

Trends in under-5 mortality rates and the HIV/AIDS epidemic

Jacob Adetunji¹

Introduction The prevalence of human immunodeficiency virus (HIV) among adults and mortality rates among under-5-year-olds have increased or stagnated in many countries. The objective of this study was to investigate whether there is a link between under-5 mortality trends and the prevalence of HIV among adults and, if so, to assess the magnitude of the effect of adult HIV prevalence on under-5 mortality rates.

Method Data from Demographic and Health Surveys were used to establish the trends in under-5 mortality rates for 25 countries for which there are data for at least two points in time. Countries were ranked according to the most recent adult HIV prevalence data and grouped in three categories: those with very high HIV prevalence ($\geq 5\%$); those with moderately high prevalence (1–4.9%); and those with low prevalence ($<1\%$). A mathematical model was fitted to obtain an estimate of the contribution of HIV/AIDS to the level of under-5 mortality in each country.

Results Under-5 mortality rates showed an increase in most countries with high adult HIV prevalence, but a decrease in almost every country with moderately high or low prevalence. The estimated contribution of adult HIV prevalence to the observed level of under-5 mortality was highest (up to 61%) in Zimbabwe (where HIV prevalence was highest) and tended to decrease with the level of HIV prevalence.

Discussion The contribution of HIV/AIDS to childhood mortality therefore appears to be most noticeable in settings where the epidemic is most severe.

Keywords: infant mortality, trends; acquired immunodeficiency syndrome, mortality; HIV seroprevalence, trends, statistics; Africa, South of the Sahara; Africa, Northern; South-East Asia; Mediterranean Region; Latin America.

Bulletin of the World Health Organization, 2000, **78**: 1200–1206.

Voir page 1205 le résumé en français. En la página 1205 figura un resumen en español.

Introduction

Although human immunodeficiency virus (HIV) and acquired immune deficiency syndrome (AIDS) originally emerged as adult health problems, they have become a major killer of under-5-year-old children, especially in developing countries. Children of HIV-seropositive mothers can acquire the virus directly through vertical transmission; about 25–30% of children born to infected mothers become infected with HIV and almost all of them die before 5 years of age in most developing countries with high HIV prevalence. Thus, under-5 mortality rates among children of HIV-infected mothers are two to five times higher than those among children of HIV-negative mothers (1). The Joint United Nations Programme on HIV/AIDS (UNAIDS) estimated that by 1996 a cumulative total of about 3 million children had been infected with HIV worldwide and that most of them had died (2). Since then, many more children are believed to have died as a result of HIV infection and other AIDS-related problems. According to UNAIDS estimates, about 14 million women

of childbearing age currently live with HIV/AIDS in the world, giving birth to children with an elevated risk of HIV infection and death before the age of 5 years. Even among children who are not infected, many will die because the resources needed to ensure their survival and health are used to care for HIV-seropositive adults.

Adult HIV prevalence and under-5 mortality rates therefore seem to have increased or stagnated in many countries. A recent World Bank report suggests that life expectancy at birth in countries with a high HIV-prevalence, such as Botswana, Zambia and Zimbabwe, is lower in 2000 than it was in 1975 (3). Although 14 million lives have already been lost to HIV/AIDS, it is estimated that only 10% of the total impact of illness and death from the pandemic has been seen so far. One of the concerns is whether the effects of the epidemic will, as some fear (4), reverse the substantial child survival gains that have resulted from huge international efforts over the past decades in several developing countries. The objective of the present study was to use available data to monitor trends in under-5 mortality in countries with different levels of adult HIV prevalence and estimate how much of the observed under-5 mortality rate is attributable to the prevalence of HIV among adults.

