



## Financial and economic costs of scaling up the provision of HAART to HIV-infected health care workers in KwaZulu-Natal

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**Objectives.** To provide new information on the financial and economic costs of providing highly active antiretroviral therapy (HAART) to health care workers in public-sector hospital settings in KwaZulu-Natal.

**Design.** An Excel model was used to estimate the cost of providing HAART to health care workers at two state-subsidised hospitals in Durban. Staff members were interviewed and protocols reviewed to identify the time and resources used to provide HAART to health care workers. The cost of the programme was estimated for various patient numbers.

**Results.** The financial cost of treating a patient for a year ranged from R5 697 to R8 762 depending on the hospital and

the number of patients treated. The economic cost of treating a patient for a year ranged from R6 123 to R8 893. These costs were shown to be robust to changes in key variables.

**Conclusions.** This study provides evidence on the cost of providing HAART to health care workers and suggests that this strategy could reduce absenteeism and alleviate future staff shortages at moderate cost to hospitals. This is crucial, given the impending human resources crisis in health care in South Africa and the growing burden of HIV/AIDS. These cost estimates should be good indicators of the costs of extending antiretroviral therapy to health care workers in public-sector hospitals in KwaZulu-Natal.

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HIV/AIDS has placed significant strain on public health institutions in sub-Saharan Africa.<sup>1</sup> Simultaneously, severe staff shortages, brain drain and increases in health worker illness are being experienced in the region.<sup>2</sup>

The South African public health service faces the challenge of scaling up the provision of highly active antiretroviral therapy (HAART). It is projected that nearly 1 500 000 patients nationally, and nearly 500 000 patients in KwaZulu-Natal (KZN), will be on HAART by 2008/2009. The rollout of a national AIDS treatment plan will require over 13 000 posts to be created by 2008.<sup>3</sup> This is occurring in an environment where there are already widespread shortages of medical staff (31% of health professional posts were vacant in 2003).<sup>4</sup> In addition, HIV seroprevalence among health care workers is estimated at 16%.<sup>5</sup> The shortage of health care workers could threaten the success of the antiretroviral (ARV) rollout and limit the health service's capacity to respond to HIV/AIDS.

A study<sup>6</sup> conducted at a KZN hospital has shown that it is feasible to provide HAART to health care workers. The provision of free HAART to HIV-infected health professionals should be introduced or strengthened as a matter of urgency.

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In southern Africa, this strategy could be used to alleviate staff shortages and to speed up the rollout of HAART. Indeed, targeted provision of HAART to health care workers may be unavoidable if HAART scale-up plans in southern Africa are to be achieved.<sup>2,5</sup> In countries yet to implement HAART, this strategy could be an important starting point in the rollout.<sup>6</sup>

This study aims to provide a comprehensive costing of HAART to health care workers, which goes beyond the estimation of drug and testing costs. Knowledge of the cost of this strategy is vital for planning purposes if it is to be adopted as health policy. This study adds to the scarce body of knowledge on the cost of providing HAART in resource-constrained settings.

### Background

Data were used from two hospitals in Durban, KZN, that provide HAART to HIV-infected employees. Hospital A (to preserve confidentiality actual hospital names are not used) is a state-subsidised, urban hospital which began offering HAART to staff members in September 2001. HIV counselling, testing and management, including provision of HAART, are integrated into the general practice service offered to staff.

Hospital B is a state-subsidised, peri-urban hospital which began providing HAART in March 2003. Full-time hospital staff are given preferential access to the programme. The staff clinic and HIV clinic operate from the same premises.

Eligibility criteria at both hospitals match the national ARV guidelines. HIV testing, adherence counselling and treatment are done on a one-to-one basis with the staff doctor to preserve



staff confidentiality and to encourage staff to take up HIV treatment. In November 2004, there were 20 and 21 staff members on HAART at the two hospitals respectively.

As shown in Table I, the drug regimens prescribed differed slightly between the two hospitals. Hospital A prescribed Combivir, which will be phased out to fall in line with national guidelines.

