Uganda Child Verbal Autopsy Study 2007

Causes of Death among Children Under Five

UGANDA
CHILD VERBAL AUTOPSY STUDY
2007

Uganda Bureau of Statistics
Kampala, Uganda

Macro International Inc.
Calverton, Maryland, USA

MEASURE Evaluation
University of North Carolina
Chapel Hill, North Carolina, USA

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This report presents findings from the 2007 Uganda Child Verbal Autopsy Study (UCVAS) carried out by the Uganda Bureau of Statistics. Funding for the study was provided by the United States Agency for International Development (USAID). Technical assistance was provided by the MEASURE Evaluation project at the University of North Carolina at Chapel Hill, North Carolina (mainly in adaptation of the study instruments, field staff training and monitoring, cause of death coding, data tabulation, and analysis) and by the MEASURE DHS project at Macro International Inc. in Calverton, Maryland (mainly in identifying the child deaths, budgeting and contracting, record matching, and analysis). The Uganda Ministry of Health assisted in the local adaptation of the international verbal autopsy questionnaires and also provided personnel for death certification and the ICD-10 coding component of the study. The opinions expressed in this report do not necessarily reflect the views of the donor organizations. It is also important to acknowledge the contribution of the office and field staff, district officials, communities, and survey respondents, without whom the study would not have been possible. The views expressed in this report are those of the authors and do not necessarily reflect the views of the United States Agency for International Development, the United States Government, or the Government of Uganda.

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PREFACE

The 2007 Uganda Child Verbal Autopsy Study (UCVAS) was the first of its kind to be carried out in Uganda. The primary objective of this survey was to gather data and information about the causes of death among children under age five in Uganda, and more specifically, to shed light on the proportion of deaths that are related to malaria. Since the vast majority of children in Uganda do not die in health facilities, information on causes of death established by health professionals is generally not available. Death certificates are almost nonexistent and those that are available are not representative of the entire population. It was therefore deemed necessary to conduct the UCVAS study to meet this objective.

The findings of the 2007 UCVAS are very important for measuring the impact of malaria on child death. To ensure better understanding and use of these data, the results of this study should be widely disseminated at the various levels of administration within the country. Important findings included in the report will be very useful to policymakers and decision-makers in Uganda.

The Uganda Bureau of Statistics would like to acknowledge the efforts of a number of organizations and individuals who contributed immensely to the success of the study. Technical assistance was provided by the MEASURE Evaluation project at the University of North Carolina at Chapel Hill, NC, USA (mainly in adaptation of the study instruments, field staff training and monitoring, cause of death coding, data tabulation, and analysis) and by the MEASURE DHS project at Macro International Inc. in Calverton MD, USA (mainly in identifying the child deaths from the 2006 UDHS dataset, budgeting and contracting, record matching, and analysis). The Uganda Ministry of Health assisted in the local adaptation of the international verbal autopsy questionnaires and also provided personnel for the death certification and ICD-10 coding component of the study.

Financial assistance was provided by the U.S. Agency for International Development (USAID).

We are grateful for the efforts of officials at the national and local levels of government who supported the survey. Finally, we highly appreciate all the field staff and, more importantly, the survey respondents, whose participation was critical to the successful completion of this survey.

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KEY FINDINGS FROM THE 2007 UGANDA CHILD VERBAL AUTOPSY STUDY

- The five leading causes of death in children under five years in Uganda are:
  - malaria (32 percent)
  - perinatal and early neonatal conditions (18 percent)
  - meningitis (10 percent)
  - pneumonia (8 percent), and
  - HIV/AIDS (6 percent).
- The overwhelming majority (77 percent) of deaths in the first month of life (neonatal deaths) are due to perinatal and early neonatal conditions.
- Among children age 29 days to 5 years, malaria is by far the major killer, accounting for 41 percent of deaths in this age group; meningitis (11 percent) and pneumonia (10 percent) are the second and third main causes of death.
- Almost half of children under five (49 percent) die at home, 39 percent die at health facilities, and the rest die in other places.
- Almost 80 percent of children under five who died received some form of treatment or care for the illness that led to death. Of these, 94 percent utilized formal health facilities including government and private hospitals and health centres.
- The vast majority of deaths to children under five are caused by diseases that are addressable through cost-effective prevention programmes, such as use of insecticide-treated bednets or childhood vaccinations.

1 INTRODUCTION

1.1 OVERVIEW AND OBJECTIVES

The objective of the 2007 Uganda Child Verbal Autopsy Study is to gather data about the causes of death of children under age five in Uganda, more specifically, to shed light on the proportion of deaths that are related to malaria. Since the vast majority of children in Uganda do not die in health facilities, information on causes of death established by health professionals on death certificates is almost nonexistent and therefore not representative of the country as a whole. This study is based on a reliable sample of deaths among children under five that was collected in the 2006 Uganda Demographic and Health Survey. Women who reported the death of a child in the three years (36 months) preceding the survey were revisited in this study. They and/or others in their household were interviewed with a verbal autopsy questionnaire designed to elicit the rough causes of death.

The study was implemented by the Uganda Bureau of Statistics (UBOS). Technical assistance was provided by the MEASURE Evaluation and MEASURE DHS projects. Funding for the local costs was provided through MEASURE DHS.

1.2 BACKGROUND ON MALARIA IN UGANDA

Malaria remains one of the most important diseases in Uganda with respect to the morbidity and mortality burden, as well as economic losses. Malaria ranks as the number one reported disease in Uganda, contributing 30-50 percent of the outpatient burden and 35 percent of hospital admissions (MOH, 2008). In most parts of Uganda, temperature and rainfall are sufficient to allow a stable, year-round (perennial) malaria transmission at high levels with relatively little seasonal variability. Malaria is highly endemic in 95 percent of the country; the remaining 5 percent consists of seasonally epidemic-prone transmission areas in the highlands of the southwest and midwest, and along the eastern border with Kenya and northeastern border with Sudan.

The peak incidence of clinical malaria follows the peak of the rains with a delay of 4-6 weeks. Most cases are seen from December to February and May to July except for the north, where the malaria season is more between May and November (MOH, 2008).

The most common vectors are *Anopheles gambiae s.l.* and *Anopheles funestus* with *A. gambiae* being the dominant species in most places. As for parasite types, all four human plasmodia species occur in Uganda but *Plasmodium falciparum* is by far the most common, responsible for 90 to 98 percent of all malaria cases. This parasite has shown increasing resistance to both chloroquine and sulfadoxine pyremethamine (SP) when used separately as single therapy and more recently as a combination drug (MOH, 2008).

The goal of malaria control in Uganda is to prevent malaria morbidity and mortality and to minimize the social effects and economic losses attributable to malaria. Uganda is also one of the first countries targeted by the President's Malaria Initiative (PMI), whose long-term goal is to reduce malaria mortality by 50 percent in about 15 African countries. To achieve this, the malaria control programme is scaling up a package of malaria control interventions, endeavour-

ing to attain high coverage and to promote positive behaviour change. The malaria component of the Minimum Health Care Package consists of the following elements: prevention and control measures through improved case management, vector control and personal protection from insect bites at the community and household levels—mainly through use of insecticide-treated mosquito nets and indoor residual spraying—selective chemoprophylaxis, intensified surveillance to help prevent and better manage epidemics, and monitoring the efficacy of existing antimalaria drugs (MOH, 1999). In 2002, a new strategy for home-based management of fevers was launched and in 2004, an Artemesinin-based combination (ACT) drug was introduced as the first line treatment regimen (MOH, [2005]). Specific targets are:

- To increase the proportion of pregnant women who have completed two doses of intermittent preventive treatment from 34 to 80 percent
- To increase the proportion of households with at least one insecticide-treated net from 15 to 70 percent
- To increase the proportion of targeted structures for indoor residual spraying in epidemic areas from 0 to 80 percent
- To increase the proportion of children under five getting correct treatment within 24 hours of onset of symptoms from 25 to 80 percent
- To reduce the case fatality rate among malaria in-patients under five from 4 to 2 percent (MOH, [2005]).

The main source of malaria data in Uganda is the routine morbidity case reports of the Health Management Information Systems (HMIS). After an increase in malaria cases reported by the HMIS in the late 1990s there was a decline in the next few years, perhaps because of the home-based management of fever strategy, which resulted in a shift from facility attendance towards community treatment. A malaria sentinel surveillance system has been established in Uganda and ten sites are currently operational. The sites collect data on malaria vectors, species, cases, parasite density, antimalaria drug use, and drug resistance.

1.3 Background on the 2006 Uganda Demographic and Health Survey

The 2006 Uganda Demographic and Health Survey (UDHS) was conducted by UBOS between May and October 2006 (UBOS and Macro International, 2007). It was designed to provide information on a wide array of demographic and health indicators in the country. Specifically, the UDHS collected information on fertility and fertility preferences, marriage, sexual activity, awareness and use of family planning methods, and breastfeeding practices. In addition, data were collected on the nutritional status of mothers and young children; infant, child, adult, and maternal mortality; maternal and child health; knowledge and behaviour regarding HIV/AIDS and other sexually transmitted infections; levels of anaemia and vitamin A deficiency; and gender-based violence.

A nationally representative sample of 8,531 women age 15-49 and 2,503 men age 15-54 were interviewed in the 2006 UDHS. This sample provides estimates of many important demographic and health indicators at the national and regional levels, and for rural and urban areas. Because of the large number of districts (80) in Uganda, the country was divided into nine

regions for purposes of analysis. Portions of the northern region were oversampled to provide estimates for two special areas of interest: Karamoja and internally displaced persons (IDP) camps. The sample involved selecting 321 primary sampling units (clusters) from those selected for the 2005-06 Uganda National Household Survey (UBOS, 2006), which had previously been selected from the 2002 census frame. To these were added 17 more clusters in Karamoja and 30 IDP camps, for a total of 368 clusters. Because of the disproportionate sample probabilities at the national level, the data are weighted.

As part of the 2006 UDHS, women age 15-49 who were interviewed were asked for a complete history of all their live births, including the month and year of birth, the sex, survival status, and if deceased, the age at death.

1.4 Organization and Methodology of the Study

1.4.1 Identification of Respondents

MEASURE DHS assisted UBOS in identifying the households with women who were interviewed in the 2006 UDHS and who reported that one or more of their children under five years died recently. Because the UDHS did not collect information on date of death for children who had died, this study is based on deaths occurring in the approximately three years (36 months) preceding the UDHS interview. The following algorithm was used to identify child deaths for follow-up:

> The criterion for children who died under 2 years of age is those whose date of birth plus age at death is less than 36 months before the date of the interview (because age at death for those under 2 is reported in days or months).
>
> The criterion for children who died at age 2-5, the reference period is if the date of birth plus age at death plus 12 months is within the 36 months preceding the interview. The 12 months is added because a child who was born, for example, 65 months before the date of interview and died at age 2 could have died before or after the cut-off date, depending on the exact age at death. By adding 12 months to the age at death the survey captures all deaths potentially in the reference period as well as some deaths that are not in the reference period and will have to be excluded at the household level with additional data on date of death. Thus, some children will need to be excluded from the study because their deaths were not in the reference period.

