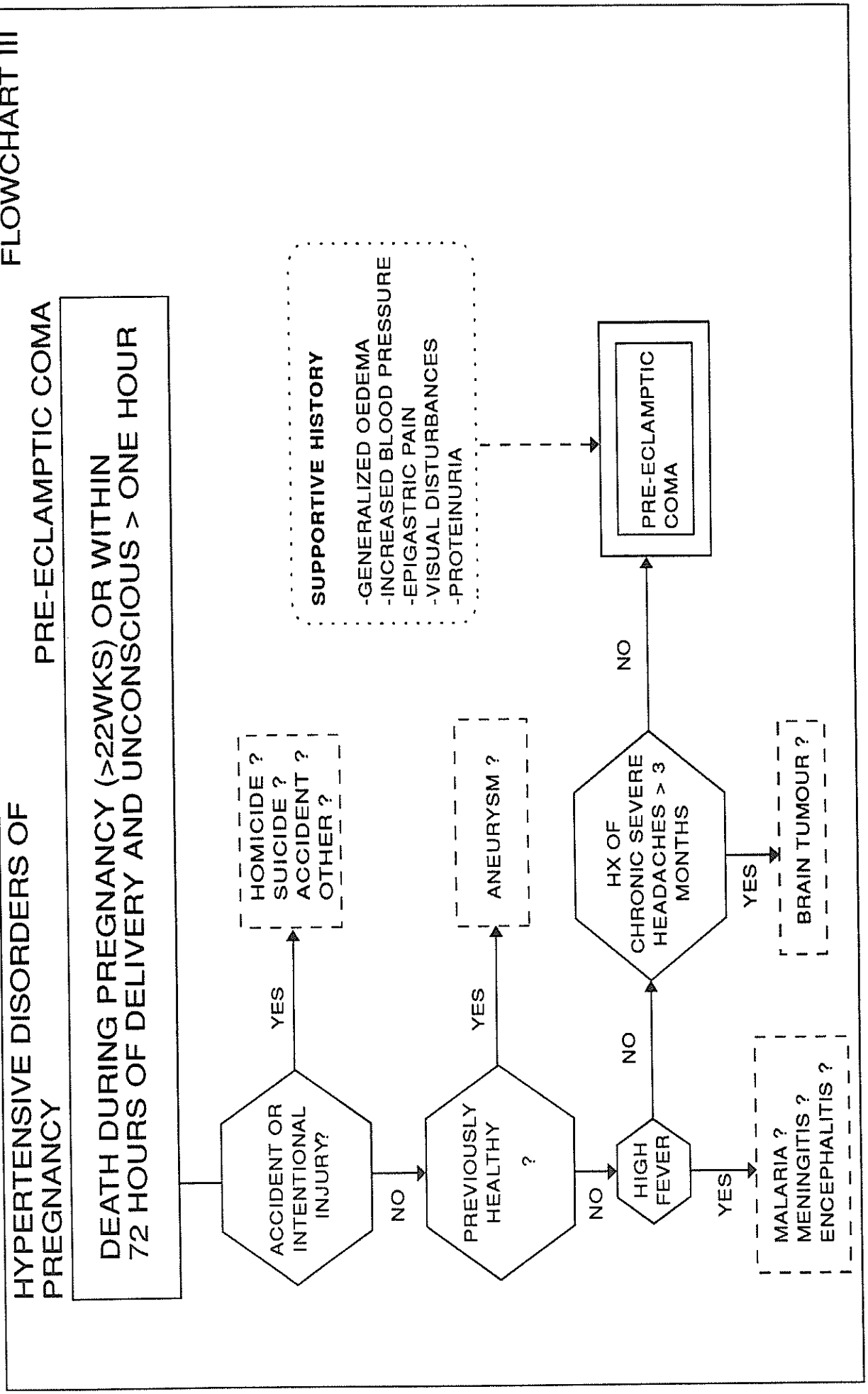
Dr Carine Ronsmans, Maternal and Child Epidemiology Unit, London School of Hygiene and Tropical Medicine, London, United Kingdom

