

The AIDS epidemic and infant and child mortality in six districts of Uganda



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Abstract

Several studies in sub-Saharan Africa have associated infant and child mortality with the AIDS epidemic in the region. The paper uses retrospective survey data of six districts in the east, south and west of Uganda to study infant and child mortality, which increased in the 1980s probably because of the AIDS epidemic and started declining in the early 1990s, a period when the epidemic was reported to be subsiding. Deeper analysis of data indicates that children whose parents are polygamous, educated, formally employed and in business are at a higher risk of death from AIDS and related illness. Although AIDS as a direct cause of death is the fourth leading killer of children, other serious diseases such as diarrhoea, respiratory infection and measles are associated with AIDS.

From the health perspective, sub-Saharan Africa lags behind the rest of the world. Infant and child mortality rates are high in the region resulting in over four million African children dying each year (Sanon 1993). While the world infant mortality rate was reported at 63 deaths per 1000 live births in 1994, Africa's infant mortality rate was 92 with regional variations of West Africa suffering 96 deaths, East Africa 104, Middle Africa 102 and Southern Africa 52 deaths per 1000 live births (Population Reference Bureau 1994). The reasons for poor child survival in Africa include social, economic and political factors which exacerbate common diseases that lead to death (Sullivan and Roskens 1991).

Measles, pneumonia, respiratory infections, diarrhoea and malaria remain the major causes of infant and child mortality globally (Kok 1993; Biddulph 1993; Hendricks 1995). Child deaths at ages 1-4 years are mainly due to diarrhoea and respiratory diseases, malnutrition and vaccine-preventable infectious diseases. Furthermore, intestinal infections cause almost five million child deaths a year (Yunes, Chelala and Blaistein 1994). It is expected that in Asia, child mortality due to AIDS will increase both as a direct effect of HIV infection among infants and from excess mortality due to diminishing care during the period of parents' illness as well as due to orphanhood. Out of over four million deaths of children each year in sub-Saharan Africa, 1.4-2.8 million deaths are due to malaria (Sanon 1993). However, AIDS will cause an increasing share of infant and child mortality because of the rising numbers of infected mothers and pregnant women (Way and Stanecki 1993). In Zambia, for example, over 20 per cent of the pregnant women in Lusaka tested positive for HIV in 1990 (*Futurist* 1994).

HIV/AIDS and child mortality

AIDS is a relatively recent challenge to child survival. It is responsible for an increase in infant and child mortality in several countries and a decrease in life expectancy (Stover 1994;

De Lay et al. 1995). Infant mortality in Zambia in 1994 was 15 per cent higher than a decade before and had clear links to HIV/AIDS (*Futurist* 1994). In a 25-year projection based on 1990 World Health Organization data, the urban infant mortality rate was expected to increase by 20 per cent (Way and Stanecki 1993).

Sub-Saharan Africa is particularly affected by the AIDS epidemic. By July 1996, 13.3 million adults (60 per cent of the world total) were living with HIV (Official Satellite Symposium 1996). According to Bongaarts (1995) child deaths due to AIDS accounted for 23.5 per cent of all AIDS deaths in 1995. The most affected is the contiguous belt stretching from Uganda and Rwanda southward to Zambia, Malawi, Zimbabwe and parts of South Africa; a belt of countries inhabited by only two per cent of the world population.

HIV transmission in adults and young people in sub-Saharan Africa is mainly through heterosexual contact, resulting in HIV infection in childbearing women and pediatric AIDS. The children born to infected mothers are at a higher risk of infection. The rate of vertical transmission from mothers to their children is reported at 25 to 35 per cent in sub-Saharan Africa (Gibb and Warra 1994). It is estimated that about 500,000 children were born with HIV in 1995, of whom 67 per cent were in sub-Saharan Africa (Official Satellite Symposium 1996). Uninfected children are endangered by the AIDS death of parents.

Child mortality in Uganda

In the 1969 Uganda Census, infant and child mortality was estimated at 118 per 1000 live births and 90 per 1000 children alive at age 1, while the under-five mortality was 198. In comparison, estimates based on 1991 Census data placed the infant mortality rate at 122, child mortality at 93 and the under-five mortality at 203, implying an overall intercensal deterioration in children's health (Republic of Uganda 1995).

Closer examination of the 1969 census estimates of infant and child mortality shows a steep decline in mortality from March 1954 to July 1966. Both infant and child mortality levels declined, from 157 and 129 in 1954 to 110 and 82 in 1966, respectively. In contrast, infant mortality varied from 125 to 119 and child mortality ranged between 96 and 90 between 1975 and 1988 (Republic of Uganda 1995). The increase in infant and child mortality during the 1970s is probably related to the political unrest and mismanagement of the economy resulting in deterioration of health services.

The results of the 1995 Uganda Demographic and Health Survey (UDHS) show infant and child mortality declining in the 1990s. Infant mortality was reported at 81.3 per 1000 live births in 1995. Child mortality was 71.9 and under-five mortality was 147.3. Five years before the survey infant mortality was estimated at 92.0 per 1000 live births while child mortality and under-five mortality were 82.9 and 167.2, respectively.

A study by UNICEF (1989) estimated that about 153,000 children die each year in Uganda mostly from preventable causes such as diarrhoea, measles, respiratory infection, malaria and malnutrition. AIDS, however, was expected to become a major cause of childhood death in the 1990s. A study of infant and child deaths in health units in Uganda found malaria the leading cause of death, responsible for 17.9 per cent of the deaths (Government of Uganda 1994). Malaria was followed by diarrhoea, accounting for nine per cent of deaths; while acute respiratory infection and measles were responsible for seven per cent of the infant deaths and 9.9 per cent of the under-five mortality.