Using these criteria, the longest recall period (between date of death of the child and date of interview with the verbal autopsy questionnaire) was expected to be 46 months (if the earliest UDHS interview was in May 2006 and the verbal autopsy data collection took place in March 2007, then the maximum recall period is 36 + 10 = 46 months). At the time the questionnaires were developed, it was decided to include stillbirths in the study, so the records for women who reported having a pregnancy loss at more than 6 months of gestation within the 36 months preceding the UDHS interview were also included. DHS staff identified for follow-up 641 deaths among children under five and 83 stillbirths in about 283 of the 368 original clusters in the UDHS. A total of 724 child deaths and stillbirths were thus included in the sample death frame

for verbal autopsy interviews. However, analysis of the stillbirths was later dropped because of difficulty in categorizing causes of death.[1]

Using the above criteria, MEASURE DHS extracted the relevant data and made a list of the household identification information for all households with a child death. UBOS then manually located each of the UDHS questionnaires relating to the sample for the 2007 UCVAS and copied out the relevant information to locate the household again, namely: district, county, subcounty, parish, UDHS cluster number, structure number, household number, and the names of the head of the household, the mother of the deceased child, the name of the child, and the age at death of the child. UBOS also designed a fieldwork control form for noting the identification of the sampled households and the results of the visits of the verbal autopsy team.

1.4.2 Verbal Autopsy Questionnaires

The 2007 UCVAS adopted the recently revised core WHO questionnaire for neonatal and child deaths that is used to collect information on causes of death for children under five (WHO, 2007). After obtaining informed consent (see Appendix A), one of two questionnaires was used: one for children who died under 29 days of age (Appendix B) and the second for children who died at 29 days to 59 months of age (Appendix C). During a visit to Uganda, a MEASURE Evaluation verbal autopsy expert worked with UBOS staff and made the appropriate modifications to the core verbal autopsy questionnaires and manuals to fit the Uganda situation. The first questionnaire (for neonatal deaths) was modified to accommodate data on stillbirths. Adaptation of the verbal autopsy interviewer's manual was carried out and the document was sent to MEASURE Evaluation for the training manual to be finalized.

UBOS made arrangements to have the Uganda-specific verbal autopsy questions translated into the six major local languages: Ateso, Luganda, Lugbara, Luo, Runyankole-Rukiga, and Runyoro-Rutoro. The translated questionnaires were back-translated and reviewed by the various language teams during training.

1.4.3 Training and Data Collection

The study involved 12 teams of two interviewers each, with preference given to those who took part in the UDHS data collection. The teams were able to speak the local languages of the areas to which they were assigned. Extra interviewers were trained to allow for attrition.

Interviewer candidates were trained for 5 days (5-9 March) in Kampala on how to locate the households with child deaths in the reference period and how to administer the verbal autopsy questionnaires. The training was conducted in the form of lectures and discussions but was augmented by group work and extensive practical exercises. The training also included a video session on some of the common childhood illnesses documented by WHO for IMCI training for nurses. This was for purposes of getting a feel of some of the symptoms of childhood illnesses. The symptoms included bulging fontanelle, chest in-drawing, skin rash, etc. A field practice session was held with mothers who had lost a child under age five in the past three

[1] The verbal autopsy teams also collected data from a few households in which a child death had occurred after the UDHS interview. However, these deaths were not included in the analysis because they did not comprise a valid sample; they occurred only in households that already had a child death that was identified from the UDHS data.

years. These respondents were identified around Kampala. The teams visited 6 rural enumeration areas (EAs) in Ssisa subcounty, Wakiso district and 5 urban EAs in Kampala city.

After the training and field practice, discussions were held with trainees to review the content of the data collection tools, question by question. The main outcome was omission of certain questions and inconsistencies. It was also agreed that in the section on the respondent's account of the death, socioeconomic information and related comments would be included, such as "I was neglected by the facility staff and left to deliver alone". Finally, during the training, the teams reviewed the translated questionnaires to check the wording and make revisions where necessary.

In addition to senior staff from UBOS and the verbal autopsy expert from MEASURE Evaluation, UBOS collaborated with the Ministry of Health (MOH) and the Institute of Public Health (IPH), Makerere, in the training. The role of the MOH was to fill in gaps and give a real picture of the situation on the ground in Uganda, while the IPH staff shared their experience with using verbal autopsies in a similar study (Demographic Sentinel Surveillance) in Iganga and Mayuge districts.

Data collection for the 2007 UCVAS started on 15 March and was completed about 7 April 2007. Teams carried the list of households with child deaths as well as the relevant 2006 UDHS women's questionnaires for further identification. As part of the data quality checks, interviewers exchanged questionnaires at the end of the day to check for inconsistencies. Teams were periodically supervised by senior UBOS staff.

1.4.4 Cause of Death Certification and Coding

Criteria for selection of doctors to review the verbal autopsies and certify the cause of death included a non-specialized medical degree (i.e., general practitioner, not a specialist) and the ability to attend the two weeks allocated for training on certification and coding of the verbal autopsy forms. Most doctors selected were from the Ministry of Health or Mulago National Hospital. Experience with cause of death coding was not a prerequisite for being recruited, and although most of the doctors selected had considerable experience in writing death certificates, none had prior training on the WHO International Classification of Diseases (ICD). The 2007 UCVAS cause of death training was thus a capacity-building exercise.

The training was conducted by the MEASURE Evaluation verbal autopsy expert. A senior UBOS official was in attendance during the training. Training consisted of theoretical classes on the verbal autopsy, background on the survey, ICD cause of death certification, and ICD-10 coding according to the SAVVY/WHO manuals and ICD-10 volumes 1, 2 and 3 (2nd edition), which had been provided by MEASURE DHS (WHO, 2005; WHO, 2007). Theory was augmented with practical work using verbal autopsy forms collected during the fieldwork.

Each physician independently produced an international cause of death certificate (Appendix D) and ICD-10 code for each reported cause. A second physician reviewed a similar set of verbal autopsy forms and produced a second death certificate and corresponding ICD-10 code. Most death certificates had one cause of death; a few had more than one cause of death—usually two.

1.4.5 Data Management

Data management posed considerable challenges for the study. Data entry and management was done by UBOS staff using the CSPro software program. The original plan was for data entry screens to be prepared to guide the ICD coding process to allow for each verbal autopsy questionnaire to be assigned to two trained certification and ICD coders for independent certification and coding as detailed in the SAVVY data processing guide. The guide calls for a data processor to key in both death certificates that are associated with a single verbal autopsy questionnaire, one directly after the other. Once both death certificates have been verified for keying inconsistencies, the cases that require reconciliation are to be sent back to the original two certifier/coders. The two certifier/coders must discuss the case until a final death certificate can be agreed on, so that each line on the reference death certificate will have one and only one cause of death and only one ICD code entered in the database.

However, there was inadequate support to allow for this aspect of the project. UBOS was only provided with programs for entering the verbal autopsy questionnaires and had to design a data capture screen for entering the death certificate information. The coders manually compared their respective death certificates. In cases in which the death certificates had discordant ICD codes, a third consensus death certificate was written and entered into the database.

A sample of the verbal autopsy forms and their respective death certificates and ICD codes were periodically reviewed by the ICD trainer who provided feedback each day to the doctors on any errors, with appropriate guidance and instructions. Some common problems were:

- Disregard of pregnancy-related events and instead coding “foetal death of unspecified cause”;
- Prematurity entered as the underlying cause of death in the presence of other conditions of the infant or foetus;
- Difficulty of establishing whether diarrhoea was of infectious or noninfectious origin;
- Wrong sequence of death events or underlying cause of death;
- Inattention to the duration of a symptom, resulting in an incorrect sequence of death events entered on the death certificate.

After all cause of death coding was completed, UBOS staff prepared data files and sent them to MEASURE Evaluation and MEASURE DHS. Considerable effort was expended by staff at both projects in trying to match the death certificate files to the verbal autopsy questionnaire files, and in turn to the 2006 UDHS dataset. Weights were then added to the file and MEASURE Evaluation produced tabulations and figures. Causes of death were collapsed into broad categories for tabulation purposes (see Appendix E).

1.5 LIMITATIONS OF THE DATA

Retrospective birth histories such as those included in the 2006 UDHS are susceptible to data collection errors. First, only surviving women age 15-49 are interviewed; therefore, no data are available for children whose mothers died. Consequently, childhood mortality estimates will be biased if the child mortality of surviving and non-surviving women differs substantially. This bias increases for rates estimated for periods farther back in time because more time will have passed between the birth and the date of the survey, thus allowing more time for the mothers to have died. However, analyses using UDHS data have shown that this bias is small and has negligible impact on the overall childhood mortality estimates in Uganda, especially for childhood mortality estimates for the five-year period before the survey. Another possible error in data collection is associated with underreporting of events (births and deaths), which can lead to underestimation of childhood mortality. Underreporting is more likely to affect early infant deaths that occur farther back in time from the date of the survey, and is unlikely to affect recent death reporting.

There was some evidence of shifting of births reported in the 2006 UDHS from calendar year 2001 to 2000, presumably because interviewers could thus avoid having to fill out the lengthy sections with questions about children under age five (UBOS and Macro International, 2007). This shifting of births would have little effect on the verbal autopsy study, however, because the study is focused on deaths occurring closer to the interview date. It should also be noted that any flaws in the data on deaths selected from the 2006 UDHS would not be expected to have any appreciable impact on the analysis of causes of death unless the bias was related to specific causes of death.

Verbal autopsy data are affected by recall effects. Presumably, difficulty in recalling the circumstances leading to the death of a child increases with the length of time since the child's death. This study is based on deaths that occurred during the 36-month period preceding the 2006 UDHS interview, or 5-46 months preceding the verbal autopsy interview. Another issue with verbal autopsy data is the ability to identify and code the correct cause of death based on signs and symptoms reported by family members. The verbal autopsy respondent may not have been with the child prior to death and thus not be aware of the child's symptoms. For these reasons, readers of this report should view the study results with appropriate caution.

1.6 RESPONSE RATES

Using the criteria described above, a total of 641 deaths among children under five were identified from the 2006 UDHS data file. In part because the implementation of the 2007 UCVAS took place 5-11 months after the 2006 UDHS interview, it was not possible to interview the mothers of all the eligible deaths that were identified from the 2006 UDHS questionnaires. Table 1 shows information about the results of the 2007 UCVAS interviews. Verbal autopsies were completed for 86 percent of the deaths. The main reasons for not completing a verbal autopsy interview were that the index household had moved away and that the verbal autopsy interview team determined that the death was ineligible.

