WHO/UNAIDS

Report on the methods used to estimate costs of reaching the WHO target of “3 by 5”
January, 2003

WHO/UNAIDS working group:
Taghreed Adam (WHO/EIP)
Stefano Bertozzi (INSP, Mexico)
Tessa Tan-Torres Edejer (WHO/EIP)
David Evans (WHO/EIP)
Robert Greener (UNAIDS)
Juan Pablo Gutierrez (INSP, Mexico)
Cate Hankins (UNAIDS)
Benjamin Johns (WHO/EIP)
Gesine Meyer-Rath (WHO/EIP)

Introduction:

This document explains the assumptions behind the estimates of the cost of providing antiretroviral therapy to 3 million people by the year 2005 (3 by 5). The estimates presented here reflect the 3 by 5 strategy and model of care discussed in the WHO/UNAIDS International Consensus Meeting on Interim Recommendations for Technical and Operational Procedures for Emergency Scaling up ARV Treatment in Resource-Limited Settings, November 18-21, 2003, Lusaka, Zambia. The estimated costs are based on country-specific estimates for a selected number of countries representing 91% of the global need for antiretroviral therapy. The estimates build on the previous costing work for the care component of the UNGASS comprehensive response to the HIV/AIDS epidemic.

The 3 x 5 strategy is based on a public health approach to ART, of which the following are key elements:

1. Standardized treatment protocols and simplified clinical monitoring.
2. Optimal use of existing physical infrastructure and human resources.
3. The involvement of people living with HIV/AIDS (PLHA) and communities in programme design and implementation.
4. Simplified record-keeping.
5. Cost minimization, including reducing the costs of drugs and diagnostics

**Methods**

The UNAIDS Care Model was used as the basis for the analysis and was updated using new data and analysis done by WHO/EIP\(^1\). Costs are based on country-specific data for selected countries from different regions of the world, accounting for 91% of the target coverage, see Annex 1 for the list.

The Zambia Consultation meeting defined an implementation strategy of providing access to ARVs to HIV/AIDS patients that is feasible to implement in resource-limited settings. Therapy for AIDS patients will be initiated by doctors/nurses at district hospital/primary health facilities for prescription and clinical follow-up. Community health workers/trained lay volunteers will provide adherence and treatment support.

**Patient-level costs include:**\(^2\)
- HIV testing and counseling, including distribution of condoms;
- provision of nevirapine to HIV positive pregnant patients who are WHO Stage I and II;
- provision of first-line antiretroviral drugs (ARV) to HIV positive adults (WHO Stage III or IV) and children above the age of 18 months (WHO Pediatric Stage II-III) and, in the case of clinical diagnosis of failure, provision of second line drugs;
- prophylaxis, diagnosis and treatment of opportunistic infections (OIs);
- laboratory tests for suspected toxicity (for those showing clinical signs of toxicity) and switching individual drugs in case of confirmed toxicity; In middle-income countries costs also include the operating costs of CD4 and viral load monitoring tests every 6 months\(^3\).
- palliative care;

**Programme costs include:**\(^4\)
- training of doctors and nurses for initiation and monitoring of antiretroviral therapy;
- recruitment and training of community health workers and lay volunteers to follow up patients for treatment and adherence support;
- supervision and monitoring;

---

\(^1\) TB/HIV estimates were done in collaboration with THD/STB, WHO.

\(^2\) See Annex 2 for the underlying assumptions used in the analysis of patient costs.

\(^3\) For low-income countries the operating costs of virological (viral load, P24 antigen) and immunological (CD4, total lymphocyte count) monitoring tests were not included for 2004-2005 as these were not part of the care model for these two years as defined at the consensus meeting.

\(^4\) See Annex 3 for the underlying assumptions used in the analysis of programme costs.
increasing the capacity of the drug distribution and storage systems, including purchasing vehicles;
universal precautions;
post exposure prophylaxis;
purchasing of CD4 and viral loads at provincial hospitals, and in 30% of district hospitals in low income countries with an HIV prevalence higher than 5%, the cost of which is introduced in 2005 – it was assumed that middle income countries (e.g., South Africa, Botswana, Thailand) already have CD4 or viral load machines. Coulter counters and automated biochemistry machines were added in low income countries in 2005 based on current health infrastructure levels.