AIDS in Uganda

AIDS was first diagnosed in the southern part of Uganda in 1982 and since then the graph for cumulative number of AIDS cases has continued in an upward trend with all districts reporting AIDS cases. By December 1995 the reported cumulative AIDS cases were 48,312

(STD/AIDS Control Programme 1996). The rates in young women are higher than in males of comparable age. The highest rates of infection and disease occur in women aged 20-30 years many of whom were most likely infected in their teens (Berkley et al. 1989; ACP 1990). Antenatal clinic studies estimate HIV prevalence rates in pregnant women of 15 to 30 per cent, and vertical transmission rates of 20 to 40 per cent (Abbas 1993; Wabwire-Mangen 1995), producing a high prevalence of pediatric AIDS. In Uganda, pediatric HIV infection is listed as the sixth leading cause of childhood mortality and it is projected that if the status quo is maintained, it may become the third leading cause of death by the year 2000 (Wabwire-Mangen 1995). However, recent studies have reported declining HIV prevalence among pregnant women attending antenatal clinics and young women in some parts of the country (Madraa and Ruranga-Rubaramira 1996).

The purpose of this paper is to examine the incidence of child death due to AIDS and related diseases and infant and child mortality in the era of AIDS. Maternal and paternal factors of mortality are analysed.

Method

The data are from a multiphase study entitled 'Evolution of household composition and family structure under conditions of high mortality in Uganda' conducted in six districts of Uganda. The districts are Mbale and Iganga in the east, Masaka in the south, Mbarara and Kabale in the southwest and Hoima in the west.

This paper is based on two surveys conducted in 1992 and 1995 and vital registration for one year during 1995 and 1996. The two surveys used the same questionnaire and covered the same area. Information was collected on the background characteristics of households, contribution of members to the welfare of their households, mortality since the household was formed, orphanhood and orphan caretaking arrangements, migration and behaviour patterns of widows and widowers, current patient care in the household, attitude towards illness and death in the community, and fertility.

The paper uses data on mortality and reproduction. The section on mortality includes the following questions: name of the dead person; sex; age at death; year of death; cause of death or symptoms the dead person showed before he or she died; length of illness; action taken about the illness; where the person died; and changes the death caused in the household.

The reproduction section had two parts, the first part giving numerical characteristics of the woman's reproductive history while the second part provides characteristics of the child. The questions in Part 1 were asked of ever-married women aged 15-49 years in 1992 and 12-49 in 1995. They asked the name of the respondent; age; whether she had ever given birth; where the children were living; whether she had ever lost any child; number of sons and daughters dead; and finally the total number of children she had borne.

In order to gather detailed information about the children in Part 2, the interviewer listed the number of children in their birth order. From this list information was collected on name of child, whether the child was the result of single or multiple birth, sex of child, whether still alive, age of child (if alive) and age at death (for dead child). For children under 15 years and not living with their mothers, the person with whom the child was living was identified.

In the 1992 survey, a sample of 1797 households consisting of both urban and rural residents were picked from the total households which had experienced death since they were formed. The smallest residential unit, now known as Local Council (LC), equivalent to a village, was used. From each LC selected, the households which had experienced mortality in the recent past were identified and surveyed. A total of 2352 households including those in the 1992 study were interviewed in 1995. The extra households picked in the 1995 survey had experienced death in the inter-survey period.

Vital registration was done in all the six districts and information was gathered on mortality, fertility, marriage and migration. The data from the section on mortality were used for this paper.

Results of the survey

Background information about the sample

Out of 1797 households sampled in 1992, 1658 had experienced a death between 1982 and 1992 and 1007 out of 2352 households surveyed in 1995 had experienced a death during the inter-survey period. Households were grouped as AIDS-affected and non-AIDS-affected households. The AIDS-affected households experienced death from AIDS and related causes while the non-AIDS-affected households experienced death from other diseases.

In the 1992 survey, 622 children under five were reported to have died; 52.9 per cent were males and 47.1 per cent females; 32 per cent of them died before their first birthday. Between the 1992 and 1995 surveys 226 children under five died: 50.9 per cent were males and 49.1 per cent females. Of these, 37.6 per cent died during their first year of life. From the vital data, 250 under-five children were reported dead in a period of one year; the proportion of the males (56%) dead was higher than that of females (44%) and 40 per cent of the deaths occurred during infancy.

The causes of under-five death were grouped as follows: diarrhoea, AIDS, malaria, measles and other causes. Malaria was the leading cause of death, responsible for 28.5 per cent of deaths in 1992, 26.1 per cent in 1995 and 45.2 per cent from the vital registration. According to the 1992 survey, AIDS ranked fourth, responsible for ten per cent of deaths after diarrhoea (11.7%) and measles (18.8%); it was third by 1995 data, accounting for 11.9 per cent of deaths. However from the vital registration data AIDS accounted for only 4.8 per cent of the deaths and it was the fourth leading cause of death. Unreported causes of death were responsible for 7.6 per cent in the 1992 survey and 13.7 per cent in 1995. The corresponding percentage from the vital events data is 20.4.