Although HIV/AIDS occurs in both developed and developing countries, the analysis here

¹ Assistant Professor, Sociology Department, Bowling Green State University, Bowling Green, OH 43403, USA (email: adetunj@bgsu.edu).

focuses on developing countries for two main reasons: UNAIDS estimates that more than 90% of all HIV-related deaths occur in the developing world; and medical advances and available treatments in more developed regions make it difficult to observe the precise impact of HIV prevalence. In the USA, for example, although the country has one of the highest adult HIV prevalences in the developed world, infant and child mortality rates have continued to decline. Between 1981 (when the first cases of AIDS were identified in the USA) and 1998, infant mortality rates declined from 11.9 to 7.2 per 1000 live births (5, 6). This is likely to be the experience also in other industrialized countries. Major effects of adult HIV prevalence on under-5 mortality are therefore more likely to be seen in developing countries.

Materials and methods

Data sources

Data from the Demographic and Health Surveys (DHS) were used to derive trends in under-5 mortality rates in countries with different levels of HIV prevalence. The DHS project, which began in 1984, was a 13-year programme of survey data collection in several developing countries with core funding from the US Agency for International Development (USAID). A total of 25 countries that had participated more than once in the DHS programme were selected: 12 in sub-Saharan Africa, 3 in south-east Asia, 6 in Latin America and the Caribbean, and 4 in North Africa and the eastern Mediterranean. In cases where a country had participated more than twice in the DHS programme, the first and last surveys were used. To take account of the variations in the time between surveys in different countries, the percentage change in under-5 mortality rates was annualized. The rates reported for each period are direct rates and cover the 5 years preceding the date of interview.

Adult HIV prevalence data for 1994 and 1997 were obtained from WHO and UNAIDS sources (7, 8) and countries were ranked using the 1997 UNAIDS estimate (Table 1). The population estimate for 1997 was also recorded for each country (8). The 25 countries exhibit a wide variation in adult HIV prevalence: six countries with a prevalence of $\geq 5\%$ were classified as having very high prevalence; six with a prevalence between 1% and 5% were classified as moderately high; and 13 with a prevalence of $<1\%$ were regarded as having low prevalence. Under-5 mortality rates for two periods are also presented in order to observe the trends according to the level of adult HIV prevalence (Table 1).

Analysis of data

Trends in mortality rates do not indicate the magnitude of the effects of adult HIV prevalence on under-5 mortality levels. In fact, it is possible for the overall level of under-5 mortality to decline even

if the proportion caused by HIV/AIDS increases, as found in a study in Uganda (9). The present study therefore provides an estimate of the impact of HIV/AIDS obtained by a separate mathematical expression. The procedure is based on the following premise: since the number of under-5-year-olds who die of HIV/AIDS is directly related to the number of children who were infected with HIV from their mothers (10), the proportion of under-5-year-old children dying from HIV/AIDS is a function of the proportion of infected mothers, the rate of mother-to-child transmission and the proportion of infected children who die before 5 years of age. The formula for the calculation has been expressed by Stover as follows (11):

$$U5MRA = PrevWRA \times PTR \times PD5 \times 10$$

where *U5MRA* = under-5 mortality due to HIV/AIDS; *PrevWRA* = adult HIV prevalence; *PTR* = perinatal transmission rate; and *PD5* = proportion of HIV-infected children dying before the age of 5 years. The prevalence is usually expressed as a percentage point, not in decimals.

Estimating perinatal transmission rate

To use the Stover formula, it is necessary to obtain a reasonable estimate of the perinatal (or mother-to-child) transmission rate of HIV for each country that takes into account geographical differences, quality of health care, and similar factors. Previous community-based studies have found that direct transmission of HIV from mother to child tends to occur in 25–30% of cases (1). A study in Kinshasa (12) found the rate of vertical transmission to be 27% of children with seropositive mothers. According to UNAIDS (13), the infection rate is 30–35% where no drugs such as zidovudine are administered and mothers breastfeed their infants. Without breastfeeding, the risk of infection decreases to 20%. Although some studies have used a rate of 35% (14) or 40% for sub-Saharan Africa (11), available evidence now suggests that the transmission rate is lower. This study used a vertical transmission rate of 30% for high prevalence sub-Saharan African countries and 25% for other countries, most of which are outside the sub-Saharan region.

