

# Diagnosis of causes of childhood deaths in developing countries by verbal autopsy: suggested criteria

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*In the absence of medical certification of deaths in developing countries, lay reporting and verbal autopsy have emerged as useful alternative methods for collecting data on causes of death. Of these, verbal autopsy offers advantages and is widely used in field studies and child survival programmes. However, because uniform and valid criteria for the diagnosis of common causes of death are lacking, comparison of the results of different studies becomes meaningless. This article proposes such a set of criteria for the cause of death among neonates and for those aged 1–59 months. The criteria are based on the findings of earlier validation studies, a Delphi survey and the experience gained from performing 1000 verbal autopsies in Gadchiroli, India. The emergence of such standardized criteria of causes of death should be of immense value for health planning, monitoring and evaluation purposes and for interregional comparisons.*

## Introduction

Information on causes of death is extremely important for policy-making, planning, monitoring and evaluation of health programmes, as well as being necessary for field research, comparisons, and epidemic awareness. In developing countries, where most deaths are neither attended by doctors nor medically certified, this crucial information is usually incomplete and of poor quality. Since this situation is not likely to change in the near future, there is an urgent need to search for alternative methods of obtaining information on causes of death. This is particularly important for childhood deaths, which constitute a major portion of all deaths, and which many intervention programmes are currently attempting to reduce.

In 1971 the Office of the Registrar General of India introduced a model registration survey of the cause of death, which used a simple symptom-based inquiry to determine the cause of death (1). Subsequently, WHO produced a publication on the lay reporting of health information (2). This represented a bold step to break away from the concept of the indispensability of a doctor to report morbidity and

causes of death; instead, use of a lay reporter, health worker, or trained nonprofessional was proposed. However, there were many problems with the method suggested.

The WHO publication covered deaths in all age groups, thereby making the minimum list of causes highly inadequate for childhood deaths; for example, undernutrition, birth injury or asphyxia, and prematurity were absent from the list. Many diagnostic criteria were nonspecific or overlapping; and most of the criteria were not quantified. Thus a diagnosis of measles was made if there was "fever with skin eruptions", although the fever's duration, the age group involved, or the characteristics of the rash were not specified; diarrhoea was diagnosed if there was "unqualified diarrhoea". The most important limitation was that the method required a trained or experienced person to make observations during the illness in order to arrive at a diagnosis. Such ante-mortem observations by trained workers were very often lacking, especially for childhood deaths in developing countries. The symptom-based diagnosis method proposed by the Registrar General of India also suffers from similar deficiencies (1). Thus "gastroenteritis" was diagnosed if "the person had a large number of vomitings associated with diarrhoea and dehydration"; each term was undefined and combinations of symptoms were not considered. Moreover, all the diagnostic criteria were totally unvalidated.

Development of the verbal autopsy method was the next step; this was first used in the Johns Hopkins University Narangwal research project (Professor Carl Taylor, personal communication, 1990). The method consists of an interview designed to identify

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specific medical syndromes using information about the terminal illness elicited from the relatives of the deceased person (3). Since it is based on an interview after death, it does not require observations by health workers on the live patient.

A few studies have attempted to validate sets of simple criteria to diagnose illnesses such as measles, pneumonia, diarrhoea, or acquired immunodeficiency syndrome (AIDS), by comparing diagnoses made using these criteria with medical diagnoses (4–7), and have usually found a good correlation. One study, which investigated the systematic validation of verbal autopsy for four major causes of death by comparing the diagnoses based on post-mortem interviews with the hospital medical diagnoses of the same patients, found that the method was valid for deaths of children from measles, tetanus neonatorum, diarrhoea, and pneumonia (8). Another study reported 80% agreement between hospital diagnoses of causes of adult deaths and diagnoses by verbal autopsy (9).

It has been suggested that verbal autopsy can reliably diagnose only a few conditions that form discrete, easily identifiable medical syndromes (3). However, this statement is unsubstantiated, and, with further research and refinement, the method may have wider application. In Asia and Africa 15 field studies have used verbal autopsy as a research tool (3). Also the Universal Immunization programme and the WHO acute respiratory infections control programme are currently using the verbal autopsy method to estimate the magnitude of the problem presented by their target diseases and to evaluate programme impact.