Mbale district reported the highest proportion of child deaths (24.4%) followed by Iganga (19.9%), Kabale (15.0%) and Hoima (14.1%), Masaka district had the lowest proportion (12.2%) in 1992. Iganga district recorded the highest proportion of child deaths (24.3%) followed by Hoima (18.6%), Mbale (16.8%) and Masaka (14.6%); Kabale district suffered least (11.5%) in the 1995 data. From the vital events data, the highest number of child deaths was in Mbarara district (24%), Hoima ranked second (22.4%) followed by Iganga (19.3%) and Masaka (14%) and Mbale was least affected with 7.6 per cent of the deaths.

Distribution of child deaths by households and causes of death

Under-five deaths occurred in 544 households by 1992 and 220 households in the 1992-95 inter-survey period. A summary of child deaths by households and cause of deaths is shown in Table 1. By 1992 out of 622 child deaths, 245 (39.4%) occurred in AIDS-affected households while the corresponding figures for the 1992-95 period were 59 out of 226 deaths (26.1%) reflecting a decrease between the two surveys. As expected, all the child deaths from AIDS were reported in AIDS-affected households. The percentage of child deaths from diarrhoea in AIDS-affected households was more than twice as high as in non-AIDS-affected households. Since diarrhoea is highly associated with AIDS (Wagner et al. 1993), these results are not surprising. Deaths due to malaria and measles were higher in non-AIDS-affected than AIDS-affected households.

Table 1
Child deaths by type of households and cause of deaths (%)

Cause of child deaths	Child deaths					
	AIDS affected households		Non-AIDS affected households		All	
	1992	1995	1992	1995	1992	1995
Diarrhoea	18.5	10.2	7.6	5.9	12.5	7.2
AIDS	24.4	45.8	0.0	0.0	10.9	13.8
Malaria	16.5	13.6	41.9	37.5	30.6	30.3
Measles	17.3	13.6	22.9	30.9	20.4	25.6
Others	23.2	16.9	27.6	25.7	25.7	23.1
Total	99.9	100.1	100.0	100.1	100.1	100.0
Number	245	59	315	136	569	195

Distribution of children dead by cause of death, age at death, sex and district

Table 2 presents the percentage of children by age at death, sex and district for the three inquiries. The results of 1992 and 1995 show that deaths due to AIDS were higher during infancy than childhood. Malaria followed a similar pattern for the three inquiries while the effect of measles was the reverse. Sex had no significant effect on cause of death.

According to the 1992 survey malaria was the leading cause of the under-five deaths in three of the six districts, Masaka, Mbarara and Hoima (Table 2). By 1995, malaria was leading in the four districts of Mbale (34.9%), Kabale (33.3%), Hoima (24.1%) and Mbarara (42.9%), and killed as many as AIDS (25.0%) in Masaka district, while in Iganga measles was still leading. From the vital events data, malaria accounted for the highest proportion of child deaths in Masaka, Mbarara, Kabale and Hoima, while in Iganga it caused as many deaths as measles. Diarrhoea was the leading cause of under-five deaths in Mbale district.

As a direct cause of death AIDS was reported in the 1992 survey to be the leading killer of children in Kabale (27.1%), while in Masaka it accounted for 20 per cent of the deaths. In other districts, AIDS was responsible for at least five per cent of deaths except in Hoima where the proportion was lower. According to the 1995 survey, the percentage of children dead from AIDS remained high in Masaka district while in Kabale it dropped drastically from 27.1 to 4.1 per cent during the inter-survey period. There was a dramatic increase in the proportion of children who died of AIDS in Hoima, Mbarara and Iganga. However, the results from the vital events data show low proportions of between 4.1 and 7.9 per cent with little variation between the districts. Other killers of children listed, such as diarrhoea and respiratory infection, have been associated with AIDS; also it is possible that what is reported as malaria is fever associated with AIDS.

Table 2
Per cent distribution of children dead by age, sex and district for 1992, 1995 and 1995/96

	Cause of death															Chi square p-value		
	AIDS			Diarrhoea			Malaria			Measles			Others					
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
Age (yrs)																		
0	11.1	14.5	4.3	11.1	7.2	7.1	32.7	31.9	61.4	8.8	17.4	8.6	36.3	29.0	18.6			
1-4	110.6	13.5	7.0	13.4	7.1	10.9	30.0	29.4	54.3	25.2	30.2	14.0	20.8	19.8	14.0			
ALL	10.8	13.8	6.0	12.7	7.2	9.5	30.8	30.3	56.8	20.3	25.6	12.1	25.4	33.1	15.5	0.000	0.334	0.528
Number	62	27	12	73	14	19	117	59	113	117	50	24	146	45	31			
Sex																		
Male	11.3	12.2	6.6	13.6	8.2	12.3	30.1	24.5	51.9	20.9	29.6	12.3	24.2	25.5	16.9			
Female	10.3	15.5	5.4	11.7	6.2	6.5	31.5	36.1	62.4	19.8	21.6	11.8	26.7	20.6	14.0	0.900	0.343	0.592
ALL	10.8	13.8	6.0	12.7	7.2	9.5	30.8	30.3	56.8	20.3	25.6	12.1	25.4	23.1	15.5			
Number	62	27		73	14	19	117	59	113	117	50	24	146	45	31			
District																		
Mbale	5.5	9.1	6.7	37.7	15.2	33.3	28.8	39.4	13.3	13.0	21.2	6.7	15.1	15.2	40.0			
Iganga	7.4	13.7	6.8	4.6	3.9	11.4	22.2	21.6	34.1	40.7	45.1	34.1	25.0	15.7	13.6			
Masaka	20.0	25.0	6.9	0.0	3.6	6.9	31.4	25.0	75.9	22.9	10.7	6.9	25.7	35.7	3.4	0.000	0.005	0.000
Mbarara	9.9	17.9	7.9	4.5	0.0	2.6	28.4	42.9	79.5	22.8	28.6	2.6	34.6	40.7	7.7			
Kabale	27.1	4.2	4.3	5.9	8.3	13.0	17.6	33.3	39.1	11.8	12.5	4.3	37.6	41.7	39.1			
Hoima	1.2	10.3	4.1	4.7	13.8	6.1	60.0	24.1	69.4	11.8	20.7	8.2	22.4	31.0	12.2			
ALL	10.8	13.5	6.0	12.7	7.3	9.5	30.8	30.1	56.8	20.3	25.9	12.1	25.4	23.3	15.5			
Number	62	26	12	73	14	19	117	58	113	117	50	24	146	45	31			