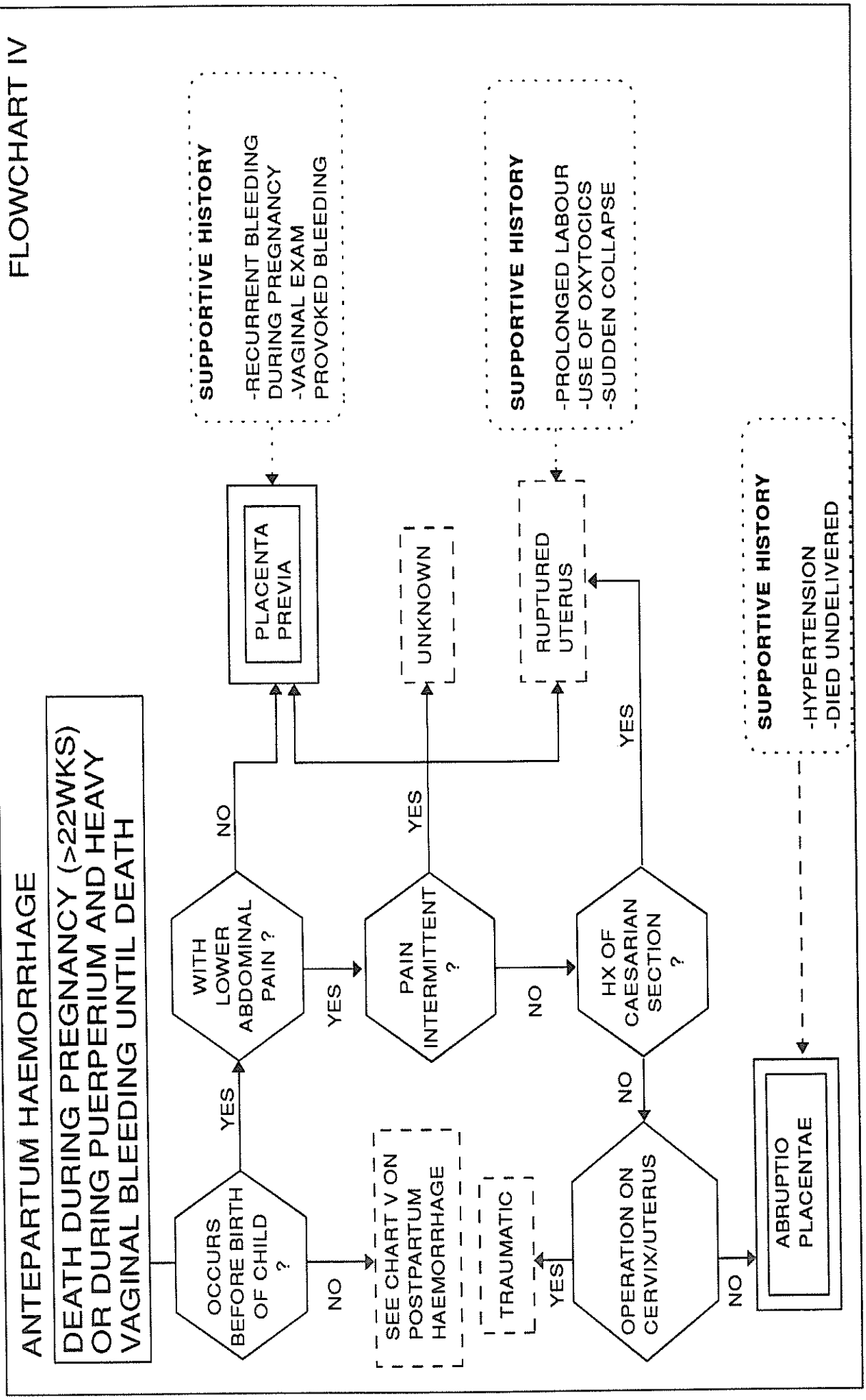
Dr Cleone Rooney, Office of Population Censuses and Surveys, London, United Kingdom

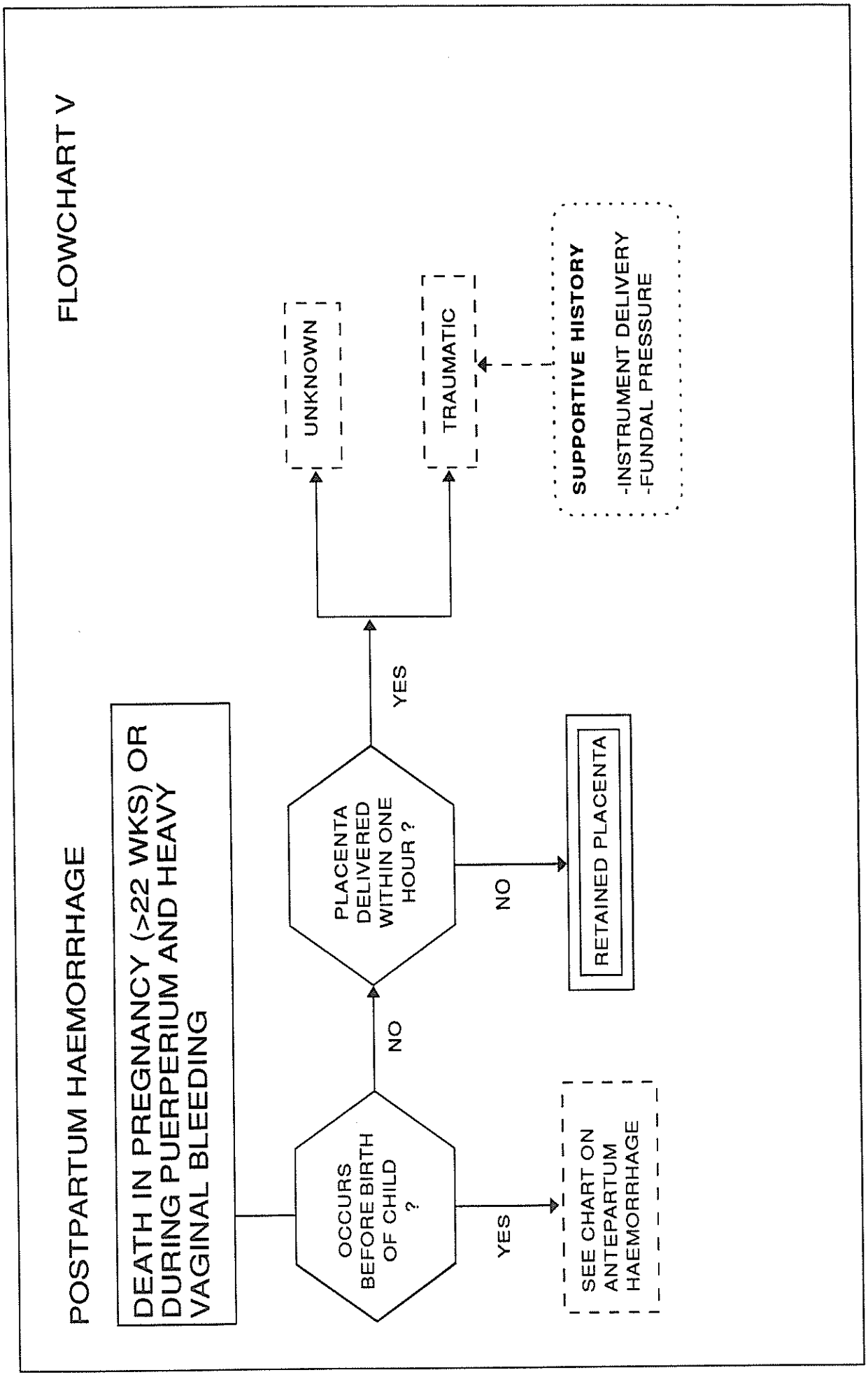
Appendix 2: Flowcharts for causes of maternal death