Proportion of HIV-infected children dying under the age of 5 years

The Stover formula also requires an estimate of the proportion of HIV-infected children who will die before the age of 5 years. In a review article, Boerma & Whitworth (1) concluded that the median age at death for HIV-infected children is about 2 years in Africa, although it could be about 6–8 years elsewhere. According to a United Nations estimate (14), by the age of 4 years about 84% of all paediatric HIV cases in sub-Saharan Africa and in Cambodia will have converted to AIDS and all who convert to AIDS will die before the age of 5 years. For the present study, it is assumed that 90% of HIV-infected children will die by the age of 5 years.

Table 1. Trends in adult HIV prevalence and under-5 mortality rates (U5MR) in 25 developing countries^a

Country (year of first and most recent survey)	Adult HIV prevalence			U5MR per 1000		
	1994	1997	% change	Period 1	Period 2	Annual % change
Very high adult HIV prevalence						
Zimbabwe (1988, 1994)	17.35	25.84	48.9	75	77	0.4
Zambia (1992, 1996)	17.10	19.07	11.5	191	197	0.8
Kenya (1989, 1998)	8.31	11.64	40.0	89	112	2.9
Côte d'Ivoire (1994, 1998–99)	6.77	10.06	48.6	150	181	4.6
Uganda (1988, 1995)	14.54	9.51	–34.6	180	147	–2.6
United Republic of Tanzania (1991–92, 1996)	6.44	9.42	46.3	141	137	–0.7
Moderately high adult HIV prevalence						
Cameroon (1991, 1998)	3.03	4.89	61.4	126	151	2.8
Ghana (1988, 1998)	2.25	2.38	5.8	155	108	–3.0
Dominican Republic (1991, 1996)	0.99	1.89	90.9	60	57	–1.0
Senegal (1986, 1997)	1.36	1.77	30.1	191	139	–2.5
Mali (1987, 1995–96)	1.26	1.67	32.5	250	238	–0.6
Niger (1992, 1998)	1.05	1.45	38.1	318	274	–2.3
Low adult HIV prevalence						
Peru (1991–92, 1996)	0.25	0.56	124.0	78	59	–5.4
Guatemala (1987, 1998–99)	0.43	0.52	20.9	110	59	–4.0
Brazil (1986, 1996)	0.65	0.43	–33.8	86	49	–4.3
Colombia (1990, 1995)	0.21	0.36	71.4	35	36	0.6
Madagascar (1992, 1997)	0.06	0.12	100.0	163	159	–0.5
Bolivia (1994, 1998)	0.06	0.07	16.7	116	92	–5.2
Philippines (1993, 1998)	0.05	0.06	20.0	54	48	–2.2
Indonesia (1991, 1997)	0.05	0.05	0.0	97	58	–6.7
Egypt (1992, 1995–96)	0.03	0.03	0.0	85	81	–1.3
Bangladesh (1993–94, 1996–97)	0.03	0.03	0.0	133	116	–4.3
Jordan (1990, 1997)	0.02	0.02	0.0	39	32	–2.5
Turkey (1993, 1998)	0.002	0.01	400.0	61	52	–3.0
Yemen (1991–92, 1997)	0.01	0.01	0.0	122	121	–0.1

^a The HIV prevalences for 1994 are UNAIDS working estimates (8). The 1997 figures are from UNAIDS country prevalence estimates (8). Mortality rates refer to the 5 years preceding the date of survey and are taken from Demographic and Health Survey country reports.

Once the variables in the Stover equation have been estimated, the under-5 mortality per 1000 that is directly attributable to HIV/AIDS can be calculated (Table 2).

Results

The prevalence of HIV among adults increased between 1994 and 1997 in most of the 25 countries (Table 1). The most noticeable exceptions were Uganda (in the very high prevalence group) and Brazil (in the low prevalence group). Uganda is one of the countries where the HIV/AIDS epidemic is believed to have reached its peak and has begun to decline. In both 1994 and 1997, Zimbabwe had the highest adult HIV prevalence, increasing by almost 50% in just

3 years. In some of the low prevalence countries, there was no change in the adult prevalence levels. The largest increase was in Turkey, but the initial rate was so low that the 400% increase still resulted in a prevalence of only 0.01%.