**Table I. Proportion of patients on each regimen**

Regimen	Proportion of patients on regimen (%)
Hospital A	
D4T, 3TC, efavirenz	65
Combivir, efavirenz	30
Combivir, nevirapine	5
Hospital B	
D4T, 3TC, efavirenz	90
D4T, 3TC, nevirapine	10

## Methods

Financial and economic costs of HAART provision were estimated. Financial costs were considered to be all additional costs incurred as a result of introducing this programme. Financial costs included the cost of buildings acquired and salaries of new staff hired as a result of introducing the programme (fixed costs) and the cost of drugs, medical consumables, testing and monitoring (variable costs).

Economic costs were considered to be the total resource usage of the programme. These costs included the above as well as the cost of hours existing staff members worked on the programme, and using existing buildings and equipment on the programme.

These resources would have been put to alternative uses if they had not been deployed on the HAART programme. As such, these costs should be included to reflect overall resource usage.

The costing was carried out from the perspective of the individual hospital. It included all costs borne by the hospital, but not the additional costs that might be borne by the Department of Health (DOH) if this intervention were adopted as policy (for example provincial overheads, monitoring and evaluation, and training costs).

Key hospital staff were interviewed, face-to-face, and protocols reviewed to identify the activities and resources used (staff time, equipment, consumables and premises) and the frequency of consultations and laboratory testing.

The resources used for each activity were estimated by combining data on yearly patient usage, average time taken per activity and yearly operational hours for each resource. Unit prices were then applied to each resource. The total cost of HAART provision was established by adding the costs of all component activities.

The model used drug prices available to the South African government as at November 2004 and the Combivir access price as at October 2004. DOH salary information and drug and laboratory test prices available to provincial hospitals were used in the model.

An Excel model, developed by the Enhancing Care Initiative KZN PLUS and the Harvard AIDS Institute, was amended and was used to combine the cost data collected. The model estimates the costs of the HAART programme at different patient numbers. In addition, it calculates the maximum number of patients each resource can service in a year and capacity utilisation of each resource at different patient numbers, given assumptions about the percentage of time it is available to be used on this programme.

In modelling the programme, 70% of patients were assumed to be in their first year of treatment. The proportion of staff on each drug regimen was based on the current proportions at each hospital.

The cost of the HAART programme was estimated for current patient numbers, for estimated patient numbers when the national prevalence rate for health care workers<sup>5</sup> (16%) is applied, and for estimated patient numbers when a 20% prevalence rate is applied. It was assumed that half of all HIV-positive staff members would be on HAART at any point.

This model is unique as it allows researchers to determine the changing resource requirements of a programme as patient numbers increase. The proportion of total staff time and facility time allocated to the programme is calculated for different patient numbers. This model estimates how per patient cost of HAART changes with patient numbers and estimates at what point new investment in facilities is needed. This is an advantage over other models that assume a static cost per patient and do not allow for economies of scale. Human resource costs of programmes are often neglected. This model focuses on human resource costs.

At both hospitals, facilities and staff were shared with other programmes. The costing approach used allowed the researchers to estimate the percentage of time that each resource was used on this programme. This percentage was applied to all costs shared with other programmes (for example cleaning and maintenance) to estimate the proportion to be allocated to this programme.

## Results

The results of the model (summarised in Table II) show that, at current patient numbers, it costs between R5 697 and R8 762 to treat one health care worker with HAART for 1 year (costs for hospitals B and A, respectively).

The difference in financial cost between the hospitals is largely explained by the higher fixed costs at Hospital A. At both hospitals, the HAART programme for health care workers was introduced after HAART for the general public. There



**Table II. Summary of results**

	Hospital A	Hospital B
Total financial cost per patient per year (R)		
Current patient numbers	8 762	5 697
16% prevalence rate	7 088	5 697
20% prevalence rate	6 858	5 697
Total economic cost per patient per year (R)		
Current patient numbers	8 893	6 778
16% prevalence rate	7 219	6 778
20% prevalence rate	7 114	6 778

was no capital expenditure (land, buildings or equipment) associated with the introduction of this programme. As a result, there were no fixed costs of the programme at Hospital B. At Hospital A the introduction of the programme necessitated that staff extend their working hours. The cost of additional working hours is a fixed labour cost (of R55 799 per year).