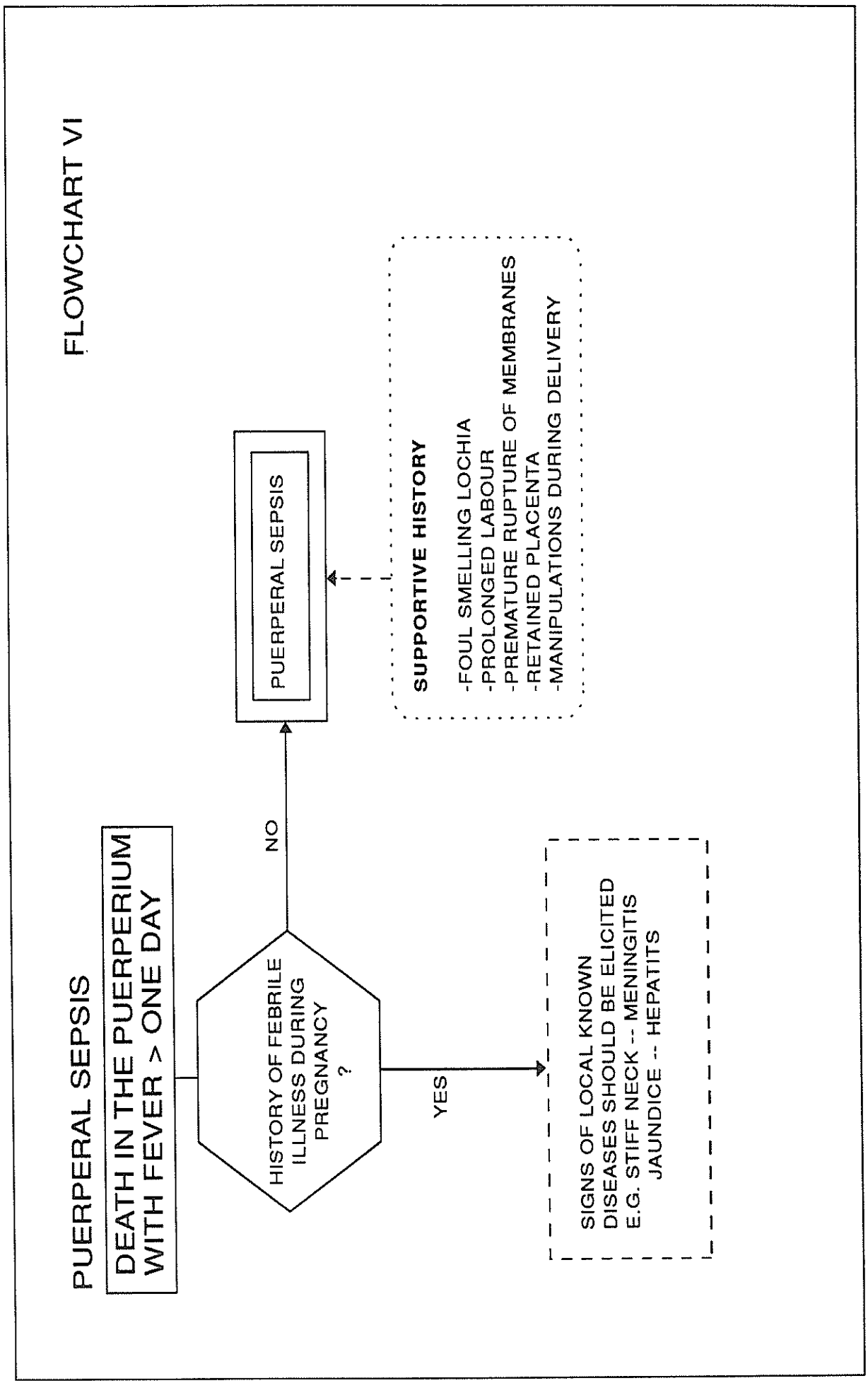


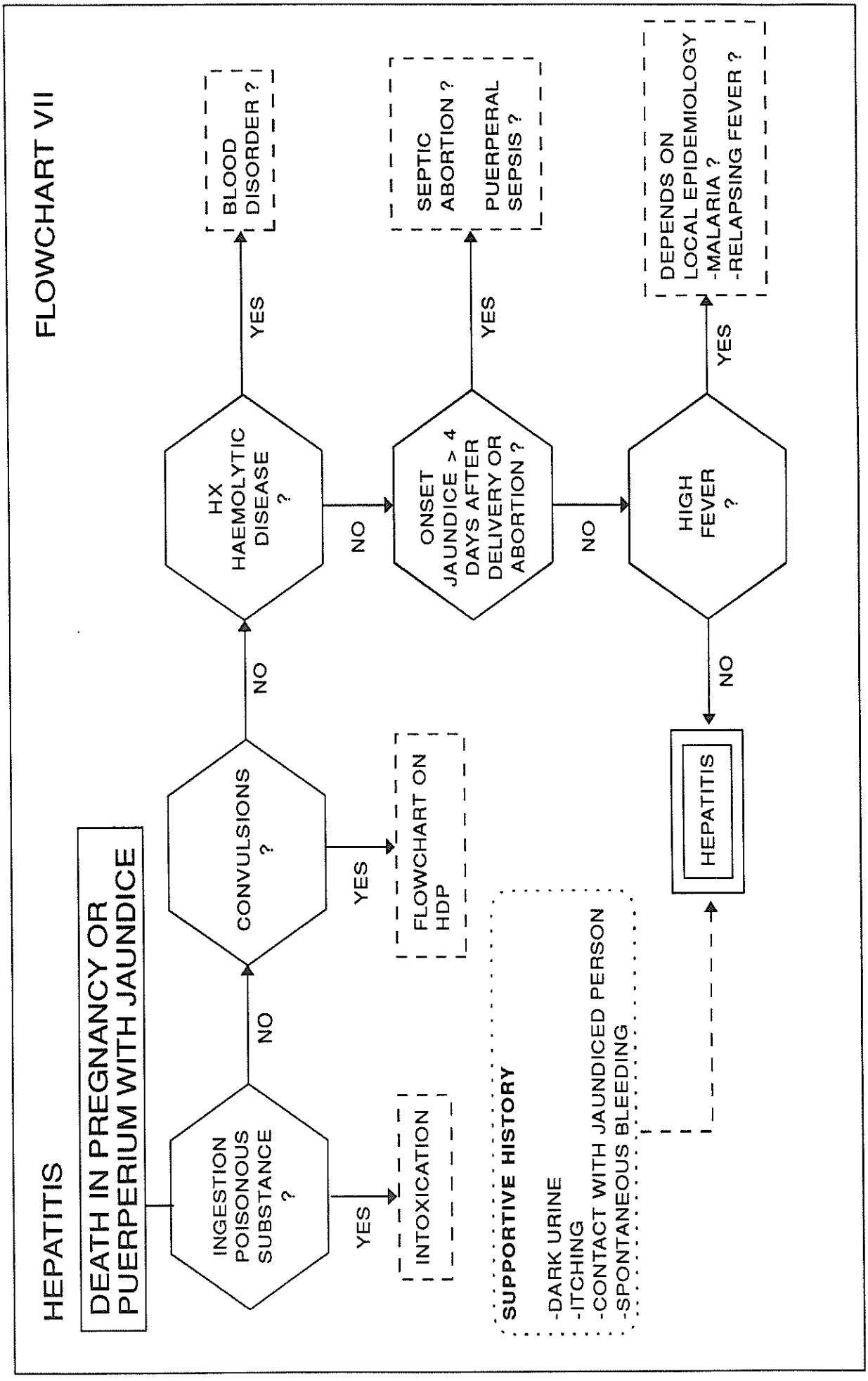

FLOWCHART II
HYPERTENSIVE DISORDERS OF PREGNANCY
ECLAMPSIA
DEATH DURING PREGNANCY (>22 WKS) OR WITHIN 72 HOURS AFTER DELIVERY
CONVULSIONS WITHIN ONE WEEK OF DEATH
YES
NO
OTHER CAUSES
HX CONVULSIONS OUTSIDE PREGNANCY ?
YES
EPILEPSY ?
NO
HIGH FEVER ?
YES
MALARIA ?
MENINGITIS ?
ENCEPHALITIS ?
NO
ECLAMPSIA
SUPPORTIVE HISTORY
-EPIGASTRIC PAIN
-INCREASED BLOOD PRESSURE
-GENERALIZED OEDEMA
-VISUAL DISTURBANCES
-PROTEINURIA
-COMA > ONE HOUR