Note that these elements relate only to the 3 by 5 strategy and only those preventive activities required to support it directly. They do not include scaling up other interventions, assuming these will continue at the current rate. Given the short time frame of the 3 by 5 strategy, they do not include major changes to the health system infrastructure.

The number of people requiring ARV is taken from UNAIDS country-specific projections of prevalence, incidence and mortality and assumes that the number of people requiring ARVs in any given year is equal to the number of people expected to die within 2 years in the absence of ARV therapy, i.e. projections of the number of HIV infected people in the last 2 years of life. The 3 by 5 coverage target accounts for around 50% of the total global need for ARV treatment using this definition of when people require ARV.

The total number of people receiving ARV in a year is the sum of those newly placed on ARV in that year plus those surviving on ARV therapy from the previous year (including those who had access to ARV prior to the 3 by 5 initiative). The analysis assumes that people who stop treatment or who die while on treatment are replaced by other eligible people who had not been able to initiate therapy.

Baseline access to ARV: The number who have access to ARV therapy in 2003 was drawn from the results of a WHO coverage survey\(^5\), in countries where such survey results were available. In sub-Saharan African countries where no survey data were available, the average percentage of the population enrolled in an ARV programme from other sub-Saharan countries was used. For non-African countries, the average percentage reported from other non-African countries was used.

Note for this analysis, the costs for 2004-5 of those who were already on HAART in 2003 have been included in the costing, on the assumption that

---

they would transfer to the public sector if drugs and services were offered for free or at a lower cost, as was the experience in Botswana.

**Survival rates:** 10% of the newly enrolled patients are assumed to die within the first 3 months of initiating ARV therapy through the 3 by 5 strategy\(^6\). The survival benefit for the remaining population is assumed to be 3-5 years (on the average about 5-7 years in total after initiation of therapy, depending upon whether the patients who initiate therapy are drawn from the more or less immunosuppressed portion of the total eligible population).

**Entry points.** Three main entry points for recruitment of eligible patients were used and costed separately – TB clinics, health facilities (in-patient and outpatient) and antenatal care clinics. This is to account for the different ARV drug regimens (TB versus pregnant versus other) and the total number of HIV tests required, the coverage of which varies by entry point.

**Growth rates in coverage:** The results are presented for three assumptions of the growth rates in coverage to reach the target of 3 million by the end of 2005. These present different rates for the number covered in the first and second years of the programme, as follows:

- **Assumption 1:** 10% of the target is met in 2004, and 90% in 2005 (i.e. 300,000 on ARV during 2004, and the remaining 2,700,000 during 2005)

- **Assumption 2:** 20% of the target is met in 2004, and 80% in 2005 (i.e. 400,000 by 12/03, 500,000 by 06/04, 600,000 by 12/04, 1,600,000 by 6/05 and 3,000,000 by 12/05 – this scenario reflects the targets defined in the 3 by 5 strategy document).

\(^{6}\) These figures were derived from reports presented at the WHO/UNAIDS International Consensus Meeting on Interim Recommendations for Technical and Operational Procedures for Emergency Scaling up ARV Treatment in Resource-Limited Settings, November 18-21, 2003, Lusaka, Zambia.
Cost of antiretroviral drugs: The costs of antiretroviral drugs have changed rapidly in recent years, and will probably continue to change during the two years of the 3 by 5 programme. The estimates presented here are for two possible assumptions, as follows:

- **Scenario A: “Higher cost”** - Unit cost of drugs per year (tradable component only) is as follows (source: Joint UNICEF/UNAIDS/WHO/MSF project):
  - $304 for first line therapy (fixed-dose combination)
  - $1108 for switch to second line therapy
  - $706 for switch due to toxicity
  - $505 for patients with TB ($353 for 6 months then use first line for remaining 6 months)
  - $831 for pregnant patients with TB ($679 for 6 months then use first line for remaining 6 months)

- **Scenario B: “Lower cost”** – As negotiated by the Clinton Foundation. The cost amounts to $140 per patient per year for the standard first-line treatment and was originally offered to a limited number of countries. However, Scenario B assumes that the lower cost of first line drugs would be accessible to all countries, and is estimated as a function of the country-specific HIV prevalence rate and income per capita where higher prevalence countries pay less and higher GDP countries pay more. The cost of second line treatment was assumed to undergo a similar cost reduction compared with scenario A.
  - $140 for first line therapy
  - $510 for switch to second line therapy
  - $325 for switch due to toxicity
  - $423 for patients with TB ($353 for 6 months then use first line)
  - $749 for pregnant patients with TB ($679 for 6 months then use first line)