The major difficulty in extending the application of verbal autopsy is the lack of standardized diagnostic criteria and an instrument of inquiry. Consequently, every study has selected and applied its own set of criteria to diagnose various causes of death, thereby introducing considerable variation, which makes cross-comparison of results meaningless. Unfortunately, because of the limitations discussed above, the lay-reporting criteria proposed by WHO are not useful for carrying out verbal autopsies (2). Hence, there is a pressing need to develop standardized diagnostic criteria and a questionnaire to elicit the information by verbal autopsy. Here, we propose a tentative set of criteria for this purpose.

## Materials and methods

We carried out a field trial of interventions against childhood pneumonia in Gadchiroli, a rural area of India with a population of 82 000 (10). Verbal autopsy was used to diagnose the children's causes of death. Starting with the minimum list of causes of

death and their diagnostic symptoms and signs suggested by WHO (2), we developed a modified list and diagnostic criteria to suit the local pattern of mortality in children. Those causes that were of public health importance, because of their higher frequency, or which might have been amenable to interventions in villages, were given preference in the list. The diagnostic criteria were selected on the basis of their ability to be recognized by parents. Both the list and criteria were field-tested and refined in the course of the field trial on pneumonia, and recommendations made by the Indian National Neonatology Forum on the classification and criteria for causes of neonatal deaths were incorporated (11). Also, useful data and validated criteria for a limited number of diseases were provided by the results of a study carried out in the Philippines (8).

Since validation studies on criteria for all causes of child death were not feasible, we employed the Delphi method. This method, an interactive survey of expert opinion, is frequently employed by industry for planning and forecasting purposes, and is useful for drawing conclusions in situations where there are comparatively few reliable data. The method uses the opinions of experts as data; the disadvantage is that a different group of experts may reach different conclusions (12). For this purpose, we provided widely experienced consultant paediatricians (5 from India, 5 from the USA) with a list of proposed criteria for each cause of death. The paediatricians were requested to carry out the following: rank each criterion by order of importance for diagnosing a particular cause of death; categorize each criterion as essential (prerequisite), pathognomonic (confirmatory), or supportive; and propose alterations to the criteria or new criteria. Based on the responses, the criteria were ranked, further modified, and each criterion was categorized. The revised set was presented at two workshops on verbal autopsy organized by the Epidemiology–Management Network of India and modified in the light of the participants' suggestions.

After studying the local practices and terms used to describe various symptoms and signs of childhood illnesses, we drew up a verbal autopsy questionnaire to elicit the necessary information. The questionnaire and criteria were further field-tested. Over the last 3 years since the initial set was developed for the pneumonia study, the criteria and questionnaires have been field-tested on 1000 verbal autopsies and improved.

## Results

The minimum list of causes of death in children in developing countries and the proposed diagnostic criteria are listed in Annex 1.

## Discussion

The following points should be noted about the criteria shown in Annex 1.

- Some of the diagnostic criteria proposed here, although based on sound paediatric principles, are culture-specific, e.g., withholding breast-feeding for the first 3 days after birth. Adaptations may therefore be necessary if they are to be used in other settings.
- The criteria were evolved in a rural area with an infant mortality rate (IMR) of about 100 per 1000 live births. A modified set of criteria may be required in settings with lower IMRs. For example, congenital malformations may emerge as an important cause of death at lower IMRs, and hence need further classification.
- Understanding the local terms used for certain conditions is of paramount importance, since verbal autopsy is based on interviewing parents or carers; it is as crucial as learning to elicit physical signs for clinical diagnosis, otherwise the results obtained are invalid. Very often excellent local synonyms are available for medical terms; for example, tachypnoea is described as *lahak* in the Gadchiroli area and night blindness is called *chalanya andhar*.
- Some of the criteria may appear insufficient by the standards of clinical diagnosis. However, it must be remembered that these criteria are to be applied in situations where a fatal outcome has already occurred, imparting the criteria with a different significance. Thus, fever with otitis media, persistent headache, and vomiting may not be sufficient clinical evidence to diagnose meningitis; however if a child died with these symptoms, it is sufficient reason to assign meningitis as a "possible" cause of death. The occurrence of unconsciousness or convulsions is taken to be confirmatory evidence.
- Since the diagnosis of cause of death by verbal autopsy is retrospective, and is based on the interview of a carer who is usually illiterate, criteria that need observation by a physician or health worker (such as a respiratory rate count for diagnosing pneumonia) were not included.
- In many instances, more than one set of diagnostic criteria were suggested because a fixed set was inadequate to cover the broad range of clinical presentation.
- The causes of death determined using these criteria may be less accurate in individual cases. They are, however, meant for epidemiological diagnosis.
- The causes of death were arbitrarily divided into two lists: one for neonates and another for children aged 1 month to 4 years and 11 months. However, there is an inevitable overlap. Hence, prematurity,

