The Costs of HIV/AIDS Among Professional Staff in the Zambian Public Health Sector

CENTRAL BOARD OF HEALTH

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Contents

Acronyms used in this report

AIDS	Acquired immune-deficiency syndrome
ARCH	Applied Research in Child Health (Project)
ARV	Antiretroviral medication
CBoH	Central Board of Health
CIHD	Center for International Health and Development
DHMT	District Health Management Team
DHS	Demographic and Health Survey
GRZ	Government of the Republic of Zambia
HAART	Highly active antiretroviral treatment
HIV	Human immunodeficiency virus
IMF	International Monetary Fund
KDHMT	Kasama District Health Management Team
LDHMT	Lusaka District Health Management Team
NAC	National AIDS Council
SD	Standard deviation
USAID	United States Agency for International Development
UTH	University Teaching Hospital
VCT	Voluntary counseling and testing
WHO	World Health Organization

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1 Executive Summary

Despite their high level of training and medical knowledge, health professionals remain a population that is vulnerable to HIV/AIDS. AIDS-related mortality has been recognized as a significant factor in the loss of trained health staff in high prevalence countries, but little empirical research has been done to quantify the damage. In this study, we applied a case/comparison methodology to estimate the costs of HIV infection in the professional workforce at three Zambian healthcare institutions: Lusaka District Health Management Team, University Teaching Hospital (the national tertiary care hospital) and Kasama District Hospital and Health Management Team. Deaths or medical retirements among professional staff were analyzed wherever the complete personnel records were available, with the exclusion of cases resulting from violence, accident or disease of sudden onset. 108 cases were identified over a three-year period ending in October 2003. Each case was matched with two comparisons of similar age, sex and professional training. Data were collected for both cases and comparisons on absenteeism, compensation and medical care and reimbursement. Data were also collected on death and retirement benefits paid, or owed, to the cases.

Between November 2002 to October 2003, death rates were 0.4 percent for doctors, 2.8 percent for clinical officers and 3.5 percent for nurses working at the study sites. Because some records were missing, we could not determine the exact proportion of deaths due to AIDS or related chronic diseases. In the final year of employment, those who left the workforce because of illness recorded an average of 28 additional days of leave. Costs associated with this additional leave, plus death or retirement related payments averaged $4,056 for a doctor, $2,678 for a clinical officer and $3,674 for a nurse.

Although we collected data on hospital admissions and medical reimbursements, no information was obtained on many of the cases, suggesting that such records are incomplete, or that individuals choose to be treated away from their normal place of employment. The records confirmed an increase in the utilization of health care by those who died, and we have added an allowance of $200 for the incremental health costs associated with AIDS. Total costs were approximately 3.6 percent of the current payroll for these classes of professionals in these institutions.

We were we not able to quantify overtime payments or loss of the productivity as a result of absenteeism and illness. In addition, there is undoubtedly some HIV/AIDS related absenteeism included in the comparisons. For these reasons, our results underestimate the total cost of HIV in healthcare workers.

Perhaps the most disturbing finding is the cumulative impact that these death rates have on trained health cadres. For doctors, mortality is not the largest reason for attrition from the work force, nor the most important factor contributing to the high-observed vacancy rates. But for clinical officers and nurses, death is the largest single reason for loss. The average age at death for all health professionals was 37.7 years. Clinical officers die with 57 percent of their normal career remaining; nurses die halfway through the normal

career. The current output of clinical officers would have to increase by 80 percent to offset observed AIDS mortality. Graduating classes of nurses would have to expand by a 50 percent to offset current mortality.

HIV prevention, though essential, will not reduce the number of existing infections in health professionals. Expanding the output of training classes is a longer-term solution; it will be several years before higher training quotas can offset increasing vacancy rates. In the short- to medium-term, the most effective way to reduce attrition and vacancies among nurses and clinical officers is through the effective treatment of AIDS. If effective antiretroviral treatment is provided, it should be possible to increase the productive life span of HIV positive professionals by five years or more. If such treatment costs $500 per person per year, the costs (that we have been able to document) incurred with each death will purchase six to eight years of antiretroviral therapy. If all professionals who need antiretroviral therapy were to receive it in a timely fashion, vacancy rates at the end of five years should be 10 percent to 15 percent lower than they would be in the absence of such treatment.

2 Background

Much has been written about the burden placed on the health sector in Africa by HIV/AIDS. Most of the literature focuses on the increased demand for health services created by AIDS and its opportunistic infections and on the costs of providing hospital care to HIV-infected patients (Hassig *et al.* 1990;Tembo *et al.* 1994;Hansen K *et al.*). For over a decade, HIV/AIDS has been a driving force in the demand for healthcare in much of sub-Saharan Africa (Hassig,*et al* 1990). HIV/AIDS-related conditions accounted for 54 percent in South Africa in 2001 (Colvin M *et al.* 2001). The Government of the Republic of Zambia (GRZ) estimates that 45 percent of all hospital beds in the country will be occupied by AIDS patients by 2014 (Zambian National HIV/AIDS/STD/TB Council).

Fewer studies have analyzed the impact on healthcare of HIV/AIDS-related morbidity and mortality among healthcare personnel. The extent to which HIV infections in the healthcare workforce reduce labor productivity and increase operating costs for a given volume of service or fixed cadre of healthcare workers is largely unknown. Due to its labor-intensive nature, the health sector is particularly vulnerable to increased morbidity and mortality in the workforce (Isaksen J *et al.*; Foster S 2004). While health workers predominantly get infected through sexual transmission, they face an additional risk from occupational exposure. This risk is usually very low, but it could be important in an environment where HIV prevalence among patients is high and protective equipment is not adequately available (World Bank; Consten *et al.* 1995; Gumodoka *et al.* 1997). HIV-infected health workers are also at increased risk of contracting other infections, especially tuberculosis, at the workplace (Foster S 2004; Whiteside A). Obligations to provide care for sick family members and attendance at funerals may account for additional absenteeism from work (Foster S). Finally, the epidemic affects the productivity and the quality of care through increased stress and burnout, fear of contracting HIV from patients, perceptions of inadequacy of the care provided, and ethical dilemmas experienced during work (Foster S 2004; Whiteside A).

Data on HIV prevalence among healthcare professionals in Zambia are not yet available.[*] The rate of HIV infection in the general population in Zambia is high, although there is early evidence suggesting that it may have stabilized (Garbus 2004). The most recent surveillance study conducted at antenatal clinics found prevalence varying from a high of 26.2 percent among urban residents to a low of 11.7 percent among rural residents (Fylkesnes *et al.* 2001). The Demographic and Health Survey (DHS) conducted in 2002 found that an average of 17.8 percent of women and 12.9 percent of men were HIV positive (Central Statistics Office. 2004). In the absence of population-specific data, it is reasonable to assume that prevalence in the healthcare workforce is consistent with these national estimates.