Estimates of staff capacity utilisation generated by the model show that even if the number of health care workers on HAART increases to 47, no new staff would be needed at either hospital if the current workload on other programmes remained unchanged.

The variable costs associated with the programme are strikingly similar across hospitals (R5 972 and R5 697 per patient per year at hospitals A and B respectively). The cost of ARV drugs was the largest cost component.

The economic cost of treating 1 patient for 1 year, at current patient numbers, was R8 893 at Hospital A and R 6 778 at Hospital B. There was less difference in the economic cost between the programmes as the opportunity cost of staff time was included for Hospital B. At Hospital B the introduction of HAART for health care workers meant that staff time was diverted from other activities. The opportunity cost of diverting staff time was estimated at R929 per patient per year. Including this cost provides a more accurate estimate of the

**Table IV. Results of sensitivity analysis**

	Economic cost per patient per year: Hospital B (R)
Baseline (21 patients)	6 778
Cost of drugs (decrease 10%)	6 450
Cost of drugs (decrease 20%)	6 123
Frequency of consultation decreased to match operational plan	6 348
Staff doctor salary level increased	7 003

total cost of HAART at Hospital B. Staff costs remained lower at Hospital B (R929 per patient per year) than at Hospital A (R2 970 per patient per year) at current patient numbers. This is because less staff time was dedicated to the programme at Hospital B and it was not a function of differences in salaries. Table III shows the breakdown of economic cost in detail.

As patient numbers increase, the fixed costs at Hospital A will be spread over a larger number of patients, and the average cost per patient at Hospital A will decrease and become more similar to the cost at Hospital B (Table II). There were no fixed costs at Hospital B, so average costs will not change as patient numbers change.

Hospital B provided HAART at a lower cost per patient. This is because less staff time was dedicated to the programme at Hospital B and because Hospital A was using a slightly more expensive drug regimen.

Sensitivity analysis was performed, altering several key variables. As shown in Table IV, the cost estimates are robust to these changes.

## Discussion and conclusions

In this study, the researchers attempted to quantify the costs of providing HAART to health care workers more scientifically than has been done previously.<sup>6</sup> This was achieved by using a formal model which included the cost of human resources, medical consumables and equipment in addition to drug and testing costs.

As this is a model of the costs of scaling up treatment at facility level it cannot be used to estimate the cost to the provincial DOH of scaling up this care to all hospitals in KZN. Provincial costs were used in this model to make results generalisable to public-sector hospitals. As a result this study provides a good estimate of what the programme might cost if implemented at an individual provincial hospital. In introducing HAART for health care workers at public-sector hospitals, it is likely that staff time would be diverted from other activities (as at Hospital B). As a result the cost estimates from Hospital B are likely

**Table III. Breakdown of economic cost per patient per year (current patient numbers)**

	Hospital A (20 patients)		Hospital B (21 patients)	
	Rands	%	Rands	%
Fixed cost of labour (per patient)	2 790	31	-	0
Variable cost (per patient)	6 103		6 778	
Labour (opportunity cost)	-		929	14
Equipment and rooms (opportunity cost)	131	1	152	2
Drugs	3 660	41	3 276	48
Tests	1 872	21	1 824	27
Medical consumables	441	5	597	9
Total cost per patient	8 893		6 778	
Total cost (current patient numbers)	177 866		142 340	



to give a more realistic indication of the cost for provincial hospitals.

There are several limitations to this study, which may impact on the reliability of the cost estimates. No allowance was made for patients on second-line regimens. Switching to second-line regimens could raise per patient cost substantially. In calculating the cost of labour, the researchers assumed that all staff time spent on HAART was additional to time spent on other HIV treatment. In reality this may be offset by less time spent treating opportunistic infections. Consultations are likely to be less frequent in hospitals that are following the government protocol more closely. For both reasons the cost-of-labour estimate here may be an overestimate.

Time per activity was obtained from interviews with the clinicians implementing the programme. Where patient numbers are low (as is the case here), it may be difficult to estimate the average time for each activity accurately. The accuracy of cost and capacity predictions depends on the accuracy of these estimates and on assumptions made in the model. Observation of activities could not be performed to validate clinicians' estimates without compromising the confidentiality of HIV-positive staff members. Experience has taught the authors that activity logs completed by hospital staff tend to be unreliable as they are often partially completed, long after the actual event.