FLOWCHART III
HYPERTENSIVE DISORDERS OF PREGNANCY
PRE-ECLAMPTIC COMA
DEATH DURING PREGNANCY (>22WKS) OR WITHIN 72 HOURS OF DELIVERY AND UNCONSCIOUS > ONE HOUR
ACCIDENT OR INTENTIONAL INJURY?
YES
HOMICIDE ?
SUICIDE ?
ACCIDENT ?
OTHER ?
NO
PREVIOUSLY HEALTHY ?
YES
ANEURYSM ?
NO
HIGH FEVER
YES
MALARIA ?
MENINGITIS ?
ENCEPHALITIS ?
NO
HX OF CHRONIC SEVERE HEADACHES > 3 MONTHS
YES
BRAIN TUMOUR ?
NO
PRE-ECLAMPTIC COMA
SUPPORTIVE HISTORY
-GENERALIZED OEDEMA
-INCREASED BLOOD PRESSURE
-EPIGASTRIC PAIN
-VISUAL DISTURBANCES
-PROTEINURIA


FLOWCHART IV
ANTEPARTUM HAEMORRHAGE
DEATH DURING PREGNANCY (>22WKS) OR DURING PUERPERIUM AND HEAVY VAGINAL BLEEDING UNTIL DEATH
OCCURS BEFORE BIRTH OF CHILD ?
YES
NO
SEE CHART V ON POSTPARTUM HAEMORRHAGE
TRAUMATIC
WITH LOWER ABDOMINAL PAIN ?
YES
NO
PAIN INTERMITTENT ?
YES
NO
HX OF CAESARIAN SECTION ?
YES
NO
OPERATION ON CERVIX/UTERUS
YES
NO
PLACENTA PREVIA
UNKNOWN
RUPTURED UTERUS
ABRUPTIO PLACENTAE
SUPPORTIVE HISTORY
-RECURRENT BLEEDING DURING PREGNANCY
-VAGINAL EXAM PROVOKED BLEEDING
SUPPORTIVE HISTORY
-PROLONGED LABOUR
-USE OF OXYTOCICS
-SUDDEN COLLAPSE
SUPPORTIVE HISTORY
-HYPERTENSION
-DIED UNDELIVERED


FLOWCHART V
POSTPARTUM HAEMORRHAGE
DEATH IN PREGNANCY (>22 WKS) OR DURING PUERPERIUM AND HEAVY VAGINAL BLEEDING
OCCURS BEFORE BIRTH OF CHILD ?
YES
SEE CHART ON ANTEPARTUM HAEMORRHAGE
NO
PLACENTA DELIVERED WITHIN ONE HOUR ?
NO
RETAINED PLACENTA
YES
UNKNOWN
TRAUMATIC
SUPPORTIVE HISTORY
-INSTRUMENT DELIVERY
-FUNDAL PRESSURE


FLOWCHART VI
PUERPERAL SEPSIS
DEATH IN THE PUERPERIUM WITH FEVER > ONE DAY
HISTORY OF FEBRILE ILLNESS DURING PREGNANCY ?
NO
YES
PUERPERAL SEPSIS
SUPPORTIVE HISTORY
-FOUL SMELLING LOCHIA
-PROLONGED LABOUR
-PREMATURE RUPTURE OF MEMBRANES
-RETAINED PLACENTA
-MANIPULATIONS DURING DELIVERY
SIGNS OF LOCAL KNOWN DISEASES SHOULD BE ELICITED
E.G. STIFF NECK -- MENINGITIS
JAUNDICE -- HEPATITS


FLOWCHART VII
HEPATITIS
DEATH IN PREGNANCY OR PUERPERIUM WITH JAUNDICE
INGESTION POISONOUS SUBSTANCE ?
YES
INTOXICATION
NO
CONVULSIONS ?
YES
FLOWCHART ON HDP
NO
HX HAEMOLYTIC DISEASE ?
YES
BLOOD DISORDER ?
NO
ONSET JAUNDICE > 4 DAYS AFTER DELIVERY OR ABORTION ?
YES
SEPTIC ABORTION ?
PUERPERAL SEPSIS ?
NO
HIGH FEVER ?
YES
DEPENDS ON LOCAL EPIDEMIOLOGY
-MALARIA ?
-RELAPSING FEVER ?
NO
HEPATITIS
SUPPORTIVE HISTORY
-DARK URINE
-ITCHING
-CONTACT WITH JAUNDICED PERSON
-SPONTANEOUS BLEEDING

Appendix 3: Suggestions for questions to be asked in order to arrive at causes of maternal death

1. OBSTETRIC/MEDICAL CAUSES OF DEATH

1.1 EARLY PREGNANCY DEATH

During her final illness, was she bleeding from the vagina?
Did she have a high fever during her final illness?
Did she have a foul-smelling discharge during her last illness?
Did she complain of severe pain in her abdomen?

1.2 ECLAMPSIA

Did she have any fits before she died?
Did she have swelling of the legs during her pregnancy?
Did she have swelling of the face during her pregnancy?
Did she complain of blurred vision during her pregnancy?
Did she have her blood pressure taken during her pregnancy?
If yes, do you know whether her blood pressure was high or low?

1.3 HAEMORRHAGE

During her final illness, was she bleeding from the vagina?
If yes, go on to the following questions:

Did it wet her clothes, the bed or the floor? (N.B. to arrive at severity, use local terminology)
Did the bleeding start before the birth of the child?

If the bleeding started before the birth of the child:
Was she in pain while bleeding?
If not, did she have other episodes of bleeding during this pregnancy?
If there was pain, did the pain start before the labour pains?

If the pain started before the labour pains:
Did she have a cesarean section in the previous pregnancy?
Were any instruments used to help the delivery?
Did she die before the baby was born?
Do you know whether she ever had her blood pressure taken?
If yes, was it high or low?