low birth weight, septicaemia, and feeding problems, although they appear in the list for the neonatal period, are also considered as causes of death throughout infancy.

- In many instances the causes of death are diagnosed with two levels of certainties—possible and the most probable—since it is preferable to have a known probability of misclassification than blind confidence in the diagnosis. Despite this, a certain amount of misclassification, especially for neonatal deaths and deaths due to malnutrition, is unavoidable. Hence the results must be interpreted judiciously.
- Many of the suggested criteria are not based on reliable data but on experts' opinions, in which a subjective element cannot be ruled out.
- *Single or multiple causes.* Most of the deaths have more than one cause. Current epidemiological thinking no longer ascribes a single etiology to a disease (13, 14). Therefore from a set of causes, it is arbitrary to select one as the main or only cause, since the personal bias of the investigator may distort the choice. In studies of a particular disease such as diarrhoea, pneumonia or tetanus, there is a tendency to attribute the status of underlying cause to the disease of interest. For example, in two studies on childhood mortality in rural Bangladesh, one that was specially interested in malnutrition and diarrhoea attributed only 6% of deaths to pneumonia (15); whereas the other, a study of respiratory infections, attributed 29% of deaths to pneumonia (16). Moreover, a unicausal diagnosis of death fails to identify the diversity of information contributed by other causes (3). Hence, in the present study we included all the causes that contributed to death (up to a maximum of four causes for each death) in the mortality analysis.
- *Who should conduct a verbal autopsy?* Some studies have reported the use of lay reporters to conduct verbal autopsies and found that the resulting diagnoses correlated well with those conducted by professionals (3, 17). The outcome depends, however, on the complexity of the criteria used to diagnose the conditions concerned. In our experience, educated workers (those who have passed the 10th grade in school) from the local area, when trained, were able to conduct excellent inquiries, but the determination of causes of death from the results was better when performed by a physician who was experienced in the technique of verbal autopsy.
- *The instrument of inquiry.* The latest version of the verbal autopsy questionnaire that has evolved at SEARCH has about 70 questions. Separate questionnaires are used for the death of neonates and of 1–59-month-old children. Two very useful tech-

niques in designing questionnaires are to begin by asking the parents/carer to describe the illness and the event of death; and to use questionnaires that consist of a series of modules, each opening with screening questions that have a high sensitivity (e.g., the presence of a cough), which, if positive, are followed by questions to probe further and increase the specificity (3). If the response to the screening question(s) is negative, the rest of the module is omitted. It takes about 30–40 minutes to complete the questionnaire once a proper informant is located; and about 5–10 minutes to review the information and arrive at a diagnosis of the cause of death. The instruments are not included here but are available on request. Questions on childhood pneumonia are shown in Annex 2 as an example.

## Suggestions for future studies

Below are outlined various suggestions for future studies of the verbal autopsy approach.