[*] An HIV prevalence survey was conducted in Lusaka in August 2004 and results will be released after review by the Lusaka District and CBoH.

There are data on the mortality among health care professionals. Buvel.(Buve *et al.* 1994) reported a decade ago that the number of nurses dying each year in the Monze District of Zambia had increased from 2 per 1000 person-years in service in 1980-1985 to 26.7 in 1989-1991, most likely as a result of AIDS. They were unable to link each death to an HIV infection but identified no other factor that could explain the increase. In 1999, death rates of serving cadres in the Zambian health service were 0.4 percent for doctors, 4.0 percent for clinical officers, and 3.1 percent for nurses (2001). Death and medical retirement accounted for exactly half of all attrition among Zambian nurses and clinical officers in the public sector that year, though only 12.5 percent of the loss of doctor. A 2003 study in Zambia found that total staff turnover for all reasons at HIV/AIDS treatment sites was 30 percent per year (Huddart J *et al.* 2003).

Other approaches have projected the annual attrition of health staff as a function of the prevalence of HIV in the general population. The World Bank estimated that a country with a stable HIV prevalence of 20 percent would experience an annual loss of between 2.1 percent and 4.4 percent of the health sector workforce due to death from HIV.(World Bank) In Botswana, the HIV prevalence among health workers was estimated as 17 to 32 percent for 1999 and projected to rise to between 28 and 41 percent in 2005 based on HIV infection rates in the general population and limited demographic information on the health workforce. It was estimated that between 1.2 percent and 1.5 percent of the health sector labor force would die of AIDS in 1999, increasing to about 3.5 percent in 2005 (Abt Associates South Africa Inc.).

Information regarding morbidity and absenteeism among healthcare workers is even more limited. In a study at two hospitals in Zambia, about 5.5 percent of annual work days of nurses were lost due to absenteeism that was related to AIDS (Foster S). In a South African district hospital, the average number of days that nurses took off from work rose from 41.8 in 1998 to 57.5 in 2001 (Unger A *et al.* 2004).

The cost implications of morbidity and absenteeism among staff in the public sector are likely to be greater than in private businesses, due to greater job security (Lisk 2004). In the preparations for our study, senior health officials in Zambia reported that unwell employees make an effort to come to work for a while, before reaching a continuous period of sick leave of 90 days, which would otherwise result in a 50 percent reduction of their salaries.[†] The World Bank analysis cited above, which assumed that labor costs account for about half of all healthcare costs and that the cost of training health staff is equivalent to one year's salary for the same worker, estimated that a loss of 4 percent of the health workforce would add 2 percent to total health expenditure (World Bank).

Better information on the number and costs of HIV-positive employees would allow Ministries of Health and other public sector agencies to develop more effective strategies for maintaining productivity and managing costs. Such strategies might include:

[†] Personal Communication with MN Maboshe, January 2003

- Increasing the output of training institutions in order to compensate for HIV-related morbidity and mortality during the normal working lifetimes of individuals who attend training institutions.
- Increasing the number of approved posts for a particular category of worker in each facility to compensate for the time lost due to HIV-related illness and disability.
- Adjusting budgets and policies for pensions and benefits to cover the expected cost of benefits for the survivors of healthcare workers killed by AIDS. For example, in Zambia many health worker positions now remain vacant for a substantial period after the death of the incumbent because the Government is not budgeted to pay a relocation allowance to the family of the deceased worker. Until the family moves out of the Government provided house, a new worker cannot move in and fill the vacancy.
- Providing highly active antiretroviral therapy (HAART) to healthcare workers to reduce HIV/AIDS-related attrition. Much of the cost of therapy is likely to be offset by a reduction in the costs imposed by untreated HIV/AIDS, such as the treatment of opportunistic infections and high absenteeism and attrition.

All of these strategies have significant costs, but the costs cannot be weighed against the benefits without some quantitative estimates of the costs that the health system currently incurs due to HIV/AIDS in the workforce.

3 Objectives

The objective of this study was to estimate the costs to the public health service in Zambia of HIV/AIDS among professional employees. To achieve this objective, the study aimed to answer the following research questions:

i. To what extent does HIV/AIDS affect the attendance at work of doctors, clinical and medical officers, nurses, and other professionals at public health facilities?

ii. How much of the cost of operating publicly owned health facilities is attributable to HIV/AIDS infections in the professional staff?

iii. Has HIV/AIDS played a significant role in causing the current shortage of healthcare professionals in Zambia?

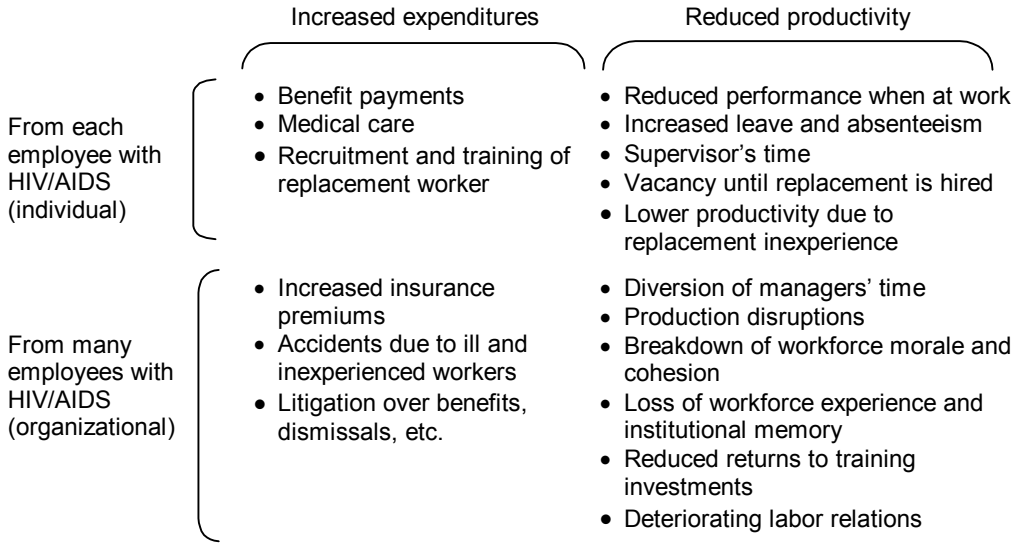
iv. What proportion of the investment in training healthcare workers is "lost" due to premature death and retirement as a result of HIV/AIDS?

4 Methods

Methodological Approach

The approach used for this study was to estimate the cost incurred by the public healthcare system (i.e. the Central Board of Health) each time a healthcare professional at a particular level is lost due to HIV/AIDS. To do this, we modified the costing methodology developed by the Center for International Health and Development (CIHD) for its study of the costs of AIDS to private sector employers in South Africa. The methodology (Rosen S *et al.* 2004) is based on the framework shown in Figure 1.