If the bleeding occurred during labour pains:
Did she have a vaginal examination during her illness (use local terminology)
If yes, did it increase the bleeding?
How long was she in labour for? (hours)
Were any drugs used just before or during the labour?

If the bleeding started after the birth of the child:
How long after the birth of the child was the placenta delivered (use local terminology)
Were any instruments used to help the delivery?

1.4 SEPSIS

Did she die before or after the birth of the child?
If after the birth, go on to the following questions:

Did she have a high fever during her final illness?
Has she been ill with any other illness during this pregnancy (use local epidemiology/local terminology)
Did she have a foul-smelling discharge during her last illness?
How long did the labour last? (hours)
Were any instruments used to help the delivery?
How long after the birth of the child was the placenta delivered (use local terminology)

1.5 JAUNDICE

Was she yellow at the time of death?
If yes, go on to the following questions:

How long/how many days was she yellow for?
Did she eat or swallow any poisonous substance?
Did she have any fits before death?
Had she ever suffered from any disease of the blood? (local epidemiology/local terminology)
Did she have a high fever during her (final) illness?

If death occurred after the time of delivery:
Was she jaundiced at the time of delivery/abortion?
If not, how many days after delivery/abortion did she develop jaundice?

Questions to help support different diagnoses:
Did she suffer from bleeding during her final illness?
Did she attend a health facility during this illness?
What did they tell her about her illness?
Did she have any tests?

If she did have tests:
Do you know the results of these tests?
Has there been anyone else in the neighbourhood or family who has been yellow within the last few months?

If after delivery:
How long was she in labour for?
Did she have a foul-smelling discharge during her last illness?

1.6 ANAEMIA

Was she short of breath at the time of death?
Was she short of breath when she carried out regular household activities?
Was she pale?

Exclude other causes:
During her final illness, was she bleeding from the vagina?
Did it wet her clothes, the bed or the floor?
Did she lose weight during her pregnancy?
Did she have diarrhoea during her pregnancy?
How long did the diarrhoea last for?

2. CONTRIBUTING FACTORS OF DEATH

The following groups of questions should be addressed to the families of women who died. They should if possible be supplemented with questions to providers.

The broad groups of questions have to do with (the three) delays in receiving treatment, resources at the last level of the health services that was reached, and personnel at the last level reached.

2.1 DELAY

2.1.1 *Delay in seeking care*

The following questions should be asked for those who never sought care:

Was the problem recognized?
Who recognized it?
Was the severity recognized?
Was it decided to seek care? Who decided it?
Was it decided not to seek care? Why not?
Did you know where to go?
Did you know how to get there?
Why didn't you go?

The following questions should be asked for those who did seek care:

When did labour begin (when did she know she was in labour?)
When was a problem recognized?
How was a decision reached to seek care?
Who made the decision?

If the woman died before labour tick here ___

How was delivery accomplished?

Mode	Yes/No	Where?	When?	Who?
Normal vaginal				
Breech extraction				
Vacuum				
Forceps				
Cesarean section				
Traditional				

Who attended labour or delivery?

Attendant(s)	Yes/No	Where?	When?
Self/none			
Relative			
TBA			
Nurse or midwife			
General doctor			
Gynaecologist, obstetrician			
Other, e.g. healer, herbalist, spiritualist, homeopath, ayurvedic			

2.1.2 *Delay in arriving at appropriate level of care*

For EACH level of referral or contact, ask the following questions:

How did she get there?
What time did she arrive?
Who did she see? List all.
When did she see this person?
What treatment was given? List all.
When was it given?
Why did she leave this level of care?
When did she leave?
Did this place provide transport to the next place?
Why not?
Where did she go next?
Is there anything else you would like to say about this?

Supplementary questions on delay in arriving at appropriate care (transport):

Describe for EACH move how the deceased was moved. Describe means of transport (e.g. on foot, by truck), how long it took to find it, and how long was spent in transit.
First move _____
Second move _____ etc.

2.1.3 *Delay in receiving care at the institution*

What time did she arrive at the last institution she attended?
Describe her condition when she arrived here (e.g. unconscious, very pale, sweating, cold)
What time did she receive treatment? List for as many treatments as possible.
What time did she die?

2.2 RESOURCES

This applies only to the last level of care reached.

Do you think there were delays in providing treatment at this level? Describe in detail, e.g. waiting for drugs, waiting for blood, waiting for hospital staff (doctor, anaesthetist, etc.)

2.3 PERSONNEL

At this last place where she was treated, do you feel that she had to wait to see the person she needed to see? Specify.
Were you EVER told to go somewhere else because medical staff were not able or were not allowed to do a procedure? Specify.
List all the health personnel seen (with their qualifications), where they were seen and whether they had been referred or not.

Appendix 4: Suggestions for a questionnaire to arrive at at causes of maternal death

WOMAN'S BACKGROUND CHARACTERISTICS

See for example DHS questionnaire, etc.

PAST MEDICAL HISTORY

Do you know of any medical problem (name) had before she became pregnant?
If yes, what?
Was she ever hospitalized?
If yes, for what reason?
Did she ever have surgery?
If yes, for what reason?