1: 1992 survey, 2: 1995 survey, 3: vital registration of 1995/96

Distribution of child deaths by cause and time of death

According to Table 3, time of death was grouped into three periods: 1982-1989 (first), 1990-92 (second) and 1993-1995 (third). The cause and time of death were reported for a total of 724 children under five years. The major cause of death in the three periods was malaria but with fewer deaths in 1990-1992. Deaths from AIDS increased from 6.9 per cent in the first period to 16.3 per cent in the second period and declined to 13.8 in the third period. Diarrhoea followed a similar trend to that of AIDS; measles and malaria had a reverse trend.

Table 3
Per cent distribution of children dead by cause and time of death

Cause of death	Year of death		
	1982-1989	1990-1992	1993-1995
AIDS	6.9	16.3	13.8
Diarrhoea	6.5	20.4	7.2
Malaria	30.5	26.7	30.3
Measles	25.6	16.7	25.6
Others	30.5	20.0	23.1
Total	100.0	100.1	100.0
Number	246	283	195

Characteristics of the parents and child deaths

Paternal and maternal factors have been studied and found to greatly influence infant and child mortality (e.g. Ewbank, Henin and Kekovole 1986). With this in mind information on the parents of the dead children was used to investigate the effect of the parents' characteristics on child death from AIDS in comparison to other causes. Data had been collected on parents who were still alive. Only 376 and 168 children had their mothers alive in the 1992 and 1995 surveys and the corresponding numbers of children with living fathers were 330 and 162, respectively. Many parents of the children who had died of AIDS were also dead; this necessitated the regrouping of cause of death as 'AIDS and related causes' and 'non-AIDS causes'. The characteristics of the parents investigated were age, marital status, education level and occupation.

Table 4 shows the distribution of dead children by characteristics of their mothers. More children whose mothers were aged 25-39 years died from AIDS and related causes than those with mothers aged 15-24 and 40 years and above.

According to the 1992 survey, the highest proportion of children dead from AIDS and related diseases were born to mothers who were never married, while those whose mothers were separated, divorced and widowed ranked second. In the 1992 and 1995 inter-survey period, the children whose mothers were widowed, separated and divorced suffered the highest mortality from AIDS and related diseases followed by those whose mothers were never married and the smallest percentage was recorded among children whose mothers were monogamously married.

Mothers' level of education showed interesting results. The proportion of children, who died of AIDS and related diseases, whose mothers had never been to school slightly increased between the two surveys. The percentage of children whose cause of death was AIDS and related diseases and who had mothers educated to primary and secondary levels decreased by 6.9 and 23.0, respectively in the 1995 survey.

Table 4
Per cent distribution of children dead by cause of death and characteristics of mothers

Mothers' characteristics	AIDS and related diseases		Cause of death Non-AIDS disease		Chi square p-value	
	1992	1995	1992	1995	1992	1995
Age						
15-24	0.0	8.1	0.0	91.9		
25-39	18.2	15.0	81.8	85.0		
40-49	9.5	0.0	90.5	100.0	0.400	0.114
50+	7.7	6.3	92.3	96.6		
ALL	10.5	13.3	89.5	86.9		
Number	10	18	85	119		
Marital status						
Never married	60.0	17.1	40.0	82.9		
Married monog.	19.5	9.5	80.5	90.5		
Married polyg.	16.2	14.3	83.8	90.5	0.107	0.291
Wid./sep./div.	21.1	30.0	78.9	70.0		
ALL	19.4	13.7	80.6	86.3		
Number	72	23	299	145		
Education Level						
None	12.3	12.8	87.8	87.2		
Primary	16.7	9.9	88.3	90.1		
Secondary	52.4	29.4	47.6	70.6	0.047	0.095
Post-secondary	33.3	0.0	66.7	0.0		
ALL	19.5	13.1	80.5	86.9		
Number	72	23	299	145		
Occupation						
Subsistence farming	18.3	10.7	81.7	89.3		
Formal employment	50.0	40.0	50.0	60.0		
Business/trade	29.4	50.0	70.6	54.0		
Others	11.8	16.7	88.2	83.3	0.047	0.037
ALL	19.4	13.7	80.6	86.3		
Number	72	23	299	143		

Occupation of the mother had a significant effect on the cause of child death. Most deaths were of children whose mothers were in formal employment, followed by those whose mothers were engaged in business and trading while the fewest deaths were of those whose mothers were subsistence farmers, by the 1992 survey. The percentage of children dead whose mothers were in formal employment and subsistence farming declined between 1992 and 1995 but that of children whose mothers were businesswomen or traders increased.

Table 5 shows the percentage of dead children by their fathers' characteristics. The children who had died of AIDS and related diseases and had living fathers were only those whose fathers were aged 50 years and above in the 1992 survey. In the 1995 survey more children whose fathers were age 25-39 years died of AIDS and related causes than those with fathers aged 50 years and above.