Of the 554 completed verbal autopsy questionnaires reviewed by the medical doctors for death certification and ICD coding, an additional 13 deaths that were reported in the UDHS as having been born alive and later died were determined by the medical doctors to have been stillbirths. Therefore, they were excluded from the analysis involving live births. A total of 541 child deaths with complete information on causes of deaths were included in the analysis for this report.

Table 1. Results of verbal autopsy

Percent distribution of eligible deaths by outcome of the verbal autopsy (VA) interview (unweighted), Uganda 2007

Outcome	Percentage
VA completed	86.4
VA not completed	13.6
Household moved	3.9
Ineligible death[1]	3.6
Not a resident	1.7
Respondent away	1.6
Security reasons	0.8
Child not dead	0.3
House vacant	0.2
No reason given	1.6
Total	100.0
Number	641

[1] In the UCVAS, one death was reported as an abortion, another was reported as being outside the age range, while the remainder were reported as "Not eligible".

2 STUDY RESULTS

2.1 DISTRIBUTION OF DEATHS BY CHARACTERISTICS

Table 2 shows the weighted distribution of the deaths analysed. Just over one-fifth (120) of the under-five deaths were among children who died in the first four weeks of life. Reflecting the predominantly rural nature of Uganda, only 10 percent of the deaths occurred among children in urban areas. Over two-thirds of child deaths were among children of mothers who had only primary education. About half of all neonatal, postneonatal, and malaria deaths occurred among children of women in age group 20-29. Deaths are fairly evenly divided by wealth tercile, though fewer fall in the highest tercile. Over half of all deaths under age five were among male children (55 percent), with the proportion being even higher for neonatal deaths (64 percent). Over half of all child deaths reported during the study period occurred under the age of one year (58 percent).

Table 2. Percent distribution of neonatal, postneonatal/child, and all under-five deaths by background characteristics, Uganda 2007

Background characteristic	Neonatal deaths (0-28 days)	Post-neonatal/ child deaths (29 days-4 years)	All deaths under five years
Residence			
Urban	8.6	10.1	9.8
Rural	91.4	89.9	90.2
Mother's education			
No education	21.6	23.0	22.7
Primary	67.2	66.0	66.3
Secondary +	11.2	11.0	11.0
Wealth tercile			
Lowest	37.8	35.7	36.1
Middle	32.7	40.9	39.1
Highest	29.6	23.5	24.8
Mother's age at birth			
<20	8.3	3.8	4.8
20-29	48.6	51.1	50.6
30-39	35.3	35.1	35.1
40-49	7.7	10.0	9.5
Sex of child			
Male	63.6	52.6	55.1
Female	36.4	47.4	44.9
Child's age at death			
0 years	100.0	46.5	58.5
1 year	na	28.9	22.4
2 years	na	12.9	10.0
3 years	na	8.0	6.2
4 years	na	3.7	2.9
Total	100.0	100.0	100.0
Number[1]	120	409	529

[1] For variables based on the 2006 UDHS data (e.g., mother's education, wealth status), the number of cases is somewhat lower because of missing information for cases in which the verbal autopsy and UDHS records could not be matched.
na = Not applicable

2.2 CAUSES OF DEATH AMONG CHILDREN UNDER FIVE

As shown in Table 3 and Figure 1, malaria is the most common cause of death among children under five in Uganda, accounting for just under one-third of the under-five deaths. The next most common cause of death is perinatal and early neonatal conditions (18 percent of under-five deaths), followed by severe infections including meningitis and pneumonia, accounting for about 18 percent of under-five deaths. HIV/AIDS is among the top killers of children under five, accounting for about 6 percent of the under-five mortality burden in Uganda. The proportion of under-five deaths from malnutrition (5 percent) is only slightly higher than the proportion caused by diarrhoea and other intestinal infections (4 percent). The "all other diseases" category comprises conditions such as skin diseases (about 2 percent of the total mortality burden), septicaemia (1 percent), other congenital malformations such as heart and limbs (1 percent), other diseases not elsewhere classified (4 percent), and ill-defined and unspecified conditions (1 percent).

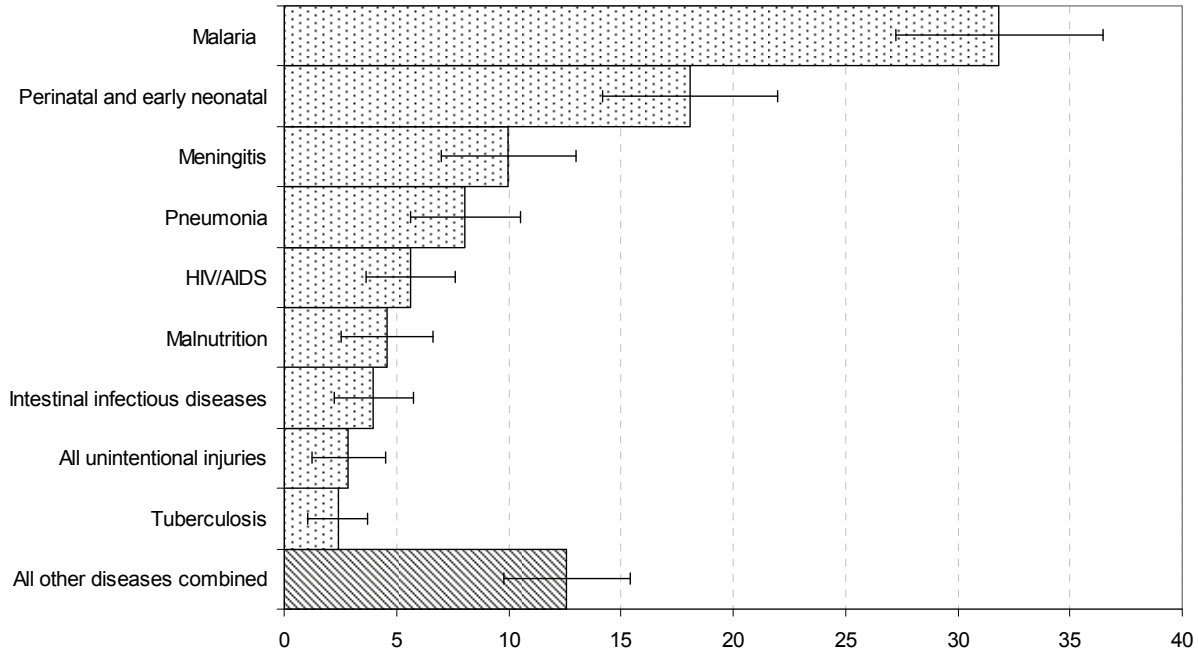
Table 3. Causes of death among children under five

Percent distribution of deaths among children under five years by cause (weighted), Uganda 2007

Cause of death	Percentage	95% confidence limits	
		Lower	Upper
Malaria	31.9	27.3	36.5
Perinatal and early neonatal conditions	18.1	14.2	22.0
Meningitis	10.0	7.0	13.0
Pneumonia	8.1	5.6	10.5
HIV/AIDS	5.6	3.6	7.6
Malnutrition	4.6	2.5	6.6
Intestinal infectious diseases/diarrhoea	4.0	2.2	5.8
Unintentional injuries	2.9	1.3	4.5
Tuberculosis	2.4	1.0	3.7
Measles	0.9	0.2	1.6
Tetanus	0.9	0.0	2.0
Kidney disorders	0.5	0.0	1.2
Viral hepatitis	0.4	0.0	1.0
Malignant neoplasms	0.1	0.0	0.4
Cerebrovascular diseases	0.1	0.0	0.4
Congenital malformations of the central nervous system	0.1	0.0	0.2
All other diseases[1]	9.5	6.6	12.3
Total	100.0	na	na
Number	529	na	na

[1] Includes skin diseases (1.8%), septicaemia (1.2%), other congenital malformations (1.2%), ill-defined and unspecified causes (1.0%), and all other causes combined (4.3%)
na = Not applicable

Figure 1 Ten Most Common Causes of Death among Children Under Five Years, Uganda 2007



Note: Error bars show the 95% confidence intervals around the proportions

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2.3 CAUSES OF DEATH AMONG NEWBORNS

The riskiest period of life occurs immediately after birth. As documented in the 2006 UDHS, for the period 1-5 years preceding the survey, the neonatal mortality rate was 29 deaths in the first month of life per 1,000 births, compared with a rate of 46 deaths per 1,000 from age 1-11 months (postneonatal mortality rate). The under-five mortality rate was 137 deaths per 1,000 live births (UBOS and Macro International, 2007). Thus, in Uganda, about one-fifth of all deaths to children under five occur in the first month of life. In the 2007 UCVAS, deaths in the neonatal period (i.e., the first 28 days of life) were followed up using the questionnaire specifically designed for this age group (see Appendix B).

As shown in Table 4, perinatal and early neonatal conditions account for over three-quarters of deaths during the first month of life (neonatal period). The next most common cause of neonatal deaths is meningitis (8 percent of neonatal deaths), followed by tetanus (4 percent). At this young age, malaria accounts for only 1 percent of all deaths, slightly more than pneumonia (<1 percent) and unintentional injuries and accidents (<1 percent).

Table 4. Causes of neonatal deaths

Percent distribution of deaths among infants age 0-28 days by cause of death (weighted), Uganda 2007

Cause of death	Percentage	95% confidence limits	
		Lower	Upper
Perinatal and early neonatal conditions	77.4	68.8	86.0
Meningitis	8.4	2.2	14.5
Tetanus	4.0	0.0	8.8
Malaria	1.0	0.0	2.9
Pneumonia	0.8	0.0	2.0
Unintentional injuries	0.8	0.0	2.5
Congenital malformations of the central nervous system	0.3	0.0	1.0
All other diseases	7.4	2.4	12.4
Total	100.0	na	na
Number	120	na	na

All other diseases together account for 7 percent of all neonatal deaths and include the following conditions: skin diseases (1.7 percent), other congenital malformations (2.1 percent), undetermined causes (1.5 percent), and other causes not elsewhere classified (2.1 percent).

2.4 CAUSES OF DEATH AMONG CHILDREN AGE ONE MONTH TO UNDER FIVE YEARS

A second verbal autopsy questionnaire (Appendix C) was used to gather information on symptoms and conditions leading to the death of children age 29 days to five years. The causes of deaths among these children are presented in Table 5.