In summary, there are six possible scenarios of the assumptions considered:

- 1A: 10%/90% with higher drug costs
- 1B: 10%/90% with lower drug costs
- 2A: 20%/80% with higher drug costs
- 2B: 20%/80% with lower drug costs

**Results:**

The estimated costs for 2004 and 2005 are summarized in the table below, for the four scenarios considered. The final column of the table is an estimate of the costs of maintaining the 3 million on ARV therapy during 2006, assuming

---

that the target of 3 million was reached only at the end of 2005, and that therapy would not be stopped at that time.

Note that these are preliminary estimates and although the estimates were build up country by country, the intent was to provide a global aggregate target. More precise country estimates are being developed in consultation with countries.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1A: 10%/90% with higher drug costs</td>
<td>$1.80</td>
<td>$3.60</td>
<td>$5.40</td>
<td>$4.50</td>
</tr>
<tr>
<td>1B: 10%/90% with lower drug costs</td>
<td>$1.72</td>
<td>$3.00</td>
<td>$4.70</td>
<td>$3.70</td>
</tr>
<tr>
<td>2A: 20%/80% with higher drug costs</td>
<td>$1.95</td>
<td>$3.60</td>
<td>$5.50</td>
<td>$4.40</td>
</tr>
<tr>
<td>2B: 20%/80% with lower drug costs</td>
<td>$1.82</td>
<td>$3.00</td>
<td>$4.80</td>
<td>$3.60</td>
</tr>
</tbody>
</table>

Note: These estimates are for 34 countries representing 91% of the global need for antiretroviral therapy. The estimates build on the previous costing work for the care component of the UNGASS comprehensive response to the HIV/AIDS epidemic. They do not represent an additional funding requirement over that estimated by UNGASS.
Figure 1 Total costs of 3 by 5 (Scenario 2A)

Figure 2 Percentage expenditure on capital items by year.
Figure 3 Recurrent costs per year, by scenario
Annex 1 Countries included in the analysis and percentage contribution to the overall 3 x 5 target