Figure 1. The costs of HIV/AIDS to employers



The framework in Figure 1 was developed for private sector companies in South Africa. Although the Zambian government, as an employer, is likely to face almost all of the same costs when it loses employees to AIDS, not all of them can be estimated from data routinely collected by public sector agencies, such as hospitals and clinics. At the same time, the government incurs other costs that do not pertain to private companies, such as the loss of its investment in providing core professional training to doctors and nurses. The study took these differences into account in estimating the cost per AIDS-related termination, as is discussed in more detail below.

The cost per AIDS-related termination at each level of the professional workforce was multiplied by the estimated number of deaths and retirements due to AIDS per year to generate a total cost for each study site. By comparing the age at death or retirement of employees who died of AIDS to the normal statutory retirement age, we also obtained an estimate of the loss of the nation's investment in training due to the premature death or retirement of these workers.

Study Sites and Population

The study focused on three sites within Zambia's public health system.

- Lusaka District Health Management Team (LDHMT). This is the unit providing primary and secondary care to the population of the city of Lusaka and its immediate surroundings. It has approximately 2,300 employees working at 33 sites to provide preventive and primary care as well as curative care at the "district hospital" level. Approximately 1,300 of these employees are considered "professionals" for the purposes of this study (doctors, nurses, clinical officers, midwives, laboratory technicians).

- Kasama District Hospital and Kasama District Health Management Team (KDHMT). This unit provides all medical care in Kasama, a rural district in Northern Zambia. Services include primary care and preventive services provided through health posts and small clinics and a single District Hospital that has facilities for basic surgery. KDHMT (including Kasama Hospital) employs approximately 250 professional staff.

- University Teaching Hospital (UTH), Lusaka. In addition to being the national referral hospital, UTH provides a large volume of basic hospital services for the city of Lusaka. Total employment is approximately 3,000; more than half are professionally trained.

Lusaka and Kasama Districts were selected to represent the range of settlement patterns (urban and rural) and HIV prevalence (high and low) found in Zambia. UTH was included because of its status as a national hospital and its importance to Zambian healthcare. All three institutions, and the rest of the public health system, are the responsibility of the Central Board of Health (CBoH), an agency of the national government.

The study was limited to professional staff of the three sites, with "professional" defined as positions requiring tertiary-level training. For the analysis, we aggregated the various rankings in the health service into four professional groupings:

- Doctors
- Clinical officers (individuals providing diagnostic services and having prescribing authority, but with more limited training than doctors)
- Nurses (including midwives)
- Other healthcare professionals (individuals receiving post secondary education in a health related profession, including pharmacists, laboratory and X-ray technicians, and physical therapists).

Data Collection

Two types of data were collected for the study, individual-level and aggregate.

Individual-Level Data

Personnel officers at each site were asked to identify all professional healthcare workers who died in service of natural causes or retired for medical reasons in the three years prior to data collection. Deaths or medical retirements due to accident, violence or sudden onset illness were excluded. Participating institutions were not asked to specifically identify employees lost due to AIDS. Stigma is still sufficiently high in Zambia therefore AIDS is not usually recorded as a diagnosis, and the patient's HIV status is not recorded in the personnel record. Thus, it is possible that our cases included individuals who did not have AIDS. Individuals identified as having died or medically retired due to natural causes (not sudden onset) were defined as the "cases" for our study.[‡] Personnel files were missing for some of the apparent "cases," so the number of cases analyzed in our study is smaller than the number of professionals who died or retired due to a chronic illness.

Personnel managers were then asked to identify approximately two "comparison" healthcare workers for each case. Comparisons were healthcare professionals actively working in the institution at the date of data collection, and were matched as closely as possible to the cases on professional level, sex, and age group.

Four types of data were collected for the cases and comparisons:

1. Demographic data (age, sex, position, training, and date of entering Government employment)
2. Absenteeism records
3. Medical care utilization (costs reimbursed and days of hospitalization at the employing institution)
4. Salary and other compensation.[§] Elements of compensation recorded (on a monthly basis) included:

- Basic salary
- Shift allowance
- Retention and recruitment allowance
- Rental of accommodation
- Housing allowance
- Funeral grant for spouse
- Settling allowance
- Charcoal allowance
- Meal allowance
- Uniform allowance
- Night allowance
- Employer contribution to retirement funds
- Maintenance of provided housing
- Leave travel
- Commuted leave (payment in lieu of leave)
- Tools allowance
- Rural hardship allowance
- On-call allowance.

[‡] Note that this is not a case-control study. Some components of the analysis use a retrospective cohort design. We use the terms "case" and "comparison" simply for convenience.

[§] Inflation rates are relatively high in Zambia. For comparison purposes, compensation data for cases that died/retired prior to 2003 were inflated to 2003 using data on public sector wage increases.

For cases, data were also collected on termination and death benefits[**] and pensions payable to the employee (in the case of medical retirement) or the survivors. Information collected included:

- Funeral benefits (paid and owed)
- Repatriation amount (paid and owed)[††]
- Accrued leave (paid and owed) at the time of death/retirement
- Pensions (there are several different pension schemes, depending on the employee's rank and the date when she or he joined the Civil Service)

Amounts owed but not yet paid were included in the analysis. The large number of deaths and retirements in the Zambian Civil Service has resulted in termination related obligations exceeding budgeted amounts, and there is substantial delay in payment. However, these amounts are an obligation of the employer and will ultimately be paid.

Data were collected from files held at the worksite (showing absenteeism), from personnel files held by the management or human resource office (for compensation, medical care reimbursement, and additional absenteeism), and from Civil Service offices responsible for payment of pension and survivor benefits. Medical records of the employing institution were reviewed to identify days of inpatient care.

For cases, relevant data were collected for at least one year prior to the date of death or retirement. Where possible, absenteeism records were collected for the penultimate year of employment as well. For comparisons, data were collected for the one-year period prior to the start of data collection in November 2003.

Aggregate Data

In addition, aggregate data were collected for each professional grouping at each site showing:

- Total establishment (the number of positions assigned)
- Positions filled (October 2003)
- Positions vacant (October 2003)
- Reasons for vacancies occurring in the prior year

Total budgeted and actual expenditures for personnel compensation were collected according to professional category at each site for the period November 2002 to October 2003.

[**] Death benefit levels were inflated using IMF published increases in the consumer price index for Zambia (2000-26.1%, 2001-21.7%, 2002-22.2%, 2003-18.4%)

[††] Many employees are posted away from their traditional homes. Government (and most private employers) pay to return the employee's body to his/her home village, and to return the family to their home.