The under-5 mortality rates in these countries, are shown in the last three columns of Table 1. Most of the countries with a very high adult HIV prevalence ($\geq 5\%$) in 1997 experienced increases in under-5 mortality rates in the inter-survey periods. The largest increase per annum in this group of countries, almost 5%, was in Côte d'Ivoire, followed by Kenya with about 3%. The evidence from Kenya indicated that the under-5 mortality rate in 1998 was the same as in 1993. Countries with an adult HIV prevalence of $<5\%$ tended to experience a decline in their under-5 mortality rate. The exceptions were

Table 2. Expected under-5 mortality rates (U5MR) and their ratio to the observed rate in 25 developing countries^a

Country	Total population in 1997 ($\times 10^3$)	U5MR per 1000 due to HIV	HIV-induced/observed U5MR (%)
Very high adult HIV prevalence			
Zimbabwe	11 682	46.9	61
Zambia	8 478	46.2	23
Kenya	28 414	31.4	28
Côte d'Ivoire	14 300	27.2	15
Uganda	20 791	39.3	27
United Republic of Tanzania	31 507	17.4	13
Intermediate adult HIV prevalence			
Cameroon	13 937	13.2	9
Ghana	18 338	6.4	6
Dominican Republic	8 097	2.7	5
Senegal	8 762	4.8	3
Mali	11 480	3.4	1
Niger	9 788	3.9	1
Low adult HIV prevalence			
Peru	24 367	0.6	1
Guatemala	11 241	1.2	2
Brazil	163 132	1.5	3
Colombia	37 068	0.5	1
Madagascar	15 845	0.3	<1%
Bolivia	7 774	0.2	<1%
Philippines	70 724	0.1	<1%
Indonesia	203 480	0.1	<1%
Egypt	64 465	0.1	<1%
Bangladesh	122 013	0.1	<1%
Jordan	5 774	0.1	<1%
Turkey	62 774	0.02	<1%
Yemen	16 294	0.02	<1%

^a The 1997 population figures are from UNAIDS country estimates (8). Under-5 mortality rates are from Demographic and Health Survey reports and they refer to the 5 years preceding the date of survey.

Cameroon (in sub-Saharan Africa) and Colombia (in Latin America).

The magnitude of the decline or increase in mortality rate varied in ways that cannot be explained by the level of HIV prevalence. A regression analysis of the data shows that neither the adult HIV prevalence nor its change over time is a statistically significant predictor of under-5 mortality rates ($P > 0.05$). This further suggests that the level of adult HIV prevalence alone is not enough to determine what happens to trends in mortality among children under 5 years of age. Countries vary in their underlying socioeconomic, medical, and technological resources. Therefore, HIV prevalence among adults could be just another layer in the web of causes of under-5-year-old deaths. Its impact would be mediated by the quality of the existing health and economic infrastructure.

The estimate of how much of the observed under-5 mortality rate is due to HIV prevalence is presented in the third column of Table 2. The expected contribution tends to decrease with the level of adult HIV prevalence, irrespective of the level of under-5 mortality. In the last column of Table 2,

the estimated contribution of adult HIV prevalence is presented as a percentage of the under-5 mortality rate for each country. The largest proportion was in Zimbabwe, where 61% of the under-5 mortality rate for 1994 could be accounted for by the high HIV prevalence among adults. Although under-5 mortality rates as well as adult HIV prevalence have been declining in Uganda, more than one-quarter of all childhood deaths were still attributable to the HIV prevalence among adults. In many countries with very low adult HIV prevalence, the impact of HIV on childhood mortality is negligible (Table 2).