REPRODUCTIVE HISTORY

How many live births has she had?
How many were alive at the time of her death?
How many had died before her death?
Has she ever had a pregnancy which ended before term?
If yes, how many?
Has she ever had a pregnancy which ended as a stillbirth?
If yes, how many?
Did she have a cesarean section in the previous pregnancy?

INDEX PREGNANCY

Could you tell us what happened before (name) died and what you think the cause of death was? (verbatim)

When did she die? (day/month/year)
Where did she die? (home, in transit, health centre, hospital, other)
When during her pregnancy did she die?

- before labour started (record month of pregnancy)
- during labour, delivery or 12 hours post-delivery (record month of pregnancy)
- after delivery (record days and/or weeks after delivery)

IF THE WOMAN DIED PRIOR TO ONSET OF LABOUR, GO TO MODULE 1
IF THE WOMAN DIED AFTER THE LABOUR STARTED, GO TO MODULE 2

* * * * * * * * * *

MODULE 1: DEATHS PRIOR TO ONSET OF LABOUR

Did she ever go for an **antenatal care** visit during her pregnancy?
- If yes, do you have an antenatal care card?
- If yes, where did she go for antenatal care?
- If yes, whom did she see for antenatal care?
- If yes, how many times did she go for antenatal care?
- If yes, did she first attend antenatal care because she had a problem with the pregnancy or just to check everything was fine? (If problem, what was the problem?)

Did she have any **fits** before she died?
Did she have swelling of the legs during her pregnancy?
Did she have swelling of the face during her pregnancy?
Did she complain of blurred vision during her pregnancy?
Did she have her blood pressure taken during her pregnancy?
- If yes, do you know whether the blood pressure was normal/high?

During her final illness, was she **bleeding** from the vagina?
- If yes, did it wet her clothes, the bed or the floor?
- Was she in pain while bleeding?

Did she have other episodes of bleeding during this pregnancy?
- If yes, were they painful?
- Did she have a vaginal exam during her illness?
- If yes, did it increase the bleeding?

Did she have a **high fever** during her final illness?
Has she been ill with any other illness during this pregnancy (local epidemiology/local terminology)?
Was she **yellow** at the time of death?
- How long/how many days was she yellow for?
- Did she eat or swallow any poisonous circumstances?
- Had she ever suffered from any disease of the blood?

Was she **short of breath** at the time of death?
Was she short of breath when she carried out regular household activities?
Was she pale?
Did she lose weight during her pregnancy?
Did she have diarrhoea during her pregnancy?
How long did the diarrhoea last for?

GO TO MODULE 3

* * * * * * * * * *

MODULE 2: DEATHS DURING LABOUR, DELIVERY OR AFTER DELIVERY

Was the baby she was carrying delivered before her death?
If yes, was the baby born alive?
If the baby was born alive, is it still alive today?
If the baby is now dead, how old was the baby when it died?

Did she ever go for an **antenatal care** visit during her pregnancy?
- If yes, do you have an antenatal care card?
- If yes, where did she go for antenatal care?
- If yes, whom did she see for antenatal care?
- If yes, how many times did she go for antenatal care?
- If yes, did she first attend antenatal care because she had a problem with the pregnancy or just to check everything was fine? (If problem, what was the problem?)

Where did the **delivery** take place? (home, health centre, clinic, hospital, other)
Who attended the delivery? (none, relative, TBA, nurse or midwife, general practitioner, gynaecologist/obstetrician, other)
Did they need instruments (forceps or vacuum) to help the baby out, was a cesarean section performed, or did the baby arrive by itself?
What part of the baby came out first?

Did she have any **fits** before she died?
- If yes, did the fits stop after the baby was born?

Did she have swelling of the legs during her pregnancy?
Did she have swelling of the face during her pregnancy?
Did she complain of blurred vision during her pregnancy?
Did she have her blood pressure taken during her pregnancy?
- If yes, do you know whether the blood pressure was normal/high?

During her final illness, was she **bleeding** from the vagina?
- If yes, did it wet her clothes, the bed or the floor?
- Did the bleeding start before the birth of the child?
- If yes, was she in pain while bleeding?
- If she was in pain, did the pain start before the labour pains?

Did she have other episodes of bleeding during this pregnancy?
- Did she have a vaginal exam during her illness
- If yes, did it increase the bleeding?

Was the placenta delivered?
How long after the birth of the child was the placenta delivered? (hours)
Were any instruments used to help the delivery?

How long was she in **labour** for? (hours)
Were any drugs used just before or during the labour?

Did she have a **high fever** during her final illness?
Has she been ill with any other illness during this pregnancy (local epidemiology/local terminology)?
Did she have a foul-smelling discharge during her last illness?

Was she **yellow** at the time of death?
- How long/how many days was she yellow for?
- Did she eat or swallow any poisonous circumstances?
- Had she ever suffered from any disease of the blood? (local epidemiology/local terminology)

Was she yellow at the time of delivery?

If not, how many days after delivery did she develop jaundice?

Was she **short of breath** at the time of death?
Was she short of breath when she carried out regular household activities?
Was she pale?
Did she loose weight during her pregnancy?
Did she have diarrhoea during her pregnancy?
How long did the diarrhoea last for?