Data were collected under the supervision of the Lusaka office of the USAID-funded Applied Research in Child Health (ARCH) Project. Data collectors were drawn from staff familiar with record keeping at the research sites. Informed consent of the subjects was not obtained because almost all of the cases had already died, and data on both cases and comparisons were contained in existing files held by management. Data collection instruments contained individual identifiers because of the need to extract data from multiple sources. Collected data were entered into a computer database in Lusaka using unique study-assigned identifiers for each case/comparison and then transmitted to Boston for analysis. Institutional Review Boards at Boston University Medical Center and the University of Zambia approved the research protocol for the study.

5 Results

Mortality in the Study Population

The existing professional workforce at the three sites is described in Table 1.

Table 1. Number of currently serving professional staff at study sites, by level (Oct. 2003)

Professional Category	LDHMT	Kasama	UTH
Doctors	28 (2%)	15 (5%)	223 (19%)
Clinical officers	145 (12%)	28 (11%)	38 (3%)
Nurses	929 (76%)	184 (71%)	743 (63%)
Other healthcare professionals	121 (9%)	33 (13%)	176 (15%)
Total professional staff	1,223 (100%)	260 (100%)	1,180 (100%)

As Table 1 illustrates, nurses were by far the largest professional grouping within the facilities studied. Clinical officers outnumbered doctors by a large proportion (2:1 in Kasama; 5:1 in Lusaka) in the two district health management teams, whereas doctors predominated at the tertiary referral center, UTH.

The number of cases and comparisons by site, profession, and sex and the average age at death or retirement (for cases) or at the time of data collection (for comparisons) is shown in Table 2. For some deaths, we were unable to obtain personnel records or information on the manner of death. These deaths are not included in the case/comparison analysis which follows. Thus, some AIDS-related deaths occurring in this work force in the study period may be excluded from the analysis.

Table 2. Observed deaths and average age at death for cases (2000-2003) or in 2003 for comparisons

Professional Category	LDHMT		UTH		Kasama		All Sites	
	Cases	Comps	Cases	Comps	Cases	Comps	Cases	Comps
Doctors								
Number	1	5	7	13	3	4	11	22
Average age	47.8	42.6	38.4	37.7	45.2	47.9	41.1	40.7
Clinical Officers								
Number	12	30	8	21	2	3	22	54
Age	31.9	36.2	40.8	38.2	39.4	39.0	35.8	37.1
Nurses								
Number	41	73	15	26	19	41	75	140
Average age	38.8	39.4	36.6	39.1	36.6	39.1	37.8	39.2
All Groups								
Number	54	108	30	60	24	48	108	216
Average age	37.3	38.5	38.1	38.5	38.3	39.9	37.7	38.8

The average age of death across all three sites and all professional groupings was 37.7 years. We do not have an overall breakdown of the age distribution within the public sector workforce (comparisons were matched on age). It is likely that individuals under age 45 make up a disproportionate share of the professional healthcare workforce in Zambia, but the concentration of deaths in the 35 to 45 range is also consistent with high AIDS-related mortality.

We also collected data on deaths and retirements in the "Other Professional" category, including those serving as laboratory technologists and pharmacists. This study found no deaths in these job groupings. The private sector job market for these professional categories is reportedly very strong in Zambia. Nearly a tenth (8.9 percent) of all pharmacists left Government service for reasons other than death and retirement in 1999 (Zambian Ministry of Health, 2001). Early departure of "Other Professionals" for the private sector could partially explain the lack of recorded deaths (since AIDS deaths do not usually occur until the mid 30s in age). No other reason for this lower death rate is immediately apparent. We believe the lack of deaths may reflect incomplete data, rather than a substantially different death rate, and we cannot make an accurate estimate of the costs associated with the loss of workers in this category. For these reasons, the analysis that follows is confined to doctors, clinical officers and nurses.

As discussed below (Section 3.5), professionals do leave Government service for other reasons. Physicians may seek training or employment abroad, and may leave Government service before an HIV infection advances to AIDS. Similarly, HIV infected nurses may seek alternative employment or resign to care for a sick family member, thus leaving Government service before becoming ill with AIDS. Our data may, therefore, understate the ultimate rate of AIDS related death among these Zambian health professionals. Clinical officers, on the other hand, are more likely to be male (and under less pressure to care for ill relatives) and have fewer alternative employment opportunities. Clinical officers are more likely to spend their entire career in Government service, and these factors may explain why clinical officer death rates are higher than those for doctors and similar to those for nurses. CBoH personnel believe that non-physician professionals, particularly nurses, may be more reluctant to seek treatment for AIDS at the institutions where they work for fear of revealing their HIV status to superiors. This reluctance to seek treatment may result in higher observed death rates. Physicians may have greater opportunities to self treat or access more advanced forms of AIDS treatment

Absenteeism

Additional days absent due to HIV/AIDS

For the analysis of absenteeism caused by HIV/AIDS morbidity, statistical comparisons were made between cases and comparison subjects. Since all employees are likely to be absent from work occasionally, we estimated the difference in the average number of leave days taken by cases and comparisons. Summary statistics were calculated as means and their standard deviations. The differences between the two and their 95 percent

confidence intervals were then computed. We also employed Tobit regression analysis to adjust for demographic factors, but as the results differed little from the analysis of means, they are not reported here.

In the year prior to death or retirement, the cases took an average of 42 days of leave. In the year prior to data collection, the comparisons took an average of 14 days of leave, a difference of 28 days (95 percent CI 17.8 – 37.8), or about 10.8 percent of the 260 working days per year (before holiday allowance). Cases recorded an average of 20 days of sick leave, while comparisons took none.[‡‡] The dispersion of the data were great; the standard deviation in the number of days of leave taken by cases was 55.6, and the standard deviation for comparisons was 35.6.

In the penultimate year of employment, cases took an average of 36 days of leave (SD 58.6). This compares with 14 days (SD 35.6) taken by the comparisons in the year prior to data collection, and 34 days (SD 74.3) in the year preceding that. This small difference in leave taken in the second to last year of employment (2 days) suggests that HIV/AIDS-related morbidity does not lead to a major increase in absenteeism until the last 365 days of service. The observations are also consistent with our concern that some sick leave goes unrecorded, and the volume of AIDS related illness which we were able to measure may be understated. We have confined the "absenteeism" cost portion of the analysis to the year prior to death and are confident that this provides a conservative estimate of the incremental costs linked to AIDS derived absenteeism.

Cost of absenteeism

The cost to Zambia's CBoH of having a professional employee absent from work would ideally be calculated as the value of the medical services that are not provided because of the absence, plus any additional costs incurred as a result of the absence, such as overtime pay for a colleague or the wage of a temporary replacement. Data currently collected by healthcare facilities do not, however, allow us to make this estimate. Instead, we have chosen the simpler approach of valuing the working days lost to HIV/AIDS-related morbidity at the total daily compensation rate of the absent employee. If the reduction in services provided is less than one full day's effort, for example because other staff put in longer hours to make up for the missing employee, then our results will tend to overestimate the true cost of absenteeism. If, on the other hand, the absence of one employee causes other employees to be less productive, for example if an absent nurse forces a surgery that also involves a physician and clinical officer to be delayed, then our results will underestimate the true cost of absenteeism.