Discussion

Since the appearance of HIV/AIDS, researchers and policy-makers have shown a keen interest in assessing its demographic, social and economic impact. Unfortunately, apart from data from a few prospective study sites (15, 16) — findings from which are usually difficult to generalize — pertinent data necessary to answer many important questions have been scarce. For example, most of the countries

severely affected do not have reliable data on cause of death, making it difficult to assess the direct impact of the HIV/AIDS epidemic on mortality. Demographers and health researchers have therefore had to resort to indirect methods, including the use of models and projections, many of which are reported in the literature (14, 17–21). The results often vary, and it is difficult to know how much of the variation is due to the underlying assumptions and data quality. Other researchers have tried comparative analysis of mortality trends (9, 22, 23). For example, Ntozi & Nakanaabi (9), working in Uganda, compared mortality trends in households with HIV infection to those in households with none, while Garenne et al. (22) monitored trends in overall mortality rates among children to check whether the arrival of, or increase in, adult HIV was associated with any increases in under-5 mortality.

One of the common elements of the studies that have analysed trends in childhood mortality and HIV prevalence is that they have tended to use data from the same location; they do not usually compare trends across countries with different levels of adult HIV prevalence. It is therefore difficult to know whether the observed trends hold in other settings with different mortality or HIV prevalence levels. The approach adopted in the present study overcomes this weakness by comparing mortality trends across countries with different levels of adult HIV prevalence.

One of the main findings is that under-5 mortality rates increase in most countries with an adult HIV prevalence of $\geq 5\%$, while decreases are observed at lower prevalences. This observation may be good news for a few reasons. First, according to recent UNAIDS estimates (14), only nine countries fall into this category; they are all in sub-Saharan Africa, and have relatively small populations (Table 2). This suggests that trends in under-5 mortality rates in these countries may have only negligible impact on regional or global under-5 mortality trends. However, because of the pace at which HIV prevalence has increased in recent years in several countries, including South Africa, there is no room for complacency.

Moreover, the estimates presented here are limited in their capability to capture the indirect effects of adult HIV/AIDS on under-5 mortality. Only the direct effects that operate through vertical or perinatal transmission of the HIV virus are assessed. There are many ways in which adult HIV/AIDS could affect the level of under-5 mortality including, at the household level, the death of or frequent illness of the care-giver or breadwinner, unexplained trauma, and depletion of essential material (economic) and nonmaterial resources. The time, energy and financial resources needed to care for children might

be diverted to caring for sick adults. Loss of income because of illness of the breadwinner can lead to poverty and deprivation. Adult death may result in single parenthood. The consequences of these possible scenarios could lead to negative health outcomes. Various studies of these issues in Africa have been published (12, 24, 25).

At the community and district level, high HIV/AIDS prevalence can affect negatively the level and quality of health care services. For example, resources needed for essential drugs could be swallowed up easily in purchasing the expensive drugs needed for the care of those living with HIV and AIDS. In Côte d'Ivoire, Zambia, and Zimbabwe, HIV patients are reported to have occupied 50–80% of urban hospital beds (3). There could also be a loss of health workers, either through illness and death from HIV/AIDS or attrition of new workers from fear of infection. The resultant poor health care services could then result in preventable deaths among children who are not from HIV-affected households.

Analysis of HIV/AIDS-attributable under-5 mortality relies on retrospective data collected from mothers who were alive at the time of survey; therefore, mortality among children whose mothers had died would be missed. Since mortality may be higher among children of such women, this omission may lead to underestimation of the mortality levels as well as the impact of HIV. However, this factor alone may not be large enough to alter the conclusions of this paper because various studies have found that HIV-positive women have low fertility (26, 27).

Conclusion

It is customary to attribute almost all the reversals and stagnation in under-5 mortality rates, especially in sub-Saharan Africa, to the HIV/AIDS epidemic. However, the results presented in this article suggest that the direct effects of adult HIV/AIDS may not be as large as they have generally been thought to be. This conclusion is in agreement with the findings of another study of the effects of adult HIV prevalence on infant and child mortality rates in developing regions (28). While further research and better data are needed before any firm conclusions can be reached, these results suggest that HIV/AIDS alone may not be a sufficient explanation for reversals in mortality among under-5-year-olds, except in very high HIV prevalence countries with low mortality rates. ■

Acknowledgements

I acknowledge the research assistance provided by Zhang Hong and the comments made by the reviewers.