In allocating shared costs between programmes, no account was taken of downtime. As a result, the cost of the programme may be underestimated. It is difficult to predict whether the costs of equipment and rooms at other hospitals will be similar to those estimated here as these depend on the infrastructure available at each hospital. However, as these costs were a small component of total cost, this is not a significant constraint.

Despite these limitations, the cost estimates generated in this model should provide a good guideline to likely costs at public-sector hospitals.

This analysis estimates the cost of introducing HAART for health care workers at an institution where HAART is already being provided to the general public and where the introduction of the programme requires no new capital expenditure. If investment in new equipment/premises is required to implement the programme, this will raise the costs beyond those estimated here.

For hospital managers to determine whether HAART for staff members makes financial sense, the costs estimated here should be compared with the annual costs of treating HIV-infected health care workers without HAART (not estimated here).

The costs of not providing HAART go beyond treatment costs. On average, the loss of a nurse to HIV/AIDS cost two Johannesburg hospitals the equivalent of approximately 10 months of nursing time, excluding treatment costs (D Connelly, unpublished data, 2005). This cost includes the

cost of death and disability benefits, recruitment and training, absenteeism, reduced productivity, vacancies and inexperience of replacement employees.

This study does not attempt to estimate the absenteeism or productivity losses of health care workers on HAART. However, the impact of HAART on absenteeism and worker productivity should be considered by hospital managers. Southern African research shows that formal-sector employees who died or left employment because of HIV/AIDS took 11 - 68 more days' sick leave in their final year of employment than others. They were between 22% and 63% less productive in their final year of employment than before they took ill.<sup>7</sup> Providing HAART can delay the onset of AIDS and shift these costs into the future. Preliminary data from Anglo American's HIV/AIDS treatment programme shows that 70% of the cost of providing ART is covered by savings in absenteeism.<sup>8</sup> It seems reasonable to expect that similar savings could be experienced in hospitals. The potential impact of this strategy on absenteeism is particularly important given widespread staff shortages in health care.

Although the comprehensive plan for the HIV/AIDS Care and Treatment Plan for South Africa includes the care of health workers, it does not specify the extent of this care.<sup>3</sup> Providing HAART to health care workers could be the first step institutions could take to provide HAART. The results of this costing study suggest that this strategy could go some way towards alleviating the skills crisis in health care in resource-constrained settings at moderate cost.

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#### References

1. Raviola G, Machoki M, Mwaikambo E, et al. HIV, disease plague, demoralisation, and 'burnout': resident experience of the medical profession in Nairobi, Kenya. *Cult Med Psychiatry* 2002; 26: 55-86.
2. Kober K, van Damme W. Scaling up access to antiretroviral treatment in southern Africa: who will do the job? *Lancet* 2004; 364: 103-107.
3. National Department of Health Task Team. *Operational Plan for Comprehensive HIV and AIDS Care, Management and Treatment for South Africa*. Pretoria: DOH, 2003.
4. Padarath A, Ntuli A, Berthiaume L. Human resources. In: *South African Health Review* 2003/04. Durban: Health Systems Trust, 2004: 299-316.
5. Shisana O, Hall EJ, Maluleke R, Chaveau J, Schwabe C. HIV/AIDS prevalence among South African health workers. *S Afr Med J* 2004; 94: 846-850.
6. Uebel K, Friedland G, Pawinski R, Holst H. HAART for hospital health care workers - an innovative programme. *S Afr Med J* 2004; 94: 423-427.
7. Rosen S, Vincent JR, Macleod W, Fox M, Thea DM, Simon JL. The cost of HIV/AIDS to businesses in southern Africa. *AIDS* 2004; 18: 317-324.
8. Muirhead D, Kumaranayake L, Pozo-Martin F, Charalambous S, Pemba L, Grant A. Early savings resulting from employer sponsored ART in a large South African workforce setting. 2nd South African AIDS Conference, Durban, South Africa, 7-10 June 2005.

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