Table 3 shows annual compensation (including employer contributions to social insurance and pension funds) for comparisons for each professional grouping. US dollar

[‡‡] It is not clear why no sick leave at all was reported for the comparison subjects. While it is possible that they were rarely or never sick, this does not seem likely. It is more likely that sick leave is not fully recorded, particularly for brief absences. We do not know whether the completeness of sick leave records differs between cases and comparisons.

amounts are calculated using a conversion rate of 4,720 kwacha to the dollar, the average prevailing in the week of April 5, 2004.

Table 3. Annual average compensation for comparisons

Category	Average annual compensation in 2003	
	Kwacha ('000)	2003 US$
Doctors	24,880	$5,271
Clinical officers	22,583	$4,785
Nurses	22,129	$4,688

Because of the limitations of possible inflation adjustment of prior year earnings, we used the more recent data available for the comparisons to determine the costs of a "lost" day of a worker's time. We matched cases and comparisons on age, training and job assignment and therefore assume that individuals who died of AIDS-related causes would have earned comparable salaries if still employed in 2003. A gradient across the three key professional categories is present but relatively flat, with doctors earning 10.2 percent more than clinical officers and 12.4 percent more than nurses.

Although a few non-wage compensation categories (shift, uniform, and meal allowance) may be affected by absenteeism, these categories are a relatively small proportion of total compensation. We divide the recorded annual compensation for comparisons, including these amounts, by 260 scheduled working days, obtaining the daily compensation rates shown in Table 4. The second column in this table shows the costs associated with the incremental 28 days of absenteeism of the cases in the year prior to death or retirement.

Table 4. Personnel compensation costs associated with HIV/AIDS-related absenteeism

Category	Compensation per day		Cost for 28 days HIV/AIDS-related absenteeism	
	Kwacha '000	US$	Kwacha '000	US$
Doctors	96	$20	2,679	$568
Clinical Officers	87	$18	2,432	$515
Nurses	85	$18	2,383	$505

Medical Care

In general, healthcare system employees in Zambia are entitled to free treatment at the institution where they work. In some cases, they are also reimbursed for user fees or drug costs paid personally. We attempted to collect data on both costs reimbursed and services used by the cases. However, we found records of medical reimbursement for only 17 of the 108 cases. For inpatient hospitalization, we were able to obtain records of admissions for 65 of the 108 cases. Records of medical reimbursement were found for only 14 of the 216 comparisons, while hospitalization data were found for 41 of the 216.

For those cases and comparisons where reimbursements were identified, the cases received 34,000 kwacha (US$7.20)[§§] per year more. Cases where hospitalization was identified spent 28 days in hospital, compared to 12 for the comparisons where we found hospital records. A 2002 study (Mangani F *et al.* 2002) by CBoH and The Ministry of Health estimated that the average cost of outpatient treatment in a properly staffed and equipped District Health Center in Zambia would be $11.33. Given budget and staffing constraints, current actual costs would be less. Experience suggests that an inpatient day will cost three to four times an outpatient treatment, which would give us a daily cost of inpatient care in a properly staffed hospital at $33.99 to $45.32. At these rates, this 16 day difference in inpatient utilization would add another $543.84 to $725.12 to the costs of losing a professional to terminal illness. Because of understaffing, this is an overestimate of what is actually spent, but also indicates that the estimate adopted below for to incremental medical costs is probably conservative.

The relatively small number of hospitalizations identified in the year prior to death/retirement for the cases leads us to conclude that many were hospitalized at other facilities or that records are missing. The data collected gives an inadequate picture of the utilization of health services by employees experiencing chronic disease, and we reluctantly concluded that data did not permit an estimate of the differential in health expenditure between healthy workers and those dying of HIV/AIDS. Such an analysis can only be carried out in an environment where there are very strong centralized patient records for a limited number of possible providers, or where benefit expenditures are paid by a medical scheme. Others have estimated that hospitalization for an AIDS patient in Zambia averages $200 (Zambian National HIV/AIDS/STD/TB Council 2004). This estimate is likely to be closer to the real cost than that which we were able to obtain from facility records, and we use it in our summary cost estimates.

Payments at Death or Retirement

Table 5 shows the mean payments made at the death or retirement of cases in each professional category. Included are funeral benefits, repatriation for the body and relatives, and pension and retirement fund payments due at the time of death. Amounts owed but unpaid at the time of data collection are included. Payments were inflated from the year of death to 2003 using IMF published inflation indices. In collecting data, we allowed for the payment of future pension amounts to those who retired on medical disability. However, almost all of the cases remained in employment until death, so future pension payments are not significant.

[§§] US$1 = 4,720 Zambian kwacha (average rate, April 5-8,2004, from Oanda.com).

Table 5. Average payments at death or retirement

Category	Kwacha '000	2003 US$
Doctors (n=11)	16,461	$3,488
Clinical Officers (n=22)	10,211	$2,163
Nurses (n=75)	14,960	$3,169

The amounts shown in Table 5 vary from 45 percent (clinical officers) to 68 percent (nurses) of regular annual compensation (as estimated for comparisons) at each job level. Some contributions are made to pension funds during an employee's working life and have not been deducted from the amounts recorded.

Most of these payments come in the form of funeral benefits, accrued leave and repatriation allowance, which are all cash drains on the employing agency. No pension fund payments were recorded for deceased doctors and clinical officers, and only 1 percent of recorded payments to deceased nurses came from pensions. The extent to which the Government of Zambia funds pension obligations through payroll related contributions was not available to the authors. The amount of pension payment recorded is gross, not net. However, any amount of pension payments attributable to prior contributions or investment earnings thereon would result only in a very slight overstatement in the cost of death benefits shown here.

Vacancies and Terminations

Vacancy rates

Table 6 shows the staffing patterns in each of the institutions studied. For each professional group, the first row shows the "establishment," the number of positions formally approved for assignment at this institution. The second row shows the number of positions filled in October 2003, when data collection began. The third and fourth rows show the number and percentage of positions vacant. Vacancy rates are very high for all professional groups and sites, but highest in the rural district of Kasama. At UTH, the nurses have the highest vacancy rate of any group, while vacancy rates are highest for doctors at LDHMT and for clinical officers in Kasama.[***]

[***] One would expect vacancies and filled positions to add to the total approved cadre. However, because of the high vacancy rates, many staff members may be working "out of title," or are acting in a post pending appointment. This causes the discrepancies observed in the table.