GO TO MODULE 3

* * * * * * * * * *

MODULE 3

For **EACH of the illnesses** (e.g.bleeding, fits) listed above, ask the following questions:

Did she seek care for the (illness)?
If yes, where did she seek care? (Probe separately for each of following: own home, someone else's home, health centre, clinic, hospital, other.)
If yes, who provided the care? (Probe separately for each of following: TBA, nurse or midwife, general practitioner, gynaecologist/obstetrician, other.)

For **EACH of the sources of care sought**, ask the following questions:

How did she get to (name the health facility)?
How long after the (illness) occurred did she get to the (name the health facility)?
Was a treatment given?
If yes, how many hours after arrival was the first treatment given?
What treatment was given? (Allow for more than one answer.)

* * * * * * * * * *

Appendix 5: Summary of the characteristics of selected studies using lay reporting to identify cause of death

Author	Year	Country	Sources of deaths	Female deaths	Maternal deaths*	Source of denominator	Maternal mortality ratio	Type of interviewer	Type of questionnaire	Panel to assess cause	Recall period
Alauddin 1986	1982-1983 12 months	Bangladesh, Tangail district	Village informants (community leaders)	146	48	Village informers	566	Physician	Unstructured	No	up to 2 weeks
Bhatia 1986, 1985	1984-1985 12 months	India, Anantapur district	Hospital, PHC centres, civil registration, village leaders, TBAs, physicians, teachers, schoolchildren	1073	391 (284)	Sample survey	798	Fieldworkers	Semi-structured	Single medical professional	N.S.
Chen et al. 1974	1967-1968 12 months	Bangladesh, Matlab, 132 villages	Female fieldworkers, surveillance	139	41 (37)	Surveillance	769	Obstetrician/ public health physician	Unstructured	No	2-6 weeks
Chen et al. 1974	1968-1970 24 months	Bangladesh, Matlab, 233 villages	Surveillance, linkage	440	119	Surveillance	571	N.A.	Time-of-death definition	Time-of-death definition	N.A.
Fauveau et al. 1988; Koenig et al. 1988	1976-1985 10 years	Bangladesh, Matlab, 149 villages	Surveillance by female CHWs, linkage	1037	387	Surveillance	550	Female fieldworkers	Structured and unstructured	Single physician	6 months up to 10 years
Fauveau et al. 1989	1976-1985 10 years	Bangladesh, Matlab, 79 villages	Surveillance by female CHWs, linkage	542	163	N.S.	N.S.	Female CHWs, male fieldworkers	Unstructured, semi-structured	Single public health physician	up to 10 years
Fortney et al. 1987, 1986	1981-1983 3 years	Egypt, Menoufia	Vital registration	1691	437 (385)	Projection from census data	190	Trained interviewer, social worker, (female)	Standardized, pretested and hospital records	Panel of 5 physicians	30-40 days (up to 3 months)
Fortney et al. 1986, 1987	1980-1982 2 years	Indonesia, Bali	Family planning workers, village heads, mortuary records	1214	279	Census	718	Trained interviewers (male)	Standardized, pretested	Pathologist with access to panel of 3	up to 12 months
Khan et al. 1986, 1985	1982-1983 12 months	Bangladesh, Jamalpur	TBAs	126	58	TBAs	623	Trained interviewer	One page form	Single physician	N.S.

Author	Year	Country	Sources of deaths	Female deaths	Maternal deaths*	Source of denominator	Maternal mortality ratio	Type of interviewer	Type of questionnaire	Panel to assess cause	Recall period
Kwast, 1988	1981-1983 24 months	Ethiopia, Addis Ababa	Survey	N.A.	45	Survey	457	Social science students (male and female)	Structured, hospital records, family	No	up to 2 years
Walker et al. 1985	1981-1983 3 years	Jamaica	Hospitals, police and coroner's reports, postmortem and morgue, health staff, death certificates	about 4200	193	Vital statistics	110	N.A.	Maternal death form	2 assessors from panel of 7	N.S.
Boerma and Mati, 1989	1984-1987 4 years	Kenya, Kwale District	Survey and networks (TBAs and health workers)	N.A.	35	Survey	660	Male and female secondary school graduates	Standardized	N.S.	4 years
Puffer and Griffith, 1967	1962-1964 24 months	Americas, 12 cities	Vital registration	109-675	1-97	Birth registration, baptisms	11-316	Public health nurse, social worker and hospital records	Semi- structured	2 physicians and 2 referees	up to 1 month
Greenwood et al., 1987	1982-1983 12 months	The Gambia, Farafenni	Surveillance, prospective study	N.A.	15	Surveillance	2362	Physician and clinic records	Unstructured	No	up to 1 month
Abdulghani 1993	1989-1991 21 months	North Yemen	Hospital records	623	224	Hospital	753	Trained interviewers	Standardized, pretested	Hospital physician	Up to three years
Catano et al 1992	1988-1989 12 months	Metropolitain Medellin, Colombia	Vital registration	1128	33	Hospital	71	University nurses	Two questionnaires, structured, with open ended bit	Panel with 3 to 4 physicians	Up to 8 weeks
Reitmaier	1992-1993 12 months	Cabo Verde, three major islands	Death registration in health system and registrars?	>120	NA	Registrar + BCG doses	>150	Female social worker and mother	Structured and unstructured bit, self administered portion	panel of three physicians	shortly after and after 3 months