Table 5. Causes of postneonatal and child deaths

Percent distribution of deaths among children age 29 days to five years by cause of death (weighted), Uganda 2007

Cause of death	Percentage	95% confidence limits	
		Lower	Upper
Malaria	40.9	35.4	46.4
Meningitis	10.5	7.0	14.0
Pneumonia	10.2	7.2	13.2
HIV/AIDS	7.3	4.7	9.8
Malnutrition	5.9	3.3	8.5
Intestinal infectious diseases/ diarrhoea	5.2	2.9	7.4
Unintentional injuries	3.5	1.4	5.5
Tuberculosis	3.1	1.3	4.9
Measles	1.2	0.3	2.1
Conditions originating from neonatal period	0.7	0.0	1.5
Kidney disorders	0.7	0.0	1.5
Viral hepatitis	0.5	0.0	1.3
Malignant neoplasms	0.2	0.0	0.5
Cerebrovascular diseases	0.2	0.0	0.5
All other diseases	10.1	6.6	13.5
Total	100.0	na	na
Number	409	na	na

[1] Includes skin disease (1.6%), septicaemia (1.5%), other congenital malformations (0.9%), and undetermined causes (0.8%), and all other causes combined (5.3%).
na = Not applicable

For this age group of children in Uganda, malaria is by far the leading cause of death, accounting for 41 percent of deaths to children age one month to five years. Meningitis, pneumonia, HIV/AIDS, malnutrition, and diarrhoeal diseases each account for 5-10 percent of deaths in this age group. Injuries account for 4 percent of deaths, while tuberculosis accounts for 3 percent of deaths.

2.5 PLACE OF DEATH

Figure 2 shows the percent distribution of deaths among children under five by the place of death. Table 6 shows the same data by background characteristics, including urban-rural residence, mother's education, household wealth, mother's age at birth, sex of the child, and age at death of a child.

Almost half (49 percent) of deaths among children under five occur at home, while almost 40 percent occur at a hospital or other health facility and 9 percent take place elsewhere. As shown in Table 6, there are large differences in place of death by background characteristics. For example, the proportion of deaths to children under five that occur at home is twice as high in rural areas than urban areas (52 and 23 percent, respectively). The proportion of deaths occurring at home declines as education of the mother and wealth of the mother increase. Differences in place of death by mother's age at the time of the birth and by sex of the child are not large. Interpreting variations in the place of birth by the age of the child at the time of death are hampered by the small number of cases.

Figure 2 Place of Death for All Deaths among Children Under Five Years

Table 6. Percent distribution of deaths among children under five by place of death, according to background characteristics, Uganda 2007

Background characteristic	Place of death					Total	Number
	Hospital	Other health facility	Home	Other place	Unknown		
Residence							
Urban	(57.2)	(11.7)	(22.7)	(3.2)	(5.3)	100.0	46
Rural	25.6	11.6	51.8	8.9	2.3	100.0	417
Mother's education							
No education	31.0	9.3	54.9	3.3	1.5	100.0	105
Primary	25.4	12.5	49.7	10.2	2.3	100.0	306
Secondary +	(43.4)	(11.3)	(32.1)	(7.1)	(6.1)	100.0	53
Wealth tercile							
Lowest	24.0	10.7	55.7	7.5	2.1	100.0	164
Middle	27.6	11.6	49.1	9.8	2.0	100.0	183
Highest	36.8	12.9	39.0	7.1	4.2	100.0	115
Mother's age at birth							
<30	29.6	13.2	43.2	10.1	3.9	100.0	257
30-39	27.9	8.8	58.3	3.9	1.2	100.0	163
40-49	(26.5)	(11.8)	(47.6)	(14.1)	(0.0)	100.0	43
Sex of child							
Male	26.4	13.9	48.6	8.7	2.4	100.0	279
Female	29.3	8.6	49.2	10.4	2.5	100.0	225
Child's age at death							
0 years	30.8	11.8	47.0	8.1	2.3	100.0	297
1 year	19.4	11.3	53.2	12.5	3.5	100.0	112
2 years	30.2	5.7	46.0	15.2	2.9	100.0	52
3-4 years	(29.3)	(16.3)	(50.9)	(3.5)	(0.0)	100.0	46
Total	27.8	11.4	48.8	9.3	2.8	100.0	513

Note: Total includes 50 cases with information missing for variables taken from the UDHS women's questionnaire (e.g., residence, mother's education, wealth status, and mother's age at birth). Figures in parentheses are based on 25-49 unweighted deaths.

2.6 CAUSE-SPECIFIC MORTALITY RATES

One way to analyse cause of death data is to calculate cause-specific mortality rates. The simplest way to do this is to multiply the percentages of children under five who die of each of the major causes (see Table 3) by the under-five mortality rate from the 2006 UDHS. Since the UCVAS was based on deaths to children under five that occurred in the two years prior to the 2006 UDHS, mortality rates were calculated for this period (Table 7). However, mortality rates for such a short period of time are imprecise and have relatively wide confidence intervals. For that reason, Table 7 also shows the childhood mortality rates for the period 1-5 years before the UDHS that were presented in the final report (UBOS and Macro International, 2007).[2] Rates for the three years before the UDHS are all lower than those for the period 1-5 years before the

[2] The 2006 UDHS data showed evidence of a serious shift in the reporting of births from calendar year 2001 to 2000. Most probably, this occurred because some interviewers transferred births out of the period for which child health data were collected, to reduce the length of the interview. To minimize the effect of this shifting of births, childhood mortality rates were presented for the period 1-5 years before the survey instead of the more common 0-4 years before the survey.

survey. This could be due to a decline in mortality over time and/or possible selective omission and/or transference of the births of children who died.

Table 7. Neonatal, postneonatal, infant, child, and under-five mortality rates for the periods 0-2 years and 1-5 years preceding the 2006 UDHS, Uganda 2006

Period preceding the survey	Neonatal mortality (NN)	Post-neonatal mortality (PNN)	Infant mortality ($_1q_0$)	Child mortality ($_4q_1$)	Under-five mortality ($_5q_0$)
0-2 years	26	43	68	54	118
1-5 years	29	46	76	67	137

Note: **Neonatal mortality** = the probability of dying within the first month of life; **Postneonatal mortality** = the difference between infant and neonatal mortality; **Infant mortality** = the probability of dying before the first birthday; **Child mortality** = the probability of dying between the first and fifth birthday; **Under-five mortality** = the probability of dying between birth and fifth birthday. All rates are expressed per 1,000 live births, except for child mortality, which is expressed per 1,000 children surviving to 12 months of age.

Source: 0-2 years (special tabulation of 2006 UDHS data); 1-5 years (UBOS and Macro International, 2007)

The cause-specific under-five mortality rates obtained from multiplying the under-five mortality rate for the 0-2 years before the UDHS by the percent distribution of cause of death given in Table 3 are shown in Table 8. They reflect the prominence of malaria in childhood mortality that was previously mentioned; almost four children in 100 die of malaria before reaching age five.

Table 8. Cause-specific under-five mortality rates,[1] Uganda 2007

Cause of death	Rate per 1,000
Malaria	37.6
Perinatal and early neonatal conditions	21.3
Meningitis	11.8
Pneumonia	9.5
HIV/AIDS	6.6
Malnutrition	5.4
Intestinal infectious diseases/diarrhoea	4.7
Unintentional injuries	3.4
Tuberculosis	2.8
Measles	1.1
Tetanus	1.1
All other diseases	12.7
All causes	118.0

[1] Cause-specific mortality rates were calculated by multiplying the under-five mortality rate calculated from the UDHS 2006 for the period 0-2 years before the survey to the cause-specific percentages from the 2007 UCVAS given in Table 3.

2.7 HEALTH SERVICE USE IN THE PERIOD LEADING TO DEATH

This section summarizes findings on the use of health services and facilities by children in the period leading to death in Uganda. During the verbal autopsy interviews with the mother or other family member of the child who died, in addition to questions on symptoms and signs of terminal illness, questions were also asked about treatment and medical care sought prior to death of the child. It is important to note that this section deals only with treatment behaviour for children who died and does not reflect the treatment of children who were ill but who survived. A thorough investigation of the effect of treatment would require analysis of health service utilization for both living and dead children, controlling for possible confounding variables and taking into account the timing of treatment relative to the onset of symptoms.

Figure 3 shows that about 80 percent of children who died under age five received some type of treatment for the illness that led to death.

Figure 3 Percent Distribution of Deaths among Children Under Five by Whether They Received Treatment for the Illness that Preceded Death

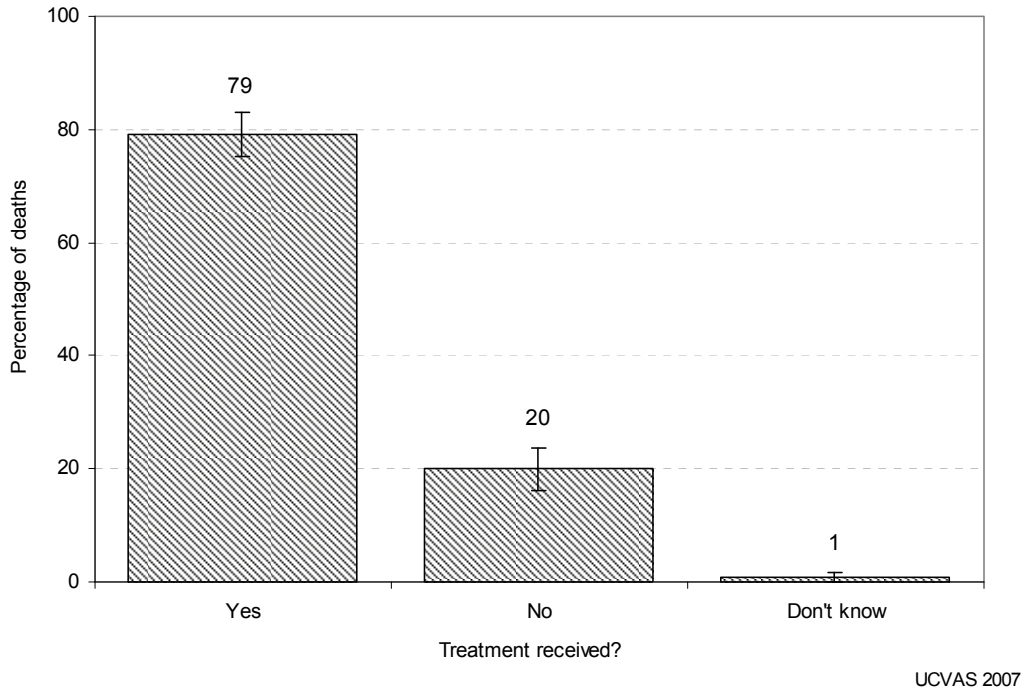
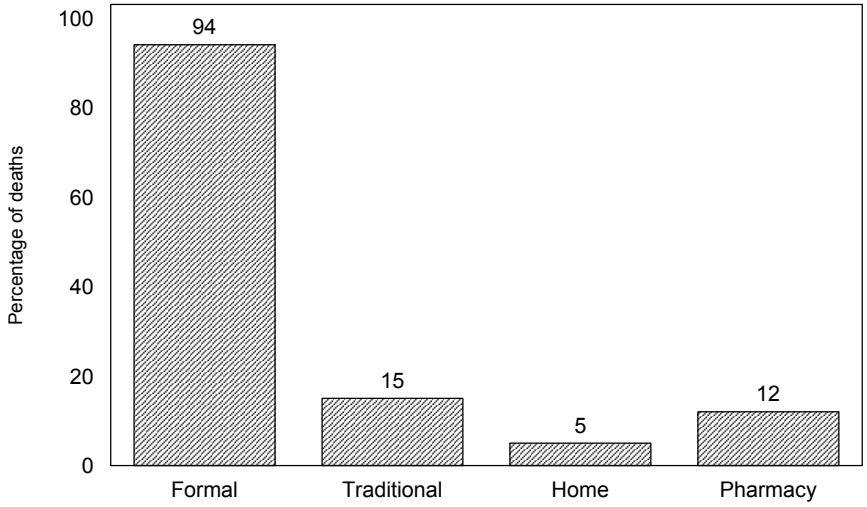


Figure 4 shows the types of places or facilities where treatment was sought for children whose parents/caregivers said they received some form of treatment during the illness leading to death. The results show that almost all children who died (94 percent) were taken to a formal health service (hospital, health centre, or health clinic) at some point during the illness leading to death. Fifteen percent of children were taken to traditional healers or herbalists at some point during their illness, 5 percent were given home remedies, and 12 percent were given medications purchased from local pharmacies or drug stores.