Table 6. Established, filled, and vacant positions

Institution	Doctors	Clinical officers	Nurses	All groups
LDHMT				
Established	49	184	1,136	1,369
Filled	28	145	929	1,102
Vacant	21	39	205	265
Vacancy rate (%)	43%	21%	18%	19%
Kasama				
Established	36	86	373	495
Filled	15	28	184	227
Vacant	20	58	190	268
Vacancy rate (%)	56%	67%	51%	54%
UTH				
Established	373	57	1,174	1,604
Filled	223	38	743	1,004
Vacant	157	25	592	774
Vacancy rate (%)	45%	44%	50%	48%
All Sites				
Established	458	327	2,683	3,468
Filled	266	211	1,856	2,333
Vacant	198	122	987	1,307
Vacancy rate (%)	42%	37%	37%	38%

The high vacancy rates prevailing at all three institutions studied suggest that replacing a professional staff member who is lost to HIV/AIDS is difficult, if not impossible, and that a newly vacant position is likely to remain unfilled for some time. Since no salary or allowances are paid when positions are vacant, a vacancy due to AIDS will reduce CBoH expenditures. It will also reduce the capacity of the public health system to deliver services. As noted earlier, we do not have a means of valuing the healthcare services not provided as a result of professional staff absences or vacancies. We will therefore not include vacancies in the cost calculations in the next section of this report. We will, however, incorporate the impact of AIDS-related vacancies in our overall assessment of work time lost to the epidemic.

Reasons for vacancies

In Table 7, the number of vacancies reported in the 12 months preceding the study and the stated reasons for those vacancies are shown.

Table 7. Reasons for vacancies occurring in the period November 2002-October 2003(# of individuals)

Institution	Doctors	Clinical officers	Nurses	All Groups
LDHMT				
Resigned	2	1	5	8
Retired	0	1	7	8
Transferred	0	0	7	7
Died	1	2	18	21
Other	4	6	20	30
Total terminations	7	10	57	74
Kasama				
Resigned	0	0	0	0
Retired	0	0	1	1
Transferred	6	0	0	6
Died	0	0	5	5
Other	3	0	0	3
Total terminations	9	0	6	15
UTH				
Resigned	15	3	17	35
Retired	0	0	1	1
Transferred	33	0	0	33
Died	0	4	42	46
Other	16	0	43	59
Total terminations	64	7	103	174
All Sites				
Resigned	17	4	22	43
Retired	0	1	9	10
Transferred	39	0	7	46
Died	1	6	65	72
Other	23	6	63	92
Total terminations	80	17	166	263

If transfers (to other public health institutions) are excluded, the annual loss of health professionals at these three sites is 217 out of 2,333 filled positions, a total annual attrition rate of 9 percent. With new graduates entering the system each year, it is clear that the current rate of vacancies has built up over a number of years. Losses within the last year (excluding transfers, which presumably do not reduce the overall capacity of the health system) accounted for 21 percent of current physician vacancies, 14 percent of clinical officer vacancies, and 16 percent of nurse vacancies.[†††]

Mortality as a reason for termination

Deaths comprised a significant proportion of all terminations (LDHMT 28 percent, Kasama 33 percent, UTH 26 percent) in the 12 months ending October 2003. The

[†††] Interestingly, while vacancy rates are high, staff turnover rates as shown in Tables 6 and 7 ([filled positions+terminations]/terminations) in the year preceding the study in the two district health systems appear to have been rather low. LDHMT and Kasama lost just 7 percent of their professional complements. Turnover at UTH was substantially higher (17 percent).

number of deaths also greatly exceeded the number of normal retirements. In the institutions studied there were 72 deaths in the year, but only 10 normal retirements.

Our analysis did not include every death of a professional serving in these institutions over the three-year period. We excluded some deceased employees for whom we were unable to obtain personnel records containing compensation and absenteeism data. If we use only our "cases" as the indicator of HIV/AIDS losses, we obtain annual loss rates of 1.4 percent for doctors, 3.5 percent for clinical officers, and 1.3 percent for nurses.[‡‡‡]. If we include all reported mortality in the year to October 2003, we obtain death rates of 0.4 percent for doctors, 2.8 percent for clinical officers and 3.5 percent for nurses. These latter rates could somewhat overstate HIV/AIDS mortality in the year to October 2003, particularly for nurses, since they include deaths due to accidents, violence, and disease of sudden onset.

The death rates cited above are within the range observed by others in severely affected African countries. Unger (Unger A *et al.* 2004) observed a 2 percent annual death rate among the staff of a hospital in South Africa, where the epidemic was later to develop than in Zambia. For nurses, the 3.5 percent death rate is above the 2.7 percent all-cause death rate observed in Monze District of Zambia in the early 1990's(Buve *et al* 1994). The Monze death rate was more than 10 times the 0.2 percent nurse death rate recorded in this District seven year earlier. Data from all Zambian healthcare facilities in 1999 showed annual death rates of 0.3 percent for doctors, 3.7 percent for clinical officers and 3.1 percent for nurses (Zambian Ministry of Health, 2001). This is also consistent with the death rates we recorded in the study institutions.

Because of our inability to obtain data on every death and precisely quantify the number of AIDS related deaths, we use the total death rates in the study institutions in the year to October 2003 to reaching our summary cost estimates. There are a few non-AIDS deaths included in this estimate, but, as noted previously, we have undoubtedly excluded some employees who resigned from the public health service before dying. Given the age at death (see Table 8) and normal life expectancy in the absence of the AIDS epidemic, it is clear that most recorded deaths, at least among clinical officers and nurses, are a result of AIDS.

Death rates for Zambian clinical officers were the highest for any professional group in 1999 (Huddart et al, 2003). For the year ending October 2003 in the study institutions, the all-cause death rate for clinical officers (2.8 percent) was slightly below that for nurses (3.5 percent). Doctors show the lowest death rates. Clinical officers are more likely to be male, to have fewer alternative employment opportunities than doctors, and to have fewer family pressures than nurses. As a result, clinical officers have lower job turnover due to causes other than death/ill health. In 1999, across the Zambian healthcare system, 79 percent of physician losses, 26 percent of nurse losses, and 20 percent of clinical officer losses were for reasons other than death, ill health, or normal retirement(Zambian Ministry of Health 2001). Even if infection rates were the same for all three

[‡‡‡] Total number of cases divided by three (years) divided by the number of filled positions at the time of data collection (November 2003)

professional groups, death rates would be higher among clinical officers because a larger portion remain in public service until the age at which AIDS mortality is highest. On the other hand, the rapid attrition of physicians for other reasons (overseas training, alternative employment) may mean that many HIV infected doctors are leaving the health service before they become ill.