- The questionnaires and criteria should be field-tested in different geographical and cultural settings.
- Validation studies should be carried out to confirm/modify the criteria we have described. The verbal autopsy technique has been validated in some studies (8, 9); however, the specific sets of criteria have been validated only for three causes of death—measles, diarrhoea, and pneumonia in children (8). Our criteria provide working definitions or hypotheses based on scientific evidence, experts' opinions, earlier validation studies, and field experience. Each set of criteria can be further validated by comparing the results obtained using verbal autopsy, conducted blind at the homes of children who died in hospital, with the medical diagnosis made at hospital (8). However, the selection bias introduced by testing the criteria on hospital deaths should be recognized. Parents sometimes know the cause of death if their child died in hospital, and children who die in hospital may not be similar to those who die in the community. The data from such validation studies will also permit computer modelling and the choice of various levels of sensitivity and specificity for different sets of criteria.
- The suitability of the criteria should be studied for combinations of various causes of death. Thus, refusal to feed, lethargy, and hypothermia, taken together, are considered sufficient to diagnose neonatal sepsis. But how sensitive and specific are these criteria in the presence of prematurity, which may modify the manifestations of sepsis, or, worse, mimic neonatal sepsis?
- A computer program should be developed to apply these criteria and diagnose the cause of death. This

will avoid any personal bias as well as errors that may arise because of manual application of the criteria to large number of deaths.

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## Résumé

### Diagnostic de la cause de décès chez l'enfant par autopsie verbale dans les pays en développement: critères proposés

La connaissance des causes de décès est essentielle, aussi bien pour les services de santé que pour les projets de recherche sur le terrain. Dans les pays en développement, en l'absence de certification médicale, le compte rendu par un non-spécialiste et l'autopsie verbale se sont révélés comme des approches de remplacement possibles pour obtenir des renseignements sur les causes de décès. L'autopsie verbale présente, par rapport à l'autre approche, l'avantage de ne pas exiger d'observation du sujet, dans la période précédant le décès, par un agent sanitaire. La méthode est considérée comme valable pour un certain nombre de maladies infantiles, et on l'utilise largement dans les études de terrain ainsi que dans les programmes d'intervention concernant la survie des enfants. Mais il manquait jusqu'à présent une série uniforme de critères pour le diagnostic des causes de décès.

Le présent article propose une telle série de critères pour le diagnostic des causes de décès chez l'enfant dans les pays en développement. Des listes distinctes de causes de décès et de critères pour chaque cause sont proposées pour les nouveau-nés et pour les enfants âgés de 1 à 59 mois. Ces critères ont été élaborés lors d'une

étude de terrain conduite dans la population et portant sur des interventions contre la pneumonie infantile, et puis modifiés après consultation de 10 pédiatres — avec utilisation de la méthode Delphi — et consultation des participants à un atelier sur l'autopsie verbale. Les séries de critères modifiés ont été essayées sur le terrain au moyen de 1000 autopsies verbales exécutées à Gadchiroli (Inde) par des équipes de la Society for Education Action and Research in Community Health (SEARCH).

Les critères ont été élaborés dans une zone où le taux de mortalité infantile (TMI) était d'environ 100 pour 1000 naissances vivantes; mais il est clair qu'ils peuvent varier, dans une certaine mesure, selon le TMI, la culture et l'environnement. Une connaissance approfondie des termes locaux désignant les divers signes et symptômes et des pratiques sanitaires locales sont des conditions qui doivent être obligatoirement remplies pour que l'on puisse procéder à une autopsie verbale. Uniquement basé sur l'interrogatoire des personnes qui ont soigné l'enfant décédé, le diagnostic a un caractère épidémiologique et peut ne pas correspondre aux normes cliniques. Dans certains cas, des séries différentes de critères de diagnostic sont proposées pour le diagnostic probable et définitif.

Dans l'analyse, nous nous sommes servis de causes de décès multiples au lieu d'une unique cause sous-jacente. Le questionnaire doit être rempli par un agent sanitaire local formé à l'autopsie verbale, et la cause de décès doit être confirmée par un médecin sur la base des réponses au questionnaire.

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## Annex 1

### Minimum list of causes of childhood deaths in developing countries and suggested criteria for diagnosis of causes of death by verbal autopsy

#### Categories of criteria

The following categories of diagnostic criteria were used:  
 — E = **essential**: this criterion must be fulfilled to make a diagnosis, but is not sufficient evidence for diagnosis;  
 — C = **confirmatory**: clinches the diagnosis (if "E" is also fulfilled); and  
 — S = **supportive**: helps in making a differential diagnosis from other possible causes of death, and provides circumstantial evidence to support a diagnosis.