<table>
<thead>
<tr>
<th>WHO REGION</th>
<th>COUNTRY</th>
<th>Adult Prevalence (%)</th>
<th>Estimates for ARV Needs (# of patients)</th>
<th>Percent of Global Need</th>
</tr>
</thead>
<tbody>
<tr>
<td>AFRO</td>
<td>South Africa</td>
<td>20.1</td>
<td>466,985</td>
<td>15.8</td>
</tr>
<tr>
<td>SEARO</td>
<td>India</td>
<td>0.8</td>
<td>308,095</td>
<td>10.4</td>
</tr>
<tr>
<td>AFRO</td>
<td>Kenya</td>
<td>15</td>
<td>189,105</td>
<td>6.4</td>
</tr>
<tr>
<td>AFRO</td>
<td>Zimbabwe</td>
<td>33.7</td>
<td>18,283</td>
<td>6.2</td>
</tr>
<tr>
<td>AFRO</td>
<td>Nigeria</td>
<td>5.8</td>
<td>180,845</td>
<td>6.1</td>
</tr>
<tr>
<td>AFRO</td>
<td>Ethiopia</td>
<td>6.4</td>
<td>1,494</td>
<td>5.0</td>
</tr>
<tr>
<td>AFRO</td>
<td>United Republic of Tanzania</td>
<td>7.8</td>
<td>121,055</td>
<td>4.1</td>
</tr>
<tr>
<td>WPRO</td>
<td>China</td>
<td>0.1</td>
<td>103,555</td>
<td>3.5</td>
</tr>
<tr>
<td>AFRO</td>
<td>Zambia</td>
<td>21.5</td>
<td>98,195</td>
<td>3.3</td>
</tr>
<tr>
<td>AFRO</td>
<td>Democratic Republic of the Congo</td>
<td>4.9</td>
<td>95,725</td>
<td>3.2</td>
</tr>
<tr>
<td>AFRO</td>
<td>Malawi</td>
<td>15</td>
<td>67,905</td>
<td>2.3</td>
</tr>
<tr>
<td>AFRO</td>
<td>Côte d’Ivoire</td>
<td>9.7</td>
<td>63,655</td>
<td>2.1</td>
</tr>
<tr>
<td>AFRO</td>
<td>Cameroon</td>
<td>11.8</td>
<td>61,790</td>
<td>2.1</td>
</tr>
<tr>
<td>AFRO</td>
<td>Mozambique</td>
<td>13</td>
<td>61,565</td>
<td>2.1</td>
</tr>
<tr>
<td>SEARO</td>
<td>Thailand</td>
<td>1.8</td>
<td>53,340</td>
<td>1.8</td>
</tr>
<tr>
<td>AFRO</td>
<td>Uganda</td>
<td>5</td>
<td>48,260</td>
<td>1.6</td>
</tr>
<tr>
<td>AFRO</td>
<td>Rwanda</td>
<td>8.9</td>
<td>38,805</td>
<td>1.3</td>
</tr>
<tr>
<td>AFRO</td>
<td>Burkina Faso</td>
<td>6.5</td>
<td>35,350</td>
<td>1.2</td>
</tr>
<tr>
<td>EMRO</td>
<td>Sudan</td>
<td>2.6</td>
<td>31,165</td>
<td>1.1</td>
</tr>
<tr>
<td>AFRO</td>
<td>Burundi</td>
<td>8.3</td>
<td>29,795</td>
<td>1.0</td>
</tr>
<tr>
<td>AFRO</td>
<td>Ghana</td>
<td>3</td>
<td>29,130</td>
<td>1.0</td>
</tr>
<tr>
<td>AMRO</td>
<td>Haiti</td>
<td>6.1</td>
<td>28,160</td>
<td>1.0</td>
</tr>
<tr>
<td>AFRO</td>
<td>Guinea</td>
<td>3</td>
<td>28,155</td>
<td>1.0</td>
</tr>
<tr>
<td>AFRO</td>
<td>Lesotho</td>
<td>31</td>
<td>28,070</td>
<td>0.9</td>
</tr>
<tr>
<td>AFRO</td>
<td>Botswana</td>
<td>38.8</td>
<td>26,755</td>
<td>0.9</td>
</tr>
<tr>
<td>AFRO</td>
<td>Angola</td>
<td>5.5</td>
<td>24,350</td>
<td>0.8</td>
</tr>
<tr>
<td>SEARO</td>
<td>Myanmar</td>
<td>1</td>
<td>21,940</td>
<td>0.7</td>
</tr>
<tr>
<td>WPRO</td>
<td>Viet Nam</td>
<td>0.3</td>
<td>20,150</td>
<td>0.7</td>
</tr>
<tr>
<td>AFRO</td>
<td>Central African Republic</td>
<td>12.9</td>
<td>19,670</td>
<td>0.7</td>
</tr>
<tr>
<td>SEARO</td>
<td>Indonesia</td>
<td>0.1</td>
<td>19,180</td>
<td>0.6</td>
</tr>
<tr>
<td>EURO</td>
<td>Ukraine</td>
<td>1</td>
<td>18,830</td>
<td>0.6</td>
</tr>
<tr>
<td>EURO</td>
<td>Russian Federation</td>
<td>0.9</td>
<td>17,940</td>
<td>0.6</td>
</tr>
<tr>
<td>AFRO</td>
<td>Namibia</td>
<td>22.5</td>
<td>14,675</td>
<td>0.5</td>
</tr>
<tr>
<td>AFRO</td>
<td>Swaziland</td>
<td>33.4</td>
<td>13,190</td>
<td>0.4</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td><strong>2,697,615</strong></td>
<td><strong>91%</strong></td>
</tr>
</tbody>
</table>
## Annex 2 Key assumptions underlying patient costs

A fundamental characteristic of the 3 by 5 implementation strategy, as defined by the Zambia Consultation meeting, is to provide access to ARVs at primary health facilities and district hospitals with doctors/nurses prescribing the ARVs and assuring clinical follow-up and with community health workers (CHWs) and lay volunteers providing treatment and adherence support and palliative care. However, as it is expected that considerable preparatory activities, particularly recruitment and training, will need to take place in low-income countries during the first phase, a district hospital-based system of initiation of therapy and follow-up in the primary health centers is costed initially, with subsequent scaling up of treatment initiation in all levels of facilities during the second phase. For middle income countries, treatment initiation and follow-up is undertaken at all levels of the health system.