Loss of Training Investment

The vast majority of Zambian healthcare professionals in the public sector received their qualification from one of Zambia's tertiary institutions for medical training. Most or all of the cost of this training was borne by the Zambian Government. In return for investing substantial national resources in providing professional training to individuals, the country assumes that these individuals will provide healthcare services to society for a long period of time.

Under Zambian civil service law, nurses, doctors, clinical officers, and other health professionals are eligible to retire on a pension at age 55. For purposes of this analysis, we assume that nurses, clinical officers, and other health professionals complete training at age 21 and doctors at age 25. This gives an expected "full working life" for those who remain in Government service of 30 years for doctors and 34 years for clinical officers, nurses and other health professionals.

Table 8 shows the average age at death or retirement for cases in this study, the number of years by which their career was shortened, and the percentage of the Government's investment in professional education lost due to premature death.

Table 8. Years of work lost due to premature death

Professional Category	Age at death	Normal retirement age	Years lost	Percentage of potential career lost
Doctors	41.1	55	13.9	46.3%
Clinical Officers	35.8	55	19.2	56.5%
Nurses	37.9	55	17.1	50.3%

Premature death or retirement due to AIDS-like illnesses causes a loss of 46-57 percent of the "full career" a trained professional might have served prior to reaching the statutory retirement age.[§§§] In many cases, special contracts are granted after this age to prolong the service of health staff members, so the full loss may be even greater.

In planning educational institutions and budgets, the effects of the premature mortality due to AIDS must be taken into account. To offset the losses to AIDS, annual output of training institutions must increase by a number equal to those losses. The first column in Table 9 shows the number in post for critical professional cadres nationwide in 2000. The second column shows the number of likely deaths nationally, based on reported

[§§§] Our assumption here is, of course, that professionals who do not die remain in the public health system until normal retirement age. It is likely that at least some of those who died would otherwise have resigned for other reasons, such as migration to the private sector or to a country offering better wages.

mortality at the study institutions in the year to October 2003. This is the number of additional professionals that must be trained to offset AIDS-related losses. The third column shows the current size of the class graduating from national training institutions each year, and the fourth column shows the percentage increase in this class required to offset the apparent AIDS mortality (Zambian Ministry of Health, 2001). The number of clinical officers trained must increase by 80 percent and the number of nurses trained each year must grow by 50 percent just to offset recorded deaths.

Premature mortality due to HIV/AIDS affects the quality of the professional workforce as well as the numbers in service. Professionals who die halfway through their career deprive the system of valuable experience gained in their years of clinical practice and reduce the pool of candidates available for senior leadership positions.

Table 9. Additional recruits required to offset AIDS mortality

Cadre	In post 2000	Estimated annual AIDS deaths	Current training output	Increase in training output required (%)
Doctors	698	3	42	7%
Clinical Officers	1,264	35	44	80%
Nurses	8,500	298	593	50%

Aggregate Costs

Table 10 shows actual personnel expenditures for the institutions studied for the period November 2002 to October 2003. Dollar equivalents are shown in parentheses. Personnel expenditures include salaries, night allowance, commuted overtime allowance, and retention and recruitment allowance.

Table 10. Actual expenditures for healthcare professionals at the study sites, November 2002 -October 2003

Professional Category		LDHMT	Kasama	UTH
Doctors				
	Kwacha (000,000)	1,242	296	10,345
	US dollars (,000)	263	63	2,192
Clinical Officers				
	Kwacha 000,000)	1,632	286	469
	US dollars (,000)	346	61	99
Nurses				
	Kwacha (000,000)	11,742	1,890	7,519
	US dollars (,000)	2,488	400	1,593
All Groups				
	Kwacha (000,000)	14,616	2,472	18,333
	US dollars (,000)	3,097	524	3,884

We have estimated two sets of costs to compare with these expenditures: death benefits and time lost in the final year of employment due to increased absenteeism. We have also added an estimate of $200 for incremental AIDS treatment costs in the year prior to

death. [i]These add to the amounts shown in Table 11 for each employee lost to AIDS or suspected AIDS.

Table 11. Cost per employee lost to HIV/AIDS

Professional Category	Kwacha ('000)	US$
Doctors	20,088	$4,256
Clinical Officers	13,584	$2,878
Nurses	18,285	$3,874

If we multiply the observed death rates in the year to October 2003 by the number of filled positions in the institutions studied, we expect the following number of AIDS deaths each year at the study institutions

- Doctors: 1 death
- Clinical officers: 6 deaths
- Nurses: 65 deaths.

The aggregate annual cost of absenteeism and death benefits for these casualties is 1,290 million kwacha or $273,000. This is approximately 3.6 percent of total actual annual personnel expenditure for doctors, clinical officers, and nurses in these institutions. Although this analysis includes a few deaths from other causes, it excludes some absenteeism related costs that we could not measure and makes no estimate of the impact on productivity. It offers a fair statement of the fiscal impact on the institutions, but is likely an underestimate of total AIDS-related costs in health professionals.

6 Discussion

The estimated annual cost of HIV/AIDS among professional staff, about 3.6 percent of total annual compensation, is significant but perhaps not crippling at first glance. Compounded over years, however, the loss of professional personnel due to HIV is a major burden on the healthcare system. The average age at death indicates that 46 to 57 percent of the normal career will be lost when a health professional dies due to HIV/AIDS. If the observed death rates among clinical officers persist, the number trained would have to increase by 80 percent to offset current AIDS related attrition in this group.

HIV related deaths are not the only source of attrition in the Zambian healthcare system. Professionals do leave for other employment, within or outside of the country. Very few workers retire "normally." However, death among nurses and clinical officers is still the largest single reason for attrition. In the study institutions, death accounted for 35 percent of all terminations of clinical officers in the last year, and 39 percent of all nurse terminations.

As the above analysis indicates, the problem of HIV/AIDS related attrition is much more acute for clinical officers and nurses than for doctors: both in terms of lives lost and in personnel costs. Costs associated with nurse deaths are 92 percent of the total estimated cost. Costs associated with clinical officer deaths add another 6 percent to the estimated total. If past trends continue, the institutions studied will lose only one physician due to death each year, and the associated cost is less than 2 percent of the total financial impact.

Increasing the output of training institutions is one way to offset the observed loss of health professionals due to HIV infection. Time and capital investment are required to expand the faculty and facilities of training institutions and bring more health professionals into the workforce. Based on current patterns of international recruiting, some of this investment will benefit wealthier countries that will "import" graduating health professionals.