Résumé

L'épidémie d'infection à VIH/SIDA et l'évolution des taux de mortalité chez les moins de 5 ans

La prévalence du virus de l'immunodéficience humaine (VIH) chez l'adulte et les taux de mortalité chez les moins de 5 ans ont augmenté ou sont restés inchangés dans de nombreux pays. On prétend souvent que l'augmentation de la prévalence du VIH chez l'adulte, observée dans certains pays, a annulé tous les progrès réalisés au cours des dernières décennies sur le plan de la survie de l'enfant. On ignore si des observations de ce type se retrouvent partout ou sont localisées. L'objectif de cette étude est d'analyser s'il existe un lien entre l'évolution de la mortalité chez les moins de 5 ans et la prévalence du VIH chez l'adulte et, si c'est le cas, d'évaluer l'ampleur de cet effet.

Pour analyser l'évolution des taux de mortalité chez les moins de 5 ans dans 25 pays disposant de données pour au moins deux périodes précises – 12 pays d'Afrique subsaharienne, six pays d'Amérique latine, trois pays d'Asie et quatre pays d'Afrique du Nord et du Moyen-Orient –, on s'est servi des données d'enquêtes démographiques et sanitaires. Les pays ont été classés en fonction de la prévalence du VIH chez l'adulte, celle-ci ayant été estimée par le Programme conjoint des Nations Unies sur le VIH/SIDA (ONUSIDA) à la fin 1997. Ils ont également été regroupés en trois catégories : six pays (tous situés en Afrique subsaharienne) ayant une prévalence très forte du VIH chez l'adulte ($\geq 5\%$), six autres (dont cinq en Afrique subsaharienne) une prévalence modérément élevée (1–4,9 %) et 13 une prévalence faible ($< 1\%$). On a calculé pour chaque pays le rythme annuel de l'évolution de la prévalence du VIH et de la mortalité chez les moins de 5 ans afin de déterminer s'il existe un lien entre ces

deux paramètres. On a également ajusté un modèle mathématique afin d'obtenir une estimation de la part que représente le VIH/SIDA dans la mortalité chez les moins de 5 ans dans chaque pays.

Les résultats ont montré que les taux de mortalité chez les moins de 5 ans ont augmenté dans la plupart des pays dans lesquels la prévalence du VIH chez l'adulte est élevée, mais qu'ils ont diminué dans presque tous les pays où cette prévalence est modérément élevée ou faible. Le rôle joué par la prévalence du VIH dans les taux de mortalité observés chez les moins de 5 ans a été le plus important au Zimbabwe (jusqu'à 61 %), pays où la prévalence du VIH est la plus forte. Cela laisse à penser que le taux de mortalité chez les moins de 5 ans aurait dû être dans ce pays bien inférieur (de l'ordre de 47 pour 1000) à celui de 77 pour 1000 naissances vivantes observé en 1994. De la même façon, au Kenya, les taux de mortalité chez les moins de 5 ans auraient dû être de 80 pour 1000, soit 28 % de moins que les 112 pour 1000 observés dans ce pays en 1998. La part que joue la prévalence du VIH dans la mortalité des moins de 5 ans tend à décroître lorsque la prévalence du VIH décroît. Le taux d'infection à VIH/SIDA chez l'adulte est néanmoins resté statistiquement non significatif en tant qu'élément prédictif du taux de mortalité chez les moins de 5 ans dans une analyse de régression.

Le VIH et le SIDA jouent un rôle dans les taux de mortalité infantile observés, rôle d'autant plus important que l'épidémie est grave. D'autres recherches sur le sujet s'imposent, y compris la collecte de données pertinentes et fiables.

Resumen

Evolución de las tasas de mortalidad de menores de 5 años y de la epidemia de VIH/SIDA

La prevalencia del virus de la inmunodeficiencia humana (VIH) en la población adulta y las tasas de mortalidad de menores de 5 años han aumentado o se han estancado en muchos países. A menudo se afirma que el aumento de la prevalencia de infección por el VIH entre adultos registrado en algunos países ha contrarrestado los progresos conseguidos en materia de supervivencia infantil durante los últimos decenios. No se sabe si ese fenómeno se da de forma generalizada o bien localizada. El objetivo de este estudio consistió en investigar si existe una relación entre la evolución de la mortalidad de menores de 5 años y la prevalencia de infección por el VIH en la población adulta y, en caso afirmativo, evaluar la magnitud del efecto.