The pattern of child death by fathers' marital status is similar to that of mothers' marital status in the 1992 survey. According to 1995 data, most children who died had fathers who were polygamously married.

Education of the father had no significant association with cause of child death. The proportion of children who died of AIDS and related diseases and had fathers with at least primary education declined in the inter-survey period whereas that of children with fathers who had not been to school increased.

Table 5
Per cent distribution of children dead by cause of death and characteristics of fathers

Fathers' characteristics	AIDS and related diseases		Cause of death Non-AIDS disease		Chi square p-value	
	1992	1995	1992	1995	1992	1995
Age						
15-24	0.0	0.0	0.0	0.0		
25-39	0.0	22.2	100.0	77.8		
40-49	0.0	0.0	100.0	100.0		
50+	10.2	6.5	89.8	93.5	0.236	0.143
ALL	8.1	7.5	91.9	92.5		
Number	10	4	114	49		
Marital status						
Never married	33.3	7.4	66.7	92.6		
Married monog.	18.2	5.3	81.8	94.7		
Married polyg.	16.8	19.1	83.2	80.7	0.844	0.059
Wid./sep./div.	23.1	0.0	76.9	100.0		
ALL	18.0	10.5	82.0	89.5		
Number	58	17	264	145		
Education level						
None	11.1	23.8	88.9	76.2		
Primary	16.9	9.3	83.1	90.7		
Secondary	21.7	7.1	78.3	92.9	0.573	0.255
Post-secondary	28.6	11.1	71.4	88.9		
ALL	18.0	11.3	82.0	88.7		
Number	58	15	264	118		
Occupation						
Subsistence farming	15.3	5.8	84.7	94.2		
Formal employment	31.3	12.5	68.8	87.5		
Business/trade	15.9	27.3	84.1	72.3		
Others	21.2	9.3	78.8	90.8	0.153	0.040
ALL	17.9	10.6	82.1	89.4		
Number	58	17	266	144		

According to the 1992 survey, most deaths due to AIDS and related diseases were of children whose fathers were formally employed; those whose fathers were subsistence farmers were least affected in the 1992 survey. The 1995 survey reported that the children whose fathers were businessmen and traders died most of AIDS and related diseases followed by the children with fathers in formal employment. The proportion of children who died of

AIDS and related diseases and had fathers in business and trading, increased in the inter-survey period while that of children with formally employed fathers declined.

Demographic and socio-economic differentials in childhood mortality

Further investigation of cause of child death was made using logistic regression. Cause of death was classified as AIDS and related diseases and non-AIDS causes. The independent variables are age, sex and district of the child and marital status, level of education and occupation of the parents. A reference category was chosen for each variable based on the results of the bivariate analysis. For comparison purposes the reference category was the same for all the data sets used. Table 6 displays the results of the logistic regression.

Regarding sex as a variable, the results of the 1992 survey and vital registration show that male children were slightly more likely to die of AIDS than females. As in the bivariate analysis, infants were more likely to die of AIDS and related diseases than children aged 1-4.

District is another variable considered. Hoima district was the reference category. According to the 1992 survey, the risk of child death from AIDS and related diseases was far higher in Masaka and Kabale, 20 and 29 times more likely respectively, than in Hoima. During the inter-survey period Hoima still had a lower risk than other districts except Kabale district and from the vital events data Hoima was least at risk. The 1995 survey and the vital registration show that the effect of AIDS is almost the same in all the six districts with Masaka and Mbarara having slightly worse effects.

Marital status was combined with type of marriage and the children whose parents were monogamously married were the reference category. According to the 1992 data, the children whose mothers had never married were three times more likely to die than those with mothers in monogamous unions, and those whose mothers were polygamously married were less likely to die. During the inter-survey period children born to widowed, divorced and separated mothers were six times more likely to die and children with mothers in polygamous unions were at twice the risk of death. The pattern of children with fathers in polygamous unions is similar to that of the mothers. It is possible that monogamous parents had extramarital partners but when they became aware of the AIDS epidemic they confined themselves to their marital partners, during the inter-survey period. Unfortunately the children with single parents and widowed fathers were not included in the analysis because of missing data.

Another variable related to cause of child deaths is level of education of the parents. The reference category comprised the children whose parents had not been to school. The children whose parents had attained post-primary education suffered the highest mortality according to the 1992 data, seven times that of the reference category for mothers and two times for fathers. Children whose parents had primary education were also at a higher risk. However, the risk of child death is declining as shown by the results of the 1995 survey.

Parents' occupation was also related to cause of child death and the children whose parents were subsistence farmers were the reference category. From the 1992 data children born to formally employed parents were more likely to die from AIDS and related illness and those born to parents engaged in trading and business were less likely to die. By 1995, the children whose mothers were subsistence farmers were at a lower risk than children of businesswomen. In addition children with fathers in business or trading and formal employment were at a very high risk.