Figure 4 Source of Treatment before Death for Children Under Five Who Died



Note: Proportions sum to more than 100 percent because a child may have been taken to more than one place. Formal refers to health facilities. Pharmacy includes drug stores.

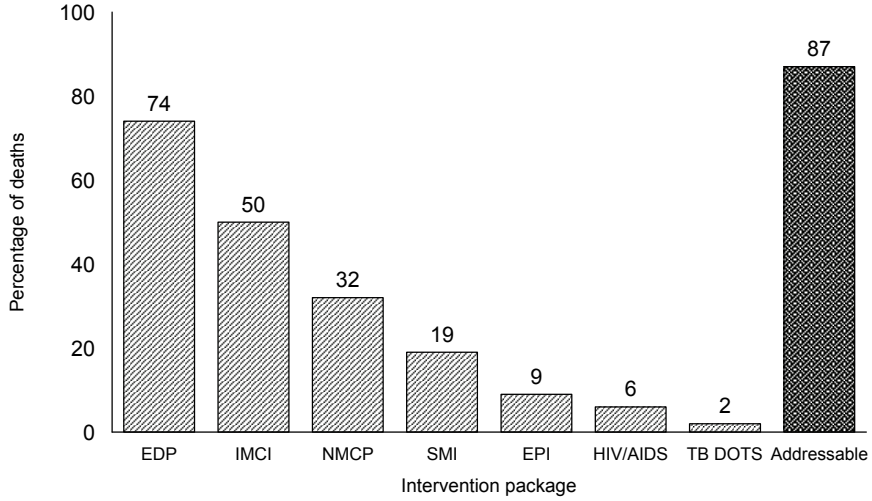
UCVAS 2007

2.8 INTERVENTION-ADDRESSABLE MORTALITY BURDEN IN CHILDREN UNDER FIVE

This section summarizes the mortality burden shares that are addressable by various existing and cost-effective health intervention programmes. The proportion of under-five deaths that could have been addressable and perhaps prevented are shown for the following programmes: the Essential Drugs Programme (EDP) kits, Integrated Management of Childhood Illnesses (IMCI), Safe Motherhood Initiative (SMI), Tuberculosis Directly Observed Treatment (TB DOTS), programmes for the prevention and treatment of HIV/AIDS and other sexually transmitted infections, the Expanded Programme on Immunization (EPI), and programmes for the prevention of transmission of malaria that are promoted by the National Malaria Control Programme (NMCP).

Figure 5 shows the proportion of the under-five mortality burden that could potentially be addressed by various health intervention packages. Here, the mortality burden is measured in terms of proportional mortality. The grouping of causes of deaths to various intervention addressable programmes is based on the assumption that these intervention programmes are available in Uganda, or could be made available at national and/or district level. Almost 90 percent of all deaths among children under five could potentially be addressed by various health intervention packages.

Figure 5 Percentage of Under-Five Deaths Addressable by Various Health Interventions



EDP=Essential Drug Programme; IMCI=Integrated Management of Childhood Illnesses;
NMCP=National Malaria Control Programme; SMI=Safe Motherhood Initiative;
EPI=Expanded Programme on Immunization; TBDOTS=Directly Observed Therapy for TB

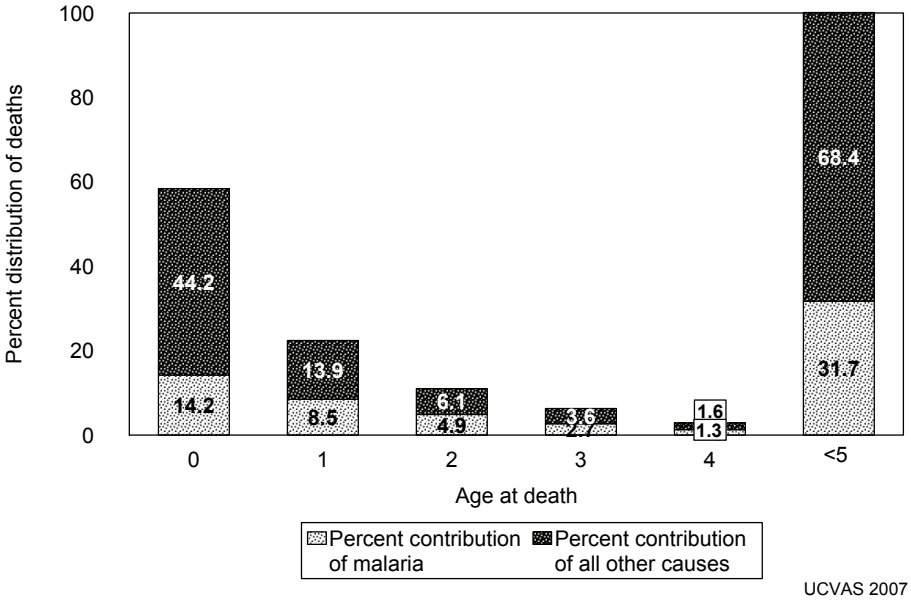
UCVAS 2007

3 BURDEN OF MALARIA MORTALITY AMONG CHILDREN

3.1 MALARIA MORTALITY

Malaria is the leading cause of illness and deaths in Uganda, especially among children under five years. Figure 6 shows the distribution of under-five deaths by age at death in years, and the relative contribution of malaria and all other causes to mortality at each age. As mentioned in Section 2.2, malaria accounts for 32 percent of all deaths in children under five in Uganda. The graph also shows that almost 60 percent of all deaths under five occur in the first year of life. Malaria accounts for a relatively smaller proportion of deaths at age 0 than at age 2, for example—where the proportion of deaths due to malaria and all other causes are almost equal. However, because of the higher overall mortality level at age 0, malaria-related prevention measures should still be focused on infants. This is more obvious in Figure 7, which shows that 45 percent of all malaria deaths under age five occur in the first year of life (0 years), while 27 percent occur at age 1 year.

Figure 6 Percent Distribution of Deaths among Children under Five by Age at Death and Proportional Contribution of Malaria to Mortality



Data presented in the main report on the 2006 UDHS show large differentials in childhood mortality by household wealth status of the mother, with a steady decline in mortality rates as mother's wealth quintile increases (UBOS and Macro International, 2007). To examine differences in malaria mortality by wealth status in the UCVAS data, deaths were categorized into wealth terciles (thirds), instead of quintiles (fifths) because the reference period was only a three-year period instead of the 10-year period used in the UDHS analysis.

Figure 7 Percent Distribution of Malaria Deaths among Children under Five by Age at Death

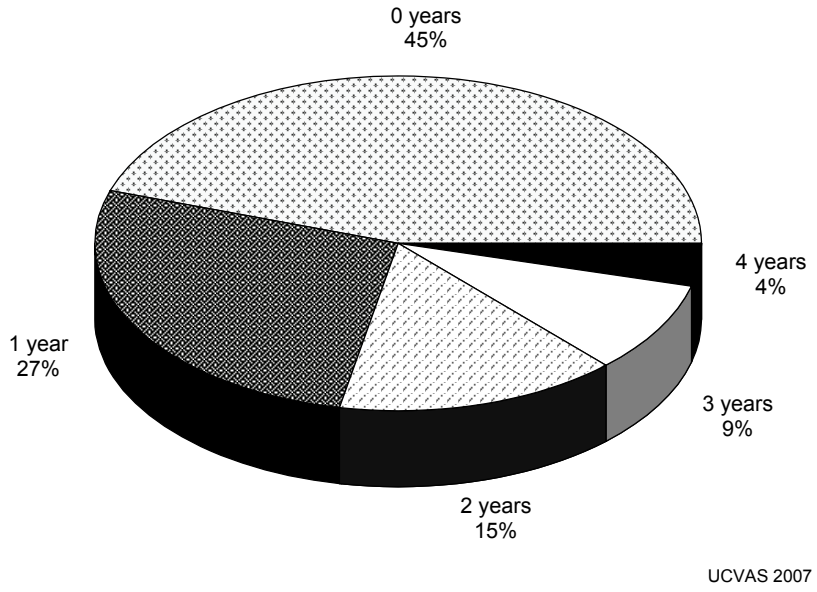


Table 9 and Figure 8 show the proportion of deaths due to malaria across wealth terciles. There is little difference by wealth in the proportion of deaths to children under five that are caused by malaria. Malaria causes 28 percent of deaths in the lowest tercile, 36 percent of those in the middle tercile and 33 percent of those in the highest tercile.

Table 9. Percent distribution of malaria and nonmalaria deaths among children under five, according to wealth tercile, Uganda 2007

Wealth tercile	Non-malaria death	Malaria death	Total	Number of deaths
Lowest	72.1	27.9	100.0	172
Middle	64.0	36.0	100.0	186
Highest	66.9	33.1	100.0	118
All deaths	67.5	32.3	100.0	477

Note: Table is based only on deaths that could be linked to the mother's record in the UDHS data file.