Se utilizaron datos de las Encuestas Demográficas y de Salud para establecer las tendencias seguidas por las tasas de mortalidad de menores de 5 años en 25 países que disponen de datos referentes al menos a dos puntos en el tiempo: 12 países del África subsahariana, seis de América Latina, tres de Asia y cuatro del norte de África y de Oriente Medio. Los países se clasificaron atendiendo a

la prevalencia de infección por el VIH en la población adulta, según las estimaciones hechas para el final de 1997 por el Programa Conjunto de las Naciones Unidas sobre el VIH/SIDA (ONUSIDA). También se agruparon en tres categorías: seis países (todos del África subsahariana) tenían una muy alta prevalencia de infección por el VIH entre los adultos ($\geq 5\%$), otros seis (cinco en el África subsahariana) tenían una prevalencia moderadamente alta (1%–4,9%) y 13 presentaban una prevalencia baja ($< 1\%$). Se calcularon las tasas anualizadas de variación de la prevalencia de infección por el VIH y de la mortalidad de menores de 5 años para cada país a fin de determinar si existe una relación entre las dos variables. Se procedió asimismo a ajustar un modelo matemático para obtener una estimación de la contribución de la infección por el VIH/SIDA a la mortalidad de menores de 5 años en cada país.

Los resultados mostraron que la mortalidad de menores de 5 años aumentaba en la mayoría de los países con alta prevalencia de infección por el VIH en los adultos, mientras que disminuía en casi todos los países

con prevalencia moderadamente alta o baja del VIH en esa población. La contribución estimada de la prevalencia de infección por el VIH en los adultos a la mortalidad observada de menores de 5 años fue máxima (hasta un 61%) en Zimbabwe, donde la prevalencia de infección por el VIH era también la más alta. Esto lleva a pensar que la tasa de mortalidad de menores de 5 años en Zimbabwe en 1994 habría sido mucho menor (en 47 por 1000) que el nivel observado de 77 por 1000 nacidos vivos. Análogamente, en Kenya, la mortalidad de menores de 5 años habría sido en 1998 de 80 por 1000 (28% menos) en lugar de los 112 por 1000 observados en el país. La contribución estimada

de la prevalencia de infección por el VIH a las tasas de mortalidad de menores de 5 años tiende a disminuir al descender esa prevalencia. No obstante, la influencia del nivel de infección de la población adulta por el VIH/SIDA como factor predictivo del nivel de mortalidad de menores de 5 años siguió careciendo de significación estadística en el análisis de regresión.

El VIH y el SIDA contribuyen a la mortalidad en la niñez, y esa contribución es especialmente manifiesta en los entornos donde más grave es la epidemia. Es necesario investigar más esta cuestión, procediendo entre otras cosas a reunir datos pertinentes fiables.