The diagnostic criteria suggested for each cause are the minimum necessary; the presence of more criteria provides stronger evidence.

#### Age at death: 0–29 days (neonatal death)

The causes of death and the suggested diagnostic criteria are outlined below.

### 1. Prematurity

C: history of <37 completed weeks' gestation (physical signs of prematurity were not noticed by women/traditional birth attendants in the study area).

Most probable diagnosis = 1 C

### 2. Low birth weight

C: too small at birth (since the usual birth weight in developing countries tends to be low, parents' judgement of "small size" usually means gross low birth weight).

C: twins (twins born in rural areas are almost invariably low birth weight).

Most probable diagnosis = 1 C

### 3. Congenital malformation

C: grossly malformed baby.

Most probable diagnosis = 1 C

### 4. Birth injury/asphyxia

C: did not cry immediately after birth (late cry = >3 minutes) or did not breathe or had very slow gasping respiration at birth.

C: drowsy or unconscious or convulsions at birth or within first 72 hours.

C: generalized flaccidity at birth or within 72 hours in a full-term baby.

S: sucking and swallowing absent at birth or within first 24 hours in a full-term baby.

S: history of prolonged labour (>24 hours in primigravidae; >12 hours in others).

S: fracture or paralysis of a limb.

S: excessive moulding of skull or caput or bruises at birth.

S: cyanosis or pallor at birth.

S: presentation other than vertex.

S: history of instrumentation in hospital or manual manipulation in home delivery.

S: second-born of a twin birth.

S: small-sized baby (babies with intrauterine growth retardation are very prone to birth asphyxia).

S: very large baby.

S: meconium-stained liquor.

Possible diagnosis = 1 C or 2 S

Most probable diagnosis = 2 C or 1 C + 1 S

### 5. Neonatal tetanus

E: age at death >4 days (although the minimum possible incubation period is 48 hours, 90% of the deaths due to neonatal tetanus occur between the 5th and 14th day postpartum).<sup>a</sup>

E: baby stopped sucking from the 4th day or later.

C: stiffness of body and arching of back with spasms on 4th day or later.

C: inability to open mouth to feed (trismus).

S: mother did not have the minimum of one dose of tetanus toxoid during this pregnancy.

S: family calls the illness tetanus (local term).

S: umbilical cord cut using a dirty instrument.

S: birth attendant did not wash her hands before delivery.

S: omphalitis.

Possible diagnosis = 2 E + 1 C + 1 S

Most probable diagnosis = 2 E + 2 C

### Respiratory diseases

To gain more insight, we subdivided this group into the following causes.

#### 6. Neonatal pneumonia

E: onset of respiratory symptoms > 6 hours after birth.

C: tachypnoea for more than 2 hours before death (to differentiate from terminal gasping).

C: respiratory distress (severe indrawing of suprasternal, intercostal, or subcostal regions).

C: expiratory grunt or groaning.

S: cough (neonates often do not cough despite having pneumonia; hence it is only supportive).

S: fever.

S: refusal of feeds.

S: cyanosis.

Possible diagnosis = 1 E + 1 C

Most probable diagnosis = 1 E + 2 C or 1 E + 1 C + 1 S

#### 7. Post-natal aspiration

The same criteria were used as for pneumonia + onset preceded by choking or a severe bout of coughing after feeding or vomiting.

#### 8. Respiratory distress syndrome

This includes hyaline membrane disease, congenital pneumonia or meconium aspiration.

E: onset of respiratory symptoms within 6 hours of birth.

C: tachypnoea.

C: respiratory distress — severe indrawing of suprasternal, intercostal, or subcostal regions.

C: expiratory grunt or groaning.

S: cyanosis.

S: feeble cry at birth (indicates probable intrauterine infection).

S: presence of one of the following predisposing factors:

— prematurity; or

— prolonged labour (>24 hours in primiparous mothers; others >12 hours).

Possible diagnosis = 1 E + 1 C

Most probable diagnosis = 1 E + 2 C or 1 E + 1 C + 2 S

<sup>a</sup> Galazka, A. & Stroh, G. *Neonatal tetanus: guidelines on the community-based survey on neonatal tetanus mortality*. Unpublished document WHO/EPI/GEN/86/8.