Figure 8 Percent Distribution of Malaria and Nonmalaria Deaths among Children under Five, by Wealth Tercile

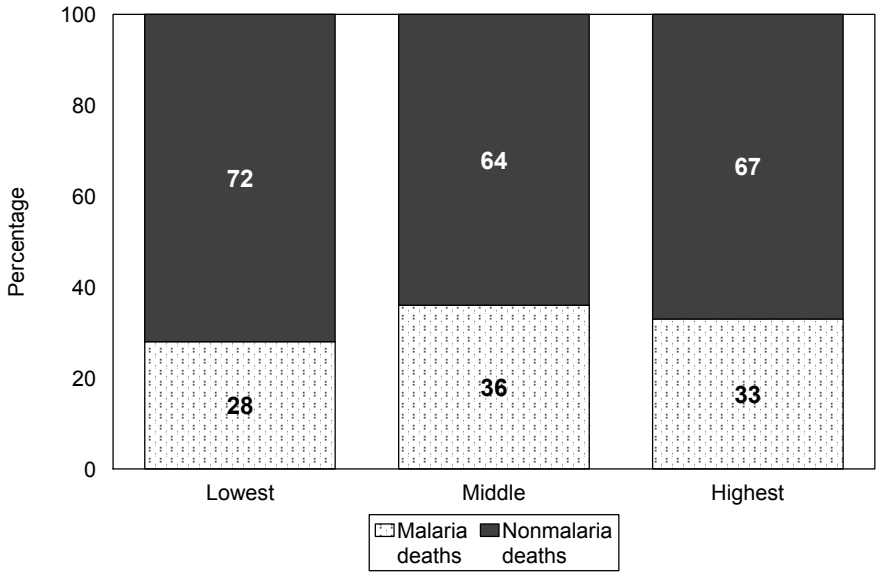
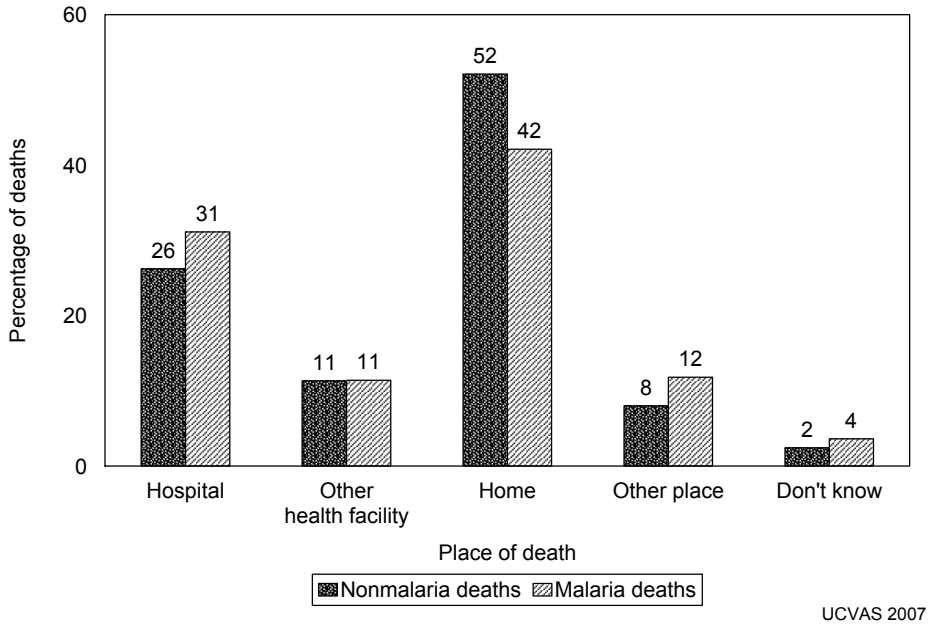


Figure 9 shows a comparison of deaths due to malaria versus deaths from all other causes (nonmalaria deaths) by place of death. It shows that nonmalaria deaths are more likely to occur at home, while deaths from malaria are slightly more likely to take place at a hospital. Differences are not large, however.

Figure 9 Distribution of Malaria and Nonmalaria Deaths among Children under Five by Place of Death



3.2 HEALTH SERVICE USE IN THE PERIOD LEADING TO DEATH DUE TO MALARIA

Deaths due to malaria can be prevented by prompt treatment with the appropriate medicines. Figure 10 shows the proportion of children who received treatment at some point during the illness that preceded their death. Data are shown separately for deaths due to malaria and deaths due to other causes. Over 90 percent of children who died from malaria received some form of treatment, be it formal or informal, during the illness that preceded their death. In comparison, only about three-quarters of children who died from causes other than malaria received treatment during their illness.

Figure 10 Percentage of Children under Five Who Received Treatment Before Death, by Whether Nonmalaria or Malaria Cause of Death

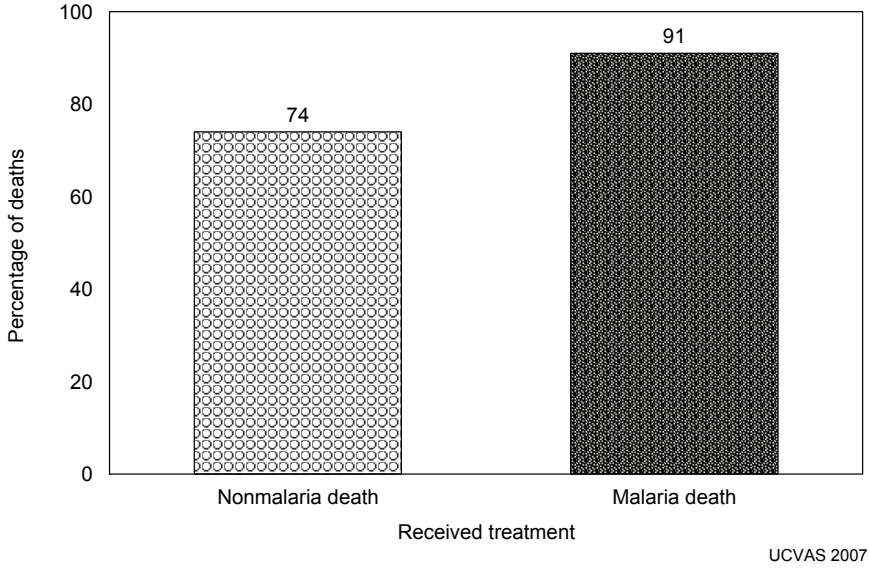
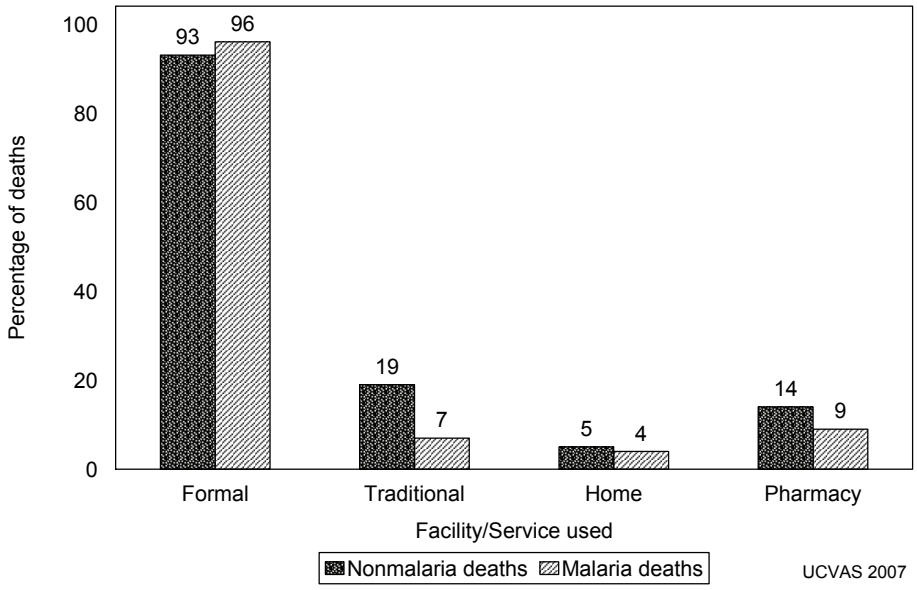


Figure 11 shows the types of places or facilities where children received treatment at some point during the illness preceding their death. The graph shows comparison between children who died from malaria and those who died from causes other than malaria.

Among children who died from malaria and who received treatment prior to death, almost all (96 percent) were taken to formal health facilities—government or private hospitals and/or health centres. Only 7 percent of children who died from malaria were taken to traditional healers or herbalists for treatment, compared with 19 percent of those who died from nonmalaria causes and were taken for treatment.

Figure 11 Source of Treatment Before Death for Deaths among Children under Five by Whether Nonmalaria or Malaria Cause of Death



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APPENDIX A - UGANDA CHILD VERBAL AUTOPSY STUDY CONSENT STATEMENT

UGANDA CHILD MORTALITY SURVEY

VERBAL AUTOPSY QUESTIONNAIRE

INTRODUCTION AND CONSENT STATEMENT

My name is [***mention your name***]. I am a [***nurse in our district's health centre, etc***] and a verbal autopsy interviewer with UBOS. One of your village leaders, [***say village guide's name***] has helped me locate your household. During the national DHS survey, this household indicated that a death occurred in the past 36 months. I am very sorry to hear that a member of your household has passed away. Please accept my sympathies. For the purpose of improving health care provision in our district and country as a whole, we are collecting information on all recent deaths in this area.

This survey is called the Post-DHS Mortality Survey. I would like to talk to you and ask you some questions about the history of events and any symptoms that [***mention the deceased's name***] had during illness before death.

At this time, do you want to ask me anything about the survey? May I begin the interview now?

(Respondent must verbally consent to interview before interviewer can proceed)

APPENDIX B - UGANDA VERBAL AUTOPSY FORM 1:
DEATH OF CHILD UNDER 29 DAYS

Relationship of the respondent to the deceased	1- Mother 2- Father 3- Grandmother 4- Grandfather 5-Aunt 6-Uncle 7-Other relative [specify]_____ _____ 8-No relation
Did you live with the deceased in the period leading to death?	1-Yes 2-No
Name of deceased	

Sex	**Date of birth**		
	Day	Month	Year
1-Male 2-Female			

Place of death	1-Hospital 2-Other health facility 3-Home 4-Other [specify]_____ 9-Don't know		
Date of death	Day	Month	Year

Residential status

The deceased was…

1 - Resident in the enumeration area
2 - Body brought home for burial
3 - Home-coming sick

What do you think was the cause of death? (Write exactly as the respondent tells you.)
Respondent's account of illness/events leading to death

PREGNANCY HISTORY	
1. How many births did the mother have before this baby?	number
2. How many months was the pregnancy when the baby was born?	months
3. Did the pregnancy end earlier than expected?	1-yes 2-no 9-don't know
3.1. If yes to 3, how many weeks before the expected date of delivery?	----------Months ----------Weeks
4. During the pregnancy, did the mother suffer from any of the following known illnesses? (READ OUT RESPONSES AND CIRCLE ALL MENTIONED)	1-high blood pressure 2-heart disease 3-diabetes 4-epilepsyor convulsion 5-HIV/AIDS 6-Syphilis 7-TB 8-Sickle cell 9-other [specify] _____
5. During the last 3 months of pregnancy, did the mother suffer from any of the following illnesses? (CIRCLE ALL MENTIONED)	1-vaginal bleeding 2-smelly vaginal discharge 3-puffy face 4-headache 5-blurred vision 6-convulsion 7-febrile illness/fever 8-severe abdominal pain that was not labor pain 9-pallor and shortness of breath (both present) 10-other [specify] _____
6. Was the child a single or multiple birth?	1-singleton 2-twin 3-triplet or more 9-don't know
6.1. If multiple births, what was the birth order of the child that died?	1-first 2-second 3- third or higher 9-don't know
DELIVERY HISTORY	
7. Where was the child born?	1-hospital 2-other health facility 3-home 4-other [specify] _____ 9-don't know
8. Who assisted with the delivery?	1-doctor 2-nurse/midwife 3-TBA 4-relative 5-mother by herself 6-other [specify] _____ 9-don't know
9. When did the water break?	1-before labor started 2-during labor 9-don't know
10. How many hours after the water broke was the baby born?	1-less than 24 hours 2-24 hours or more 9-don't know
11. Was the water bad smelling?	1-yes 2-no 9-don't know
12. Did the baby stop moving in the womb?	1-yes 2-no 9-don't know
12.1. If yes to 12, when did the baby stop moving in the womb?	1-before labor started 2-during labor 9-don't know