Table 6
Results of logistic regression where AIDS and related diseases, as a cause of death, is the dependent variable

Variable	B			S.E.			Level of sig			Exp (B): odds ratio		
	1	2	3	1	2	3	1	2	3	1	2	3
Sex												
Males	0.17	-.41	.11	.28	.43	.62	.53	.33	.85	1.19	.66	1.12
Females	0.00	.00	.00	-	-	-	-	-	-	1.00	1.00	1.00
Age of the child												
0	0.24	.01	.83	.30	.45	.70	.42	.98	.24	1.27	1.01	2.28
1-4	0.00	.00	.00	-	-	-	-	-	-	1.00	1.00	1.00
District												
Hoima	0.00	.00	.00	-	-	-	-	-	-	1.00	1.00	1.00
Mbale	1.56	.11	.28	1.06	.85	1.26	.14	.90	.82	4.75	1.11	1.32
Iganga	1.78	.66	.72	1.06	.73	.95	.09	.37	.45	5.95	1.93	2.06
Masaka	2.98	1.21	.74	1.04	.74	1.04	.00	.10	.48	19.75	3.35	2.11
Mbarara	2.18	1.06	.47	1.06	.79	.94	.04	.18	.62	8.83	2.87	1.60
Kabale	3.38	-.66	.05	1.03	1.19	1.27	.00	.58	.96	29.38	.52	1.06
Mothers' Characteristics												
Marital status												
Monogamous	0.00		.00	-		-	.57		.13	1.00		1.00
Never married	1.12		a	1.04		a	.28		a	3.08		a
Polygamous	-.20		.88	.34		.64	.56		.17	.82		2.40
Widowed/ separated	.16		1.75	.37		.93	.66		.06	1.17		5.76

Table 6 continued

Level of education					.00	.29		
None	.00	.00	-	-	-	-	1.00	1.00
Primary	.37	.04	.34	.34	.69	.26	1.47	1.04
Post-primary	1.99	1.27	.47	.92	.00	.17	7.30	3.58
Occupation					.88	.20		
Farming	.00	.00	-	-	-	-	1.00	1.00
Formal	.09	.80	.74	1.25	.90	.52	1.09	2.22
Business/trade	-.32	2.06	.63	1.17	.61	.08	.72	7.81
Fathers' Characteristics								
Marital status					.77			
Monogamous	0.00	.00	-	-	-	-	1.00	1.00
Never married	1.01	a	1.25	a	.42	a	2.73	a
Polygamous	-.15	1.76	.32	.64	.64	.01	.86	5.80
Widowed/ separated	.24	a	.72	a	.74	a	1.27	a
Level of education								
None	.00	.00	-	-	-	-	1.00	1.00
Primary	.50	-.60	.57	.75	.38	.43	1.64	.55
Post-primary	.76	-1.45	.61	.98	.21	.14	2.13	.23
Occupation					.23	.04		
Farming	.00	.00	-	-	-	-	1.00	1.00
Formal	.76	1.87	.46	.21	.10	.12	2.13	6.46
Business/trade	-.06	2.14	.47	.77	.90	.01	.94	8.51
Others	.59	1.21	.41	.87	.15	.16	1.80	3.37

1 = 1992 survey, 2 = 1995 survey, 3 = Vital registration, a = Reported cases too few to be analysed

Infant and child mortality

Data on children born alive and children surviving from the 1992 and 1995 surveys were tabulated by five-year intervals preceding 1992 and for the inter-survey period. The results are shown in Table 7 which presents the trends in infant and child mortality rates between 1973 and 1995. The table shows that the under-five mortality between the 1992 and 1995 surveys is 100 deaths per 1000 live births, which is high. Before the 1992 survey there was a fall in the under-five mortality from 149 to 100 per 1000 live births between 1988 and 1992. However, a decade before 1988, both infant and child mortality had been increasing. For comparison purposes, data from the six study districts from the Uganda Demographic and Health Survey of 1995 are presented in the same table. The trends of mortality by UDHS data are very similar to those of our study.

Table 7
Trends of infant, child and under-five mortality rates

Years	Infant mortality		Child mortality		Under-five mortality	
	1	2	1	2	1	2
1993-95	65.5	57.8	46.2	41.0	100.1	115.7
1988-92	88.1	114.4	70.2	60.0	149.0	155.9
1983-87	85.3	129.1	71.3	82.0	123.2	177.8
1978-82	59.4	123.2	50.2	74.4	106.3	165.9
1973-77	58.5	148.3	53.0	87.6	108.2	206.4

1 = 1992 and 1995 surveys, 2 = UDHS results for the six districts (Uganda Department of Statistics 1996)

Discussion**Limitations of data**

The data used for this paper have several limitations including age errors, misstatements and omissions. The causes of death for about seven per cent of the children dead were not reported in the 1992 survey; the corresponding proportions in the 1995 survey and the vital registration were 14 and 20 per cent, respectively. Since in this paper we are more interested in the cause of death, the children whose causes of death were not reported were omitted in the analysis. The age of many parents was not reported, which led to the omission of age of parents as a variable in logistic regression, as it would not have given meaningful results. Information about dead parents which was collected for a different purpose and could not be linked to the dead children resulted in loss of data on many children who had died of AIDS and whose parents had also died.

Causes of child death

As in other studies (e.g. UNICEF 1989; Government of Uganda 1994) malaria was the leading cause of the under-five mortality, responsible for over a third of the deaths in all surveys. Measles was the second most frequent cause and diarrhoea affected children more than infants except in 1992. These results confirm the findings of Hendricks (1995) that measles and malaria remain the major causes of child mortality in sub-Saharan Africa. It should be noted that some of the causes of death such as diarrhoea, measles and malaria (often reported as fever) could be linked to AIDS. Infant deaths from AIDS were more numerous

than AIDS deaths of children, probably because, as Goldfarb (1991) reported, most children in Africa born with HIV die by the age of 18 months.