**9. Diarrhoea**

- E: >3 loose, watery stools per day.  
 S: vomiting.  
 S: restriction of breast-feeding or fluids by parents.  
 C: dehydration (depressed eyeballs or fontanelle, oliguria or dark urine — any one of these).

Possible diagnosis = 1 E  
 Most probable diagnosis = 1 E + 2 S or 1 E + 1 C

**10. Dysentery**

- E: >3 loose stools per day.  
 C: blood, pus, or mucus in stools.

Most probable diagnosis = 1 E + 1 C

**11. Hypothermia**

- C: head, chest, and abdomen of baby cold for 2 hours or more before death.

Most probable diagnosis = 1 C

**12. Neonatal sepsis (includes septicaemia, meningitis)<sup>b</sup>**

- C: became drowsy, or lethargic, or unconscious 72 hours after birth (compare with birth injury).  
 C: refused feeds (having accepted feeds earlier), but mouth could be opened (compare with tetanus).  
 S: feeble cry in full-term baby.  
 S: sepsis in skin or umbilicus.  
 S: fever.  
 S: hypothermia in a baby unexposed to cold (covered parts of body were cold).  
 S: vomiting, diarrhoea, or abdominal distension (any one or more).  
 S: convulsions or spasms after first 72 hours of life.  
 S: jaundice.  
 S: cyanosis of extremities  
 S: apnoeic spells — stops breathing for period greater than 20 seconds, after good breathing at birth.  
 S: presence of one or more of the following maternal factors:  
 — prolonged rupture of membranes (>24 hours);  
 — prolonged or obstructed labour (>24 hours in primigravidae, >12 hours in others);  
 — foul-smelling liquor; and  
 — maternal fever lasting >24 hours during or within 1 week of delivery.

Possible diagnosis = 1 C + 1 S or 2 S  
 Most probable diagnosis = 1 C + 2 S or 2 C or 3 S

**13. Sudden death**

- C: sudden death of an otherwise normal baby.

Most probable diagnosis = 1 C

**14. Feeding problem (refusal to feed/failure to feed/bottle-feed)**

- C: baby did not suck or was not fed milk for two continuous days or more before death.  
 C: baby was bottle-fed (which invariably results in under-feeding due to dilute formula milk and infection in rural areas)

Most probable diagnosis = 1 C

**15. Other**

Specify

**16. Cause not known**

**Age at death: 1 month to 4 years and 11 months**

Of the following, prematurity, low birth weight septicaemia, and feeding problems should be considered in the deaths of infants only. The diagnostic criteria for these are the same as for neonates.

**1. Prematurity**

**2. Low birth weight**

**3. Septicaemia**

**4. Feeding problems**

**5. Accident, drowning, burns, poisoning, and snake bite**

- C: history of such an event before death.

Most probable diagnosis = 1 C

**6. Measles**

- E: age at the onset of rash >4 months.  
 C: fever and rash for >3 days within 90 days of death.  
 C: rash, red at the beginning, faded after darkening, within 90 days of death.  
 C: red eyes + cold or cough + rash which lasted >3 days within 90 days of death.

Possible diagnosis = 1 E + 1 C  
 Most probable diagnosis = 1 E + 2 C

**7. Malnutrition (protein-energy malnutrition, but excluding milder grades)**

- C: did not thrive for >4 months before death.  
 C: progressively lost weight and grew thinner for >1 month before death.  
 C: oedema over feet.  
 C: keratomalacia.  
 S: breast-fed for less than 6 months or introduction of formula or cattle milk (invariably dilute) in first 3 months.  
 S: late introduction of supplementary food (>9 months of age).  
 S: did not eat well for ≥1 month before death (which results in acute or chronic malnutrition).

<sup>b</sup> These criteria may not diagnose congenital sepsis in which the baby is ill at birth.

S: recurrent diarrhoea ( $\geq 3$  episodes in 3 months before death) or persistent diarrhoea (lasted  $>2$  weeks) in the last 3 months.

S: history of measles or whooping cough in the last 3 months.