13. Did a birth attendant listen for fetal heart sounds during labor?	1-yes 2-no 9-don't know
13.1. If yes to 13, were fetal heart sounds present?	1-yes 2-no 9-don't know
14. Was there excess bleeding on the day labor started?	1-yes 2-no 9-don't know
15. Did the mother have fever on the day labor started?	1-yes 2-no 9-don't know
16. How long did the labor pains last?	1-less than 12 hours 2-12 to 24 hours 3- 24 hours or more 9-don't know
16.1. Did the mother take any herbs to induce labour?	1-yes 2-no 9-don't know
17. Was it a normal vaginal delivery?	1-yes 2-no 9-don't know
17.1. If no to 17, what type of delivery?	1-forceps/vacuum 2-cesarian section 3-other [specify] _____ 9-don't know
18. Which part of the baby came first?	1-head 2-bottom 3-feet 4-arm/hand 5-other [specify] _____ 9-don't know
19. Did the umbilical cord come out before the baby was born?	1-yes 2-no 9-don't know

CONDITION OF THE BABY SOON AFTER BIRTH

20. At birth, what was the size of the baby?	1-smaller than normal 2-normal 3-larger than normal 9-don't know	
21. Was the baby premature?	1-yes 2-no 9-don't know	
21.1. If yes to 21, how many months or weeks?	months	weeks
22. What was the birth weight of the baby?		Grams
23. How soon after birth did the baby breastfeed?	Hours	days
24. Was the breastfeeding exclusive? The ministry of Health says that its difficult to interpret and its recommended that it be phrased as " In the first 24 hours after birth was the baby offered any of the following (any other fluids/solids other than breast milk)	1-yes 2-no 9-don't know	
25. Was there anything applied to the cord after birth?	1-yes 2-no 9-don't know	
25.1. If yes to 25, what was it? [specify]	_____	
25.2. What was used to cut the cord?	1. Surgical blade 2. Scissors 3. Razor blade 4. knife	
25.3. How long after birth was the baby bathed?	1. Same day 2. Following day 3. 2 days or more	

26. Were there any injury marks on the baby's head or body?	1-yes 2-no 9-don't know
26.1. If yes to 26, where were the injury marks? [specify]	_____
27. Did the baby have any malformation?	1-yes 2-no 9-don't know
27.1. If yes to 27, what kind of malformation did the baby have?	1-swelling/defect on the back 2-very large head 3-very small head 4-defect of lip and/or palate 5-other [specify] _____ 9-don't know
28. What was the color of the baby at birth?	1-normal 2-pale 3-blue 9-don't know
29. Did the baby breathe after birth, even a little?	1-yes 2-no 9-don't know
30. Was the baby given assistance to breathe?	1-yes 2-no 9-don't know
31. Did the baby ever cry after birth, even a little?	1-yes 2-no 9-don't know
32. Did the baby ever move, even a little?	1-yes 2-no 9-don't know
33. If the baby did not cry, breathe, or move, was it born dead?	1-yes 2-no 9-don't know
34. If the baby was born dead, was the baby macerated (i.e. show signs of decay)?	1-yes 2-no 9-don't know

ASK THESE QUESTIONS IF THE CHILD WAS BORN ALIVE

35. Was the baby ever able to breastfeed or bottle feed?	1-yes 2-no 9-don't know
35.1. If yes to 35, did the baby stop breastfeeding or bottle feeding?	1-yes 2-no 9-don't know
35.2. If yes to 35.1, how many days after birth did the baby stop feeding?	Days
36. Did the baby have convulsions?	1-yes 2-no 9-don't know
36.1. If yes to 36, how soon after birth did the convulsions start?	Days
37. Did the baby become stiff and arched backwards?	1-yes 2-no 9-don't know
38. Did the baby have bulging of the fontanelle?	1-yes 2-no 9-don't know
38.1. If yes to 38, how many days after birth did the baby start having bulging of the fontanelle?	Days
39. Did the baby become unresponsive or unconscious?	1-yes 2-no 9-don't know
39.1. If yes to 39, how many days after birth did the baby become unresponsive or unconscious?	Days
40. Did the baby have fever [hot body]?	1-yes 2-no 9-don't know
40.1. If yes to 40, how many days after birth did the baby have a fever?	Days
42. Did the baby have cough?	1-yes 2-no 9-don't know
42.1. If yes to 42, how many days after birth did the baby start to cough?	Days
43. Did the baby have fast breathing?	1-yes 2-no 9-don't know
43.1. If yes to 43, how many days after birth did the baby start breathing fast?	Days

APPENDIX B - UGANDA VERBAL AUTOPSY FORM 1: DEATH OF CHILD UNDER 29 DAYS

44. Did the baby have difficulty breathing?	1-yes 2-no 9-don't know
44.1. If yes to 44, how many days after birth did the baby start having difficulty in breathing?	Days
44.2. If yes to 44, did the baby have chest indrawing?	1-yes 2-no 9-don't know
44.3. If yes to 44, did the baby have grunting? [DEMONSTRATE]	1-yes 2-no 9-don't know
44.4. If yes to 44, did the baby have flaring of nostrils?	1-yes 2-no 9-don't know
41. Did the baby become cold to touch?	1-yes 2-no 9-don't know
41.1. If yes to 41, how many days after birth did the baby become cold to touch?	Days
45. Did the baby have diarrhea?	1-yes 2-no 9-don't know
45.1. If yes to 45, how many days after birth did the baby have diarrhea?	Days
45.2. If yes to 45, when the diarrhea was severe, how many times did the baby pass stools in a day?	Number
45.3. If yes to 45, was there blood in the stools?	1-yes 2-no 9-don't know
46. Did the baby have vomiting?	1-yes 2-no 9-don't know
46.1. If yes to 46, how many days after birth did the vomiting start?	Days
46.2. If yes to 46, when the vomiting was severe, how many times did the baby vomit in a day?	Number
47. Did the baby have abdominal distention?	1-yes 2-no 9-don't know
47.1. If yes to 47, how many days after birth did the baby have abdominal distension?	Days
48. Did the baby have redness or discharge from the umbilical cord stump?	1-yes 2-no 9-don't know
49. Did the baby have pustular skin rash?	1-yes 2-no 9-don't know
50. Did the baby have yellow eyes, palms, or soles?	1-yes 2-no 9-don't know
50.1. If yes to 50, how many days after birth did it begin?	Days
50.2. If yes to 50, for how many days did the baby have yellow eyes, palms, or soles?	Days

MOTHER'S HEALTH AND CONTEXTUAL FACTORS	
51. What is the age of the mother?	Years
52. Did the mother receive antenatal care?	1-yes 2-no 9-don't know
53. Did the mother receive tetanus toxoid (TT) vaccine?	1-yes 2-no 9-don't know
53.1. If yes to 53, how many doses?	Number
54. How is the mother's health?	1- healthy 2- ill 3- not alive 9- don't know

HISTORY OF INJURY / ACCIDENT	
55. Did s/he suffer from any injury or accident that led to her/his death?	1-yes 2-no 9-don't know
55.1. If yes to 55, what kind of injury/accident? (circle only one)	1- road traffic accident 2- fall 3- drowning 4- poisoning 5- burns 6- violence/assault 7- other [specify] _____ 9-don't know
55.2. If yes to 55, was the injury or accident intentionally inflicted by someone else?	1-yes 2-no 9-don't know
56. Did s/he suffer from any animal/insect bite that led to her/his death?	1-yes 2-no 9-don't know
56.1. If yes to 56, what type of animal/insect?	1- dog 2- snake 3- other [specify] _____ 9-don't know

TREATMENT AND HEALTH SERVICE USE FOR THE FINAL ILLNESS

57. Did the baby receive any treatment for the illness that led to death?	1-yes 2-no 9-don't know

57.1. If yes to 57, circle all places/facilities at which s/he received treatment during the illness that led to death:

1- Home
2- Traditional healer/herbalist
3- Government health centre
4- Government hospital
5- Private clinic
6- Private hospital
7- Pharmacy, drug seller, store
8- Other [specify] _____
9- Don't know

57.2. If yes to 57, list the treatments the baby was given for the disease that led to death [copy from prescription/discharge notes, if available.]

_____

_____

_____

DATA EXTRACTED FROM DEATH CERTIFICATE			
Do you have a death certificate?		1-yes 2-no 9-don't know	
If yes, ask to see the death certificate, and record the following information:			
Date of death on certificate:	Day	Month	Year
Date of issue:	Day	Month	Year
Record the cause of death on the first (top) line of the death certificate:			
Record the cause of death on the second line of the death certificate (if any):			
Record the cause of death on the third line of the death certificate (if any):			
Record the cause of death on the fourth line of the death certificate (if any):			

DATA EXTRACTED FROM OTHER HEALTH RECORDS *(For each type of health record, summarize entries for last 2 visits (if more than 2) and record date of issue)*	
Burial Permit Cause of death	
Post mortem results Cause of death	
MCH/ANC Card	
Hospital prescription forms	
Treatment cards	
Hospital discharge forms Diagnosis	
Other hospital documents	
Laboratory results	
	No evidence

APPENDIX C - UGANDA VERBAL AUTOPSY FORM 2:
DEATH OF CHILD AGED 29 DAYS TO UNDER 5 YEARS

Relationship of the respondent to the deceased	1- Mother 2- Father 3- Grandmother 4- Grandfather 5-Aunt	6-Uncle 7-Other relative [specify]_____ 8-No relation

Did you live with the deceased in the period leading to death? 1-Yes 2-No

Name of deceased

Sex	**Date of birth**		
	Day	Month	Year
1-Male 2-Female			

Place of death
1-Hospital
2-Other health facility
3-Home
4-Other [specify]_____
9. Don't know

Date of death	Day	Month	Year

Residential status

The deceased was…

1 – Resident in the enumeration area
2 – Body brought home for burial
3 – Home-coming sick

What do you think was the cause of death?
(Write exactly as the respondent tells you.)