There is significant variation in causes of death across districts. AIDS was the leading cause of deaths of children in Kabale district and diarrhoea was in Iganga district in 1992. It is not surprising that malaria is the leading cause of death in some of the districts, since it has been reported to be the major cause of child death in the country. Apart from in Hoima, AIDS accounted for a sizable proportion of deaths, 20 per cent in Masaka, 27 per cent in Kabale, 9.9 per cent in Mbarara, 7.4 per cent in Iganga, and 5.5 per cent in Mbale district by the 1992 survey. Unexpectedly, the proportion of children who died of AIDS in Masaka is lower than that in Kabale, yet ACP (1991) reported 6 and 452 cumulative pediatric AIDS cases in Kabale and Masaka respectively in 1991. The explanation could be that ACP results in Kabale were much less complete than in Masaka with more AIDS surveillance facilities. However, the results of the 1995 survey and those from vital registration show a very small proportion of child deaths in Kabale, implying a dramatic drop in the mortality rate. In contrast, Masaka district proportions increased from 20 to 25 per cent between the 1992 and 1995 surveys followed by a drop to 6.9 per cent in 1995/96. Since most of the children are infected through vertical transmission and studies have revealed a declining trend of HIV seroprevalence among the adults (Konde-Lule 1995), the results are plausible. The highest proportion of AIDS deaths in Masaka is not surprising since the district is known to have suffered the AIDS epidemic longest. Hoima district suffered more AIDS deaths during the inter-survey period, probably reflecting the increase in the epidemic which was new in the district so the people were not yet fully educated about it.

The distribution of children by the period in which they died shows an increase in deaths from AIDS between 1990 and 1992 and a decline in 1993-1995 (Table 3). The increase is explained by an increase in HIV infection before the population became aware of the disease and the decrease implies that the education programs about AIDS have limited its spread.

Table 4 shows a high percentage of deaths from AIDS and related illness among children whose parents were never married, divorced, separated and widowed and polygamously married, especially in the case of fathers. The widowed parents may have lost their partners from AIDS and the polygamously married are more exposed to the risk of infection than the monogamously married. This result is in agreement with the findings of Allen et al. (1991) in Rwanda, Kapiga et al. (1994) in Tanzania and Nunn (1989) in Burundi that polygamously married couples are at greater risk of HIV infection than monogamously married persons.

Both in bivariate and multivariate analysis the pattern of death for children whose parents had attained at least primary education showed a declining trend of AIDS death. This implies that the educated have changed their sexual behaviour by perhaps practising safe sex as compared to the uneducated. However, children with parents who attained at least primary education are at a higher risk of dying from AIDS and related illness than those whose parents have not been to school, except for fathers in the 1995 survey. This result corroborates the observation by Kapiga et al. (1994) in Tanzania that the risk of HIV infection increased with education level. Also Ndongko (1996) in Zambia and Over (1992) in Kinshasha reported that the AIDS epidemic affected the groups with high productive skills who are likely to be the most educated. The more educated persons are more exposed to HIV infection because they are more mobile than the uneducated.

The finding on the occupation of parents suggests that children born to subsistence farmers are at a lower risk of death from AIDS and related diseases than the children with parents in other occupations. This finding is in agreement with that of Allen et al. (1991) who found women married to subsistence farmers at a lower risk of HIV infection, so their children are also at a lower risk. Although they have less knowledge of HIV and AIDS, the subsistence farmers are less exposed to HIV infection because they tend to stay in the villages

which are less HIV prevalent than the urban areas where the formally employed and business-people live. According to the 1995 survey, the children of business people are at the highest risk to AIDS death, which confirms the hypothesis that business and trading are associated with HIV infection.

Levels and trends of infant and child mortality

The mortality rates show that the study districts experience high under-five mortality (Table 7). The results further depict increasing mortality only one year after the first AIDS case was identified in Uganda and a decline ten years later. Table 7 also presents mortality estimates from the 1995 UDHS data for the six districts and according to these results mortality increased in the early 1980s and declined five years later.

The underlying trend of infant and child mortality in our study is comparable to the trend displayed by the 1995 UDHS for the same districts. Both infant and child mortality rates increased between the 1978-82 and 1983-87 periods and declined between 1988-92 and 1993-95. These trends are consistent with reports by Konde-Lule (1995) and Madraa and Ruranga-Rubaramira (1996) that the AIDS epidemic started declining in the early 1990s. This result may suggest that the AIDS epidemic was partly responsible for the high mortality in the 1980s and confirms the findings of Ainsworth (1991), Stover (1994) and *Futurist* (1994) that AIDS is likely to increase the rates of infant, child and under-five mortality.

Conclusion

AIDS accounted for a sizable proportion of deaths of children who are under five years old although malaria and measles cause most of the child deaths. In the early 1980s infant and child mortality in Uganda may have increased because of AIDS and related diseases. However, deaths due to AIDS seem to be declining among children of some groups of people such as the educated. Factors such as education, marital status and occupation of parents influence the death of children from AIDS and related illness. Deaths due to AIDS are likely to be more numerous than those reported since other diseases such as diarrhoea, respiratory infection, fever reported as malaria, and tuberculosis are associated with AIDS. Also children reported as AIDS cases are likely to be those whose parents were known to have been seropositive, but it is difficult to use verbal autopsy to evaluate this hypothesis because many people with HIV/AIDS may not report their status correctly.

It is recommended that a study using clinical autopsy be conducted to understand the trend of the AIDS epidemic among children who are under five years old. Furthermore, since the findings about the influence of socio-economic differentials of surviving parents on AIDS mortality among children may be inconclusive, a study examining characteristics of both dead and surviving parents will give a clearer picture on the situation of AIDS mortality of children.