References

1. **Boerma JT, Whitworth JAG.** Mortality impact of the AIDS epidemic: evidence from community studies in less developed countries. *AIDS*, 1998, **12** (suppl.): S3–S14.
2. *The HIV/AIDS situation in mid-1996: global and regional highlights.* Geneva, Joint United Nations Programme on HIV/AIDS, 1996.
3. *Intensifying action against HIV/AIDS in Africa: responding to a development crisis.* Washington, DC, The World Bank, 1999.
4. **Valleroy LA, Harris JR, Way PO.** The impact of HIV-1 infection on child survival in the developing world. *AIDS*, 1990, **4**: 667–672.
5. **Hoyert D, Kenneth K, Murphy S.** Deaths: final data for 1997. *National Vital Statistics Reports*, 1999, **47**, No. 19.
6. **Martin J, Smith B, Matthews TJ, Ventura S.** Births and deaths: preliminary data for 1998. *National Vital Statistics Reports*, 1999, **47**, No. 25.
7. *HIV prevalence estimates for countries and regions.* Geneva, Joint United Nations Joint Programme on HIV/AIDS, 2000 (Internet source at http://www.unaids.org/hivaidsinfo/statistics/june98/fact_sheets/index.html, March 2000).
8. Provisional working estimates of adult HIV prevalence as of end of 1994 by country. *Weekly Epidemiological Record*, 1995, **70** (50): 355–356.
9. **Ntozi JPM, Nakanaabi IM.** The AIDS epidemic and infant and child mortality in six districts of Uganda. *Health Transition Review*, 1997, **7** (suppl.): 189–205.
10. **Nicoll A et al.** The impact of HIV-1 infection on mortality in children under 5 years of age in sub-Saharan Africa: a demographic and epidemiologic analysis. *AIDS*, 1994, **8**: 995–1005.
11. **Stover J.** The impact of HIV/AIDS on adult and child mortality in the developing world. *Health Transition Review*, 1994, **4** (suppl.): 47–63.
12. **Ryder RW et al.** Mortality in HIV-1-seropositive women, their spouses and their newly born children during 36 months of follow-up in Kinshasa, Zaire. *AIDS*, 1994, **8**: 667–672.
13. *Questions and answers: mother-to-child transmission of HIV, August 1999.* Geneva, Joint United Nations Programme on HIV/AIDS, 2000 (Internet source at <http://www.unaids.org/publications/documents/mtct/qaweb99.html>, March 2000).
14. *The demographic impact of HIV/AIDS. Report on the Technical Meeting, 10 November 1998.* New York, United Nations, 1999 (Report No. ESA/P/WP.152).
15. **Mulder DW et al.** Two year HIV-1 associated mortality in a Ugandan rural population. *Lancet*, 1994, **343**: 1021–1023.
16. **Sewankambo NK et al.** Demographic impact of HIV infection in rural Rakai district, Uganda: results of a population-based cohort study. *AIDS*, 1994, **8** (12): 1707–1713.
17. **Bongaarts J.** *Global trends in AIDS mortality.* New York, Population Council, 1995 (Research Division Working Papers, No. 80).
18. **Bongaarts J.** *Modeling the spread of HIV and the demography of AIDS in Africa.* New York, The Population Council, 1988 (Center for Policy Studies Working Papers, No. 140).
19. **Way P, Stanecki K.** *The demographic impact of an AIDS epidemic on an African country: application of the wigAIDS model.* Washington, DC, United States Bureau of the Census, 1991 (Bureau of the Census, Center for International Research Staff Working Paper, No. 58).
20. **Way P, Stanecki K.** *The impact of HIV/AIDS on world population.* Washington, DC, United States Bureau of the Census, 1994.
21. **Bulatao R, Bos E.** *Projecting the demographic impact of AIDS.* Washington, DC, The World Bank, 1992 (World Bank Policy Research Working Papers, No. 140).
22. **Garenne ML et al.** Mortality impact of AIDS in Abidjan, 1986–1992. *AIDS*, 1996, **10**: 1279–1286.
23. **Timaeus I.** Impact of the HIV epidemic on mortality in sub-Saharan Africa: evidence from national surveys and censuses. *AIDS*, 1998, **12** (suppl. 1): S15–S27.
24. **Drew RS, Makufa C, Foster G.** Strategies for providing care and support to children orphaned by AIDS. *AIDS Care*, 1998, **10** (suppl. 1): S9–S15.
25. **Gregson S, Garnet GP, Anderson R.** Assessing the potential impact of HIV-1 epidemic on orphanhood and the demographic structure of populations in sub-Saharan Africa. *Population Studies*, 1994, **48**: 435–458.
26. **Carpenter LM et al.** Estimates of the impact of HIV infection on fertility in a rural Ugandan population cohort. *Health Transition Review*, 1997, **7** (suppl. 2): 113–126.
27. **Gray RH et al.** Population-based study of fertility in women with HIV-1 in Uganda. *Lancet*, 1998, **351**: 98–103.
28. *HIV/AIDS in the developing world.* Washington, DC, United States Government Printing Office, 1999 (United States Bureau of the Census Report No. WP/98-2).