HISTORY OF PREVIOUSLY DIAGNOSED MEDICAL CONDITIONS

	Months		Months
Heart disease		Malnutrition	
Diabetes		Asthma	
Tuberculosis		Cancer of _____	
Epilepsy		Other _____	
HIV/AIDS		Other _____	

Respondent's account of illness/events leading to death

SIGNS AND SYMPTOMS NOTED DURING THE FINAL ILLNESS

1. How is the mother's health?	1- healthy 2- ill 3- not alive 9- don't know	
ASK ONLY IF CHILD WAS < 1 YEAR OLD		
2. Was the child small at birth?	1 - yes 2- no 9- don't know	
3. Was the child born prematurely?	1 - yes 2- no 9- don't know	
3.1. If yes to 3, how many weeks/months was the pregnancy at the time of delivery?	months	Weeks
4. Was the child growing normally?	1 -yes 2 -no 9 -don't know	
5. Did the child have bulging of the fontanelle?	1 -yes 2 -no 9 -don't know	
5.1. If yes to 5, how many days did the child have bulging of the fontanelle?	months	days
ASK FOR ALL CHILDREN		
6. For how long was the child ill before s/he died?	months	days
7. Did s/he have a fever?	months	days
7.1. If yes to 7, was the fever severe?	1 - yes 2- no 9- don't know	
7.2. If yes to 7, was the fever…	1- continuous 2- on and off 9-don't know	
7.3. If yes to 7, did s/he have chills/rigor?	1 - yes 2- no 9- don't know	
8. Did s/he have a cough?	months	days
8.1. If yes to 8, was the cough severe?	1 - yes 2- no 9- don't know	
8.2. If yes to 8, did the child vomit after s/he coughed?	1 - yes 2- no 9- don't know	
9. Did s/he have fast breathing?	months	days
10. Did s/he have difficulty in breathing?	months	days
10.1. If yes to 10, did the child have chest indrawing?	1 - yes 2- no 9- don't know	
10.2. If yes to 10, did s/he have noisy breathing (grunting or wheezing)? [DEMONSTRATE]	1 - yes 2- no 9- don't know	

10.3. If yes to 10, did s/he have flaring of the nostrils?	1-yes 2-no 9-don't know	
11. Did s/he have diarrhea?	months	days
11.1. If yes to 11, was there blood in the stool?	1-yes 2-no 9-don't know	
11.2. If yes to 11, how many times did s/he pass stools in a day?	number	
12. Did s/he vomit?	months	days
12.1. If yes to 12, how many times did s/he vomit in a day?	number	
13. Did s/he have abdominal pain?	months	days
13.1. If yes to 13, was the abdominal pain severe?	1-yes 2-no 9-don't know	
14. Did s/he have abdominal distension?	months	days
14.1. If yes to 14, how quickly did the distension develop?	1-rapidly within days 2-gradually over months 9-don't know	
14.2. If yes to 14, was there a period of a day or longer during which s/he did not pass any stool?	1-yes 2-no 9-don't know	
15. Did s/he have any mass in the abdomen?	months	days
16. Did s/he have headache?	months	days
16.1. If yes to 16, was the headache severe?	1-yes 2-no 9-don't know	
17. Did s/he have a stiff or painful neck?	months	days
18. Did s/he become unconscious?	months	days
18.1. If yes to 18, how did the unconsciousness start? (circle only one)	1-suddenly 2-fast (in a day) 3-slowly (many days) 9-don't know	
19. Did s/he have convulsions?	months	days
20. Did s/he have paralysis of lower limbs?	months	days
20.1. If yes to 20, how did the paralysis start? (circle only one)	1-suddenly 2-fast (in a day) 3-slowly (many days) 9-don't know	
21. Was there any change in the amount of urine s/he passed daily?	months	days
21.1. If yes to 21, how much urine did s/he pass? (circle only one)	1-too much 2-too little 3-no urine at all 9-don't know	
22. During illness that led to death, did s/he have any skin rash?	months	days
22.1. If yes to 22, was the rash on the face?	1-yes 2-no 9-don't know	
22.2. If yes to 22, was the rash on the trunk?	1-yes 2-no 9-don't know	
22.3. If yes to 22, was the rash on the arms and legs?	1-yes 2-no 9-don't know	
22.4. If yes to 22, what did the rash look like? (circle only one)	1-measles rash 2-rash with clear fluid 3-rash with pus 9-don't know	
22.5. If yes to 22, did s/he have itching?	1 -yes 2 -no 9 -don't know	
22.6. If yes to 22, did s/he have red eyes?	1-yes 2-no 9-don't know	
22.7. If yes to 22, did s/he have bleeding from the nose, mouth, or anus?	1-yes 2-no 9-don't know	

23. Did s/he have weight loss?	months	days
23.1. If yes to 23, did s/he look very thin and wasted?	1- yes 2- no 9- don't know	
24. Did s/he have mouth sores?	months	days
25. Did s/he have any swelling?	months	days
25.1. If yes to 25, where was the swelling?	1-face 2-joints 3-ankles 4-whole body 5-other [specify] _____	
26. Did s/he have any lumps?	months	days
26.1. If yes to 26, where were the lumps?	1-neck 2-armpit 3-groin 4-other [specify] _____	
27. Did s/he have yellow discoloration of eye?	months	days
27.1. Did s/he lose appetite?	1- yes 2- no 9- don't know	
27.2 . Was the child lethargic?	1- yes 2- no 9- don't know	
28. Did his/her hair color change to reddish/yellowish?	months	days
29. Did s/he look pale, or have paleness in the fingers, palms, or nail beds?	months	days
30. Did she have sunken eyes?	months	days

HISTORY OF INJURY / ACCIDENT	
31. Did s/he suffer from any injury or accident that led to her/his death?	1-yes 2-no 9-don't know
31.1. If yes to 31, what kind of injury/accident? (circle only one)	1- road traffic accident 2- fall 3- drowning 4- poisoning 5- burns 6- violence/assault 7- other [specify] _____ 9-don't know
31.2. If yes to 31, was the injury or accident intentionally inflicted by someone else?	1-yes 2-no 9-don't know
32. Did s/he suffer from any animal/insect bite that led to her/his death?	1-yes 2-no 9-don't know
32.1. If yes to 32, what type of animal/insect?	1- dog 2- snake 3- other [specify] _____ 9-don't know

APPENDIX C - UGANDA VERBAL AUTOPSY FORM 2: DEATH OF CHILD AGED 29 DAYS TO UNDER 5 YEARS

TREATMENT AND HEALTH SERVICE USE FOR THE FINAL ILLNESS	
33. Did s/he receive any treatment for the illness that led to death?	1-yes 2-no 9-don't know
33.1. If yes to 33, circle all places/facilities at which s/he received treatment during the illness that led to death: 1- Home 2- Traditional healer/herbalist 3- Government health centre 4- Government hospital 5- Private clinic 6- Private hospital 7- Pharmacy, drug seller, store 8- Other [Specify]_____ 9- Don't know	
33.2. If yes to 33, list the treatments s/he had taken for the disease that led to death [copy from prescription/discharge notes if available]. _____ _____ _____	
34. Did s/he have measles vaccination?	1-yes 2-no 9-don't know
35. Did s/he receive ORS and/or intravenous fluids (drip) treatment?	1-yes 2-no 9-don't know
36. Did s/he receive a blood transfusion?	1-yes 2-no 9-don't know
37. Did s/he receive treatment/food through a tube passed through nose?	1-yes 2-no 9-don't know
38. Did s/he have any operation for the illness?	1-yes 2-no 9-don't know
38.1. If yes to 38, how many months/days before death did s/he have the operation?	months / days
38.2. If yes to 38, where was the operation?	1- abdomen 2- chest 3-head 4- other [specify] _____ 9- don't know

Do you have a death certificate?	1-yes 2-no 9-don't know		
If yes, ask to see the death certificate, and record the following information:			
Date of death on certificate:	Day	Month	Year
Date of issue:	Day	Month	Year
Record the cause of death on the first (top) line of the death certificate:			
Record the cause of death on the second line of the death certificate (if any):			
Record the cause of death on the third line of the death certificate (if any):			
Record the cause of death on the fourth line of the death certificate (if any):			

DATA EXTRACTED FROM OTHER HEALTH RECORDS *(For each type of health record, summarize entries for last 2 visits (if more than 2) and record date of issue)*	
Burial Permit Cause of death	
Post mortem results Cause of death	
MCH/ANC Card	
Hospital prescription forms	
Treatment cards	
Hospital discharge forms Diagnosis	
Other hospital documents	
Laboratory results	
	No evidence

APPENDIX D - INTERNATIONAL FORM OF MEDICAL CERTIFICATE OF CAUSE OF DEATH

Questionnaire ID

Doctor's ID

Cause of Death	Approximate Interval between onset and death
I	
Disease or condition directly (a) ……	
.	……
leading to death	
due to (or a consequence of)	
Antecedent causes	…….
Morbid conditions if any, (b) ……	
.	……
giving rise to the above cause, Stating the underlying Condition last	
due to (or a consequence of)	
(c) ……	…….
.	
due to (or a consequence of)	…….
(d) ……	
.	
	…….....
II	
Other significant conditions Contributing to the death but Not related to the disease Or condition causing it	……..
**This does not mean the mode of dying, e.g heart failure, and respiratory failure. It means the disease, injury or complication that caused death.*	

APPENDIX E - MORTALITY TABULATION LIST FOR CAUSE OF DEATH CLASSIFICATION BASED ON ICD-10 CODES

Table E.1 below contains a glossary of the causes of death groupings used in the analysis of Uganda Verbal Autopsy Study data, together with corresponding ICD-10 codes in 3-character codes.

Table E.1 Mortality Classification Groups and ICD Codes

Cause of death	ICD-10 Codes in 3-characters
Intestinal infectious diseases (including diarrhoeal diseases)	A03, A04, A08, A09
Tuberculosis	A16, A17, A19
Tetanus	A33
Measles	B05
Viral hepatitis	B19
Human immunodeficiency virus [HIV] disease	B20 - B24
Malaria	B50, B54
Remainder of malignant neoplasms	C95
Malnutrition	E40 - E42, E46
Meningitis	G03
Cerebrovascular diseases	I62
Pneumonia	J18
Disorders of the kidney	N03, N04, N10
Perinatal and early neonatal	P00 - P03, P07, P10, P12, P20 - P22, P24, P28, P36, P38, P39, P51, P53, P76
Congenital malformations of the central nervous system	Q05
All other diseases	A36, A41, A46, A50, A51, B36, D57, D64, G04, G05, G35, G40, G83, J46, K52, K56, L02, L08, M86, Q24, Q37, Q74, R58, R95, R96, R99
All unintentional injuries	V09, V89, W19, W55, W73, W79, X20, Y57, Y65

APPENDIX F - STUDY PERSONNEL

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