Improved HIV prevention efforts will also have a long-term impact on mortality and vacancies, but most of those who will die of HIV over the next decade are already infected. In the short term, effective treatment of HIV-positive professionals could be the most effective way of reducing attrition and vacancy rates. Funds spent for treatment benefit Zambian health professionals who have made a decision to remain at home and serve their fellow countrymen. HAART is now becoming available in Zambia. If this treatment could be provided for an average of $500 per year, the $273,000 now being spent each year on 70 or so professionals who are dying due to AIDS in these institutions would purchase HAART for a year for 546 employees. Viewed another way, the estimated cost of one AIDS related death is equal to six to eight years of treatment with antiretrovirals at this price. Treatment naïve patients who adhere to HAART should survive six to eight years. If HAART adds only five years to the productive life of an infected health worker, immediate treatment of all professionals with AIDS would likely

avert deaths of the equivalent of 10-15 percent of the clinical officer and nurse workforce over the next five years. This would lead to a substantial reduction in anticipated professional vacancy rates, which will otherwise continue to climb if mortality stays at these high levels. And this would allow time to expand the output of training programs to offset epidemic mortality.

In short, the costs we have been able to estimate (and which exclude impacts that we were unable to quantify) support the creation of an immediate HAART program for affected health care professionals. In designing such a program, health officials must take into account a number of the concerns we heard in discussing the study results. Co-payments may present a problem for lower paid professionals. Perhaps more important, treatment programs should be designed so that employees do not need to reveal their HIV status to superiors or co-workers in order to access treatment. Some CBoH officials hypothesize that the high observed morality for nurses, and low measured health care costs, result from an unwillingness to seek treatment at the place of employment. Many nurses, we were told, are extremely sick before coming forward for any kind of treatment. To get the full benefit of HAART and prophylaxis for opportunistic infections, staff should be encouraged to seek testing early and comply with regular monitoring so HAART can begin at the optimal time

Limitations

We have been unable to quantify a number of costs associated with HIV/AIDS in the professional workforce. The costs of medical care, both care in the employing institution and compensation for care received elsewhere, are considerable. However, the quality of the available data prevented us from making an estimate of this cost, other than using a previous estimate of $200(Zambian National HIV/AIDS/STD/TB Council 2004) per case. Where we were able to obtain data on health facility use, the cases clearly used substantially more hospital care than comparisons.

To be conservative, we set compensation rates for lost workers at the amounts observed for comparisons still in the workforce. Inflating compensation paid to cases forward to 2003 produced higher compensation estimates, but we rejected this method because of the variability in inflationary wage increases. We also were unable to isolate the cost of overtime and other allowances paid to healthy workers to fill vacancies and replace colleagues absent due to AIDS. Both these factors may contribute to an underestimate of the direct costs of illness.

High rates of vacancy and absenteeism also reduce productivity. Patients remain longer in hospital waiting for tests and procedures. Queues in outpatient clinics will be longer. The quality of care received is probably also adversely affected. However, we have been unable to quantify these effects.

Anecdotal evidence suggests that some professionals with HIV/AIDS resign from the Civil Service before they die, perhaps in order to return home where relatives will care for them. The data available did not distinguish the reasons for voluntary resignation.

Given the high rates of HIV prevalence, some of our comparisons may have been in the earlier stages of AIDS, and the amount of absenteeism in the comparisons may be higher than it would be in a truly healthy population. Also, some absenteeism likely went unrecorded, due to lax record keeping, or the support of sympathetic supervisors. Not a single forced medical retirement was identified in our study. We were told that employees who are sick with AIDS are generally allowed to stay on the payroll until death, even if they exceed the allowed sick leave. With limited benefits available to survivors, the continuation of salary is considered to be humane, and of only moderate cost, since employees do not survive very long after they become too sick to work. For these reasons, we may have underestimated the increased absenteeism associated with HIV/AIDS.

Although we have quantified the amount of apparent HIV/AIDS attrition in the workforce, and the implications for manpower planning, we have not assigned a monetary value to the reduction in the working life of health professionals. This would require an estimate of the cost of training each professional, as well as a complex system of discounting. Thus, our estimates do not include a monetary quantification of the training investment that is lost when an employee dies of AIDS: on average, less than half way through their career.

All of these factors are likely to encourage a bias towards an underestimate of the costs imposed on the Zambian healthcare system by HIV/AIDS. The only major bias towards overestimation is the use of the total annual death rate to determine aggregate costs. Despite our efforts, files were insufficient for us to identify every chronic disease related death as a case. Using only the deaths for which we recovered full records would clearly give an underestimate of AIDS related mortality. Therefore, we used total mortality in our aggregate estimates. A few of these deaths were from other causes, but the median age of death suggests that few resulted from the chronic diseases of aging. Among nurses and clinical officers, it is likely that 80 percent to 90 percent of the recorded deaths were linked to AIDS. When we take into account that we did not record costs associated with voluntary resignations that may have been AIDS related, we are confident that our aggregate estimate of 3.6 percent of personnel costs remains an underestimate of the impact of HIV/AIDS in the professional work force.

7 Conclusions

HIV/AIDS is having a major impact on health professionals in Zambia, particularly nurses and clinical officers. Annual mortality in the study institutions was 2.8 percent for clinical officers, 3.5 percent for nurses (and only 0.4 percent for doctors). Thes staff are dying in their late 30's, on average, with more than half of their professional career remaining.

Recorded absenteeism for those who die, in the year prior to death, is 28 days more than the annual absenteeism of comparisons. In addition to the wages paid for these additional sick days, benefits paid at death amount to 10 to 16 million kwacha ($2,200 to $3,500). Incremental medical costs were difficult to measure, but there is a substantial difference in recorded health facility usage between cases and comparisons. We used a conservative estimate of $200 as the cost of caring for an AIDS victim. The total costs associated with each death varied from 14 to 20 million kwacha, depending on the professional category. In aggregate, these costs totaled 1,290 million kwacha in the institutions studied, or about 3.6 percent of annual compensation for health professionals.

Of even greater concern than cost is the impact on the cadre of trained professionals. Although death is not the major contributor to the drain of Zambian trained physicians, it is the largest reason for loss of nurses and clinical officers. After deducting transfers to other health institutions, death accounted for 35 percent of the loss of clinical officers and 41 percent of the loss of nurses. These death rates, incurred now for several years of the epidemic, help to explain the high rate of vacancy for nurses and clinical officers (although not the equally high vacancy rate for doctors). Given the typical age of death, nurses are dying with 50 percent of their professional career remaining. Clinical officers are dying with 59 percent of their career left. To offset current mortality, the number of newly trained clinical officers would have to expand by 80 percent; graduating classes of nurses would have to expand by 50 percent.

Expansion of training classes is a long-term solution to current attrition. The more immediate need is for treatment that will prolong the productive working life of infected health professionals. The costs estimated above would support a substantial program of antiretroviral care. If drugs cost $500 per year, the costs associated with each death averted would pay for six to eight years worth of HAART. Prompt action to identify HIV infected professionals and get them in to treatment is necessary. Such a program must be designed so that it encourages early testing and is sensitive to the reluctance of employees to receive care in their own institutions. Treatment should be offered in such a way that the HIV infection is not identified to superiors or co-workers.

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