S: mother feels child was repeatedly sick in last 3 months.

S: inactive/apathetic in last month.

S: night blindness present.

S: child born small or premature.

S: family calls it malnutrition (local term).

Possible diagnosis = 1 C or 2 S

Most probable diagnosis = 1 C + 1 S or 3 S

### 8. Pneumonia

E: cough  $>24$  hours.

C: tachypnoea for  $>6$  hours before death (to differentiate from terminal gasping).

C: signs of respiratory distress for  $>6$  hours before death (severe indrawing of suprasternal, intercostal or subcostal region).

S: fever.

S: central cyanosis  $>1$  hour before death.

S: grunt.

Possible diagnosis = 1 E + 1 S

Most probable diagnosis = 1 E + 1 C or 2 C

### 9. Whooping cough

E: cough  $>15$  days with severe bouts.

C: cough associated with whoop or suffusion of face during bout of coughing.

S: child not fully immunized against pertussis.

S: contact with a similar patient/epidemic.

S: difficulty in feeding due to cough and vomiting.

S: parents call it "whooping cough" (local term).

Possible diagnosis = 1 E + 2 S

Most probable diagnosis = 1 E + 1 C

### Diarrhoeal diseases

These were divided into the following subgroups.

#### 10. Dysentery

E:  $>3$  loose motions per day.

C: blood, pus, or mucus with stools.

Most probable diagnosis = 1 E + 1 C

#### 11. Persistent diarrhoea

E:  $>3$  loose motions per day.

C: continuously for  $>15$  days.

Most probable diagnosis = 1 E + 1 C

#### 12. Acute diarrhoea

E:  $>3$  loose watery stools per day.

S: vomiting.

S: restriction of fluids by the parents.

C: dehydration (any one or more of thirst, oliguria or dark urine, sunken eyeballs, or depressed fontanelle)

Possible diagnosis = 1 E

Most probable diagnosis = 1 E + 2 S or 1 E + 1 C

### 13. Infections of central nervous system (meningitis/encephalitis/cerebral malaria)

E: fever.

C: unconsciousness or altered sensorium.

C: convulsions/spasms.

S: otitis media.

S: fontanelle bulging.

S: family history of pulmonary tuberculosis.

S: neck retraction.

S: persistent headache and vomiting.

S: refusal of feeds without lockjaw (in infants only).

Possible diagnosis = 1 E + 2 S or 1 C

Most probable diagnosis = 1 E + 1 C or 2 C

### 14. Unspecified fever

This may include any fever except one associated with the causes included in this list, such as pneumonia, measles, or central nervous system infections.

E: fever.

C: no rash, tachypnoea, diarrhoea, convulsion or loss of consciousness.

Most probable diagnosis = 1 E + 1 C

### 15. Other

Specify

### 16. Cause not known

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## Annex 2

**Sample of questions to elicit information about pneumonia as a cause of death in children aged 1–59 months.** (E, C, and S are defined in Annex 1.)

1) Did the child have a cough?

(E): Yes No Don't know

If "yes", how long before death?

2) Did the child have difficult breathing?

Yes No Don't know.

If "yes" since when?

Questions 1 and 2 are for screening purposes. If the answer to question 1 or 2 is "yes", ask questions 3 to 7. Otherwise go to question 8, i.e., next module (not shown).

**Verbal autopsy criteria for childhood deaths in developing countries**

3) Did the child have fast breathing (“*lahak*”/“*dhapa*”) before death?

(C):      Yes          No          Don't know

If “yes”, for how many hours/days before death?

4) Was the child having severe chest indrawing? (“*pasarya odhate*”)

(C):      Yes          No          Don't know

If “yes”, how long before death?

5) Was the child grunting (“*kanhawate*”)?

(S):      Yes          No          Don't know

If “yes”, how long before death?

6) Did the child have fever?

(S):      Yes          No          Don't know

If “yes”, how long before death?

7) Did the child's lips and body turn blue before death?

(S):      Yes          No          Don't know

If “yes”, how long before death?

<p style="text-align: center;">Pneumonia Possible = 1 E + 1 S Most probable = 1 E + 1 C or 2 C</p>
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