References

- Abbas, M.O. 1993. Epidemiology and modes of transmission of HIV. Paper presented at Premier Cours National sur les MST, Nouakchott, Mauritania, 3-12 April.
- AIDS Control Programme (ACP). 1990. HIV/AIDS surveillance report, June. Ministry of Health, Entebbe.

- AIDS Control Programme (ACP). 1991. HIV/AIDS surveillance report, June. Ministry of Health, Entebbe.
- Ainsworth, M. 1991. Coping with the AIDS epidemic in Tanzania: survivor assistance. Unpublished manuscript.
- Allen, S., P. Van de Perre, A. Serufilira, et al. 1991. Human Immunodeficiency Virus and malaria in representative sample of child bearing women in Kigali, Rwanda. *Journal of Infectious Diseases* 164,1:67-71.
- Berkley, S.F., R. Widdy-Wirski, S.I. Okware, R. Downing, M.J. Linnan, K.E. White and S. Sempala. 1989. Risk factors associated with HIV infection in Uganda. *Journal of infectious Diseases* 160,1:22-30.
- Biddulph, J. 1993. Priorities and practice in tropical paediatrics. *Journal of Paediatric and Child Health* 29,1:12-15.
- Bongaarts, J. 1995. Global trends in AIDS mortality. Research Division Working Papers No. 80. New York: Population Council.
- De Lay, K.S., J. Corbin, A. Ross, P. Seybolt, L. Mayberry and D. Rudolph. 1995. HIV/AIDS in Africa. Washington DC: Bureau of Census.
- Ewbank, D.C., R. Henin and J. Kekovole. 1996. Integration of demographic and epidemiologic research on mortality in Kenya. In *Determinants of Mortality Change and Differentials in Developing Countries: The Five Country Case Study Project*. New York: United Nations.
- Futurist. 1994. AIDS in developing nations. 28,6:57-58.
- Gibb, D. and D. Warra. 1994. Paediatric HIV infection. *AIDS* 8, Supplement 1:S275-S284.
- Goldfarb, J. 1991. AIDS in Africa: impact on children. *Pediatric AIDS and HIV Infection: Fetus to Adolescents* 2:180-184.
- Government of Uganda. 1994. *Equity and Vulnerability: A Situation Analysis of Women, Adolescents and Children in Uganda*. Entebbe: Uganda National Council for Children.
- Hendricks, M. 1995. Stories of survival. *Johns Hopkins Magazine* 47,1:56-62.
- Kapiga, S.H., J.F. Shao, G.K. Lwihula and D.J. Hunter. 1994. Risk factors for HIV infection among women in Dar-es-Salaam, Tanzania. *Journal of AIDS* 7,3:301-309.
- Kok, P. 1993. Child mortality through AIDS. *Children Worldwide* 20,2-3:13-15.
- Konde-Lule, J.K. 1995. The declining HIV seroprevalence in Uganda: what evidence? *Health Transition Review* 5 (supplement):27-33.
- Madraa, E. and Ruranga-Rubaramira. 1996. HIV prevention works: the Uganda case study. Paper presented at 11th International Conference on AIDS, Vancouver, 7-12 July.
- Ndongko, Theresa M. 1996. A preliminary study of the socio-economic impact of HIV/AIDS in Africa. *Africa Development* 11,1:39-55.
- Nunn, P. 1989. Acquired immunodeficiency syndrome and human immunodeficiency virus infection in Bujumbura, Burundi. *AIDS Technical Bulletin* 2 June:88.
- Official Satellite Symposium. 1996. The status and trends of the global HIV/AIDS pandemic. Final report, 11th International Conference on AIDS, Vancouver, 7-12 July.
- Over, M. 1992. The socio-economic impact of adult death from AIDS in sub-Saharan Africa: a research proposal. World Bank, Washington DC.
- Population Reference Bureau. 1994. *World Population Data Sheet*. Washington DC.
- Republic of Uganda. 1995. *The 1991 Population and Housing Census: Analytical Report. Demographic Characteristics*. Entebbe: Ministry of Finance and Economic Planning.

- Sanon, P. 1993. One third of thirteen million. *Santé-Salud* 2:3.
- STD/AIDS Control Programme. 1996. HIV/AIDS surveillance report of March 1996. Entebbe: Ministry of Health.
- Stover, J. 1994. The impact of HIV/AIDS on adult and child mortality in the developing world. In *AIDS Impact and Intervention in the Developing World: The Contribution of Demography and Social Science*. Liège: International Union for the Scientific Study of Population.
- Sullivan, L.W. and R.W. Roskens. 1991. Child Survival and AIDS in Sub-Saharan Africa: findings and recommendations of the presidential mission to Africa. Report to the President, January. Washington DC: Department of Health and Human Services.
- Uganda Department of Statistics and Macro International. 1996. *Uganda Demographic and Health Survey 1995*. Calverton MD.
- UNICEF. 1989. *Children and Women in Uganda. A Situation Analysis*. Kampala.
- Wabwire-Mangen, Fred. 1995. Maternal and placental risk factors for vertical transmission of the immunodeficiency virus in Uganda. PhD dissertation, Johns Hopkins University, Baltimore.
- Way, P.O. and K. Stanecki. 1993. How bad will it be? Modelling the AIDS epidemic in Eastern Africa. *Population and Environment* 14,3:265-278.
- Yunes, J., C. Chelala and N. Blaistein. 1994. Children's health in the developing world: much remains to be done. *World Health Forum* 15,1:73-76.