The following are the key assumptions for testing and counseling, the number of facility-based visits for initiation and monitoring of ARV therapy, frequency of counseling and adherence monitoring, lab tests for toxicity and the estimated time associated with each of these activities, based on the experience in Malawi by the MSF Luxembourg programme\(^8\) and modified for 3 x 5.

### 1. Testing and Counseling:

HIV testing and counseling were estimated separately for each of three entry points. For TB clinics, hospitals and outpatient clinics, coverage is based on those with access to care and presenting with HIV/AIDS defining symptoms (clinical stage 3 and 4). For antenatal care clinics, we used the Future’s Group estimates for cost of PMTCT with 50% coverage.

**Cost of Testing:** Rapid/simple tests cost around US$ 1, to which a 50% mark-up was applied for shipment, management, loss, false positives, etc. Costs for labour was calculated as US$ 6 in Botswana, which includes about 30 minutes of nurse time (including post-test counseling). Local costs were adjusted to country specific prices based on a regression model of cost per hospital bed day as explained above (1). Every person testing positive is given a second rapid test for confirmation.

### 2. Condoms:

Number of condoms provided to people tested and those receiving care/year: 66 condoms at 15 cents each including cost of marketing and distribution.

---

\(^8\) [http://www.who.int/hiv/toolkit/arv/en/content.jsp?d=arv.01.04](http://www.who.int/hiv/toolkit/arv/en/content.jsp?d=arv.01.04)
3. ARV treatment initiation and monitoring:

The Care Model is defined as follows:

*Low income country hospital-based (year 1):*

1. Treatment initiation visit(s), clinical officer/RN, year 1: an average of 2 visits was used which assumes that initial HIV testing has been done previously, that the initial test was confirmed positive and the patient is presenting for clinical assessment to determine ARV eligibility. The average of two visits allows for handling of initial minor side effects such as nausea, etc. Average time spent per visit: 30-45 min each. Patients with major side effects or complicating illnesses are referred to a doctor.

2. Treatment initiation lab: HIV rapid test for confirmation of self-reported cases unless reliable written documentation is available, haemoglobin colorimetric scale for those who will be given zidovudine-based regimens and pregnancy test for females of reproductive age who do not have reliable methods of contraception and need to take efavirenz-containing regimens.

3. Monitoring visits, RN: at 2 weeks, at 1 month, then monthly for 6 months then every 2-3 months thereafter, 15-20 minutes on average.

4. Adherence counselor visits (by CHW): every month, 20 min on average.

5. Proportion requiring alternative first line treatment in first year of ART: 10% due to toxicity (requiring toxicity work up, almost all of whom will require a switch of a single drug) and 5% due to pregnancy and newly incident cases of tuberculosis (combined).

6. RN toxicity visit: 1 visit, 20 min (with 100% of patients referred on to a doctor).

7. MD toxicity visit: an average of 2 visits, 20 min each.

8. Full blood count (FBC) and ALT for clinically suspected toxicity (one each on average per patient).

9. % with toxicity, pregnancy or TB, year 2: same as in year 1.

10. % with clinical failure year 1: 10% death in the first three months.

11. % with clinical failure year 2: 5%.

*Low-income country, health center-based (year 2):*

As per low-income country, hospital based with treatment initiation at health centres by clinical officer or nurse.

*Middle-income country, hospital or health centre-based (year 1 and 2):*

As per low-income hospital-based, plus:
a. FBC every 6 months
b. CD4 every 6 months
c. Viral load every 6 months
d. Plus toxicity monitoring every year

Note: cost of CD4 and viral load machines is included in 2005 for low-income countries but the analysis assumes that they will be used starting 2006.

3.1. Annual cost of ARV initiation and monitoring visits: The annual per patient cost or ARV initiation and monitoring visits was estimated as the annual number of visits at hospitals or health centres, as described in the care model above, multiplied by the respective unit cost per visit. Unit cost per visit were based on regression models to estimate country specific cost per outpatient visit at hospitals (Taghreed Adam and David Evans, Rules of Thumb for Allocating Hospital Costs Across Departments. A Multi-Country Analysis (forthcoming)) and cost of per outpatient visit at health centres (Taghreed Adam, Steve Ebener, Benjamin Johns and David Evans, Cost of Scaling up Health Interventions at Primary Facilities. A Multi-Country Analysis (forthcoming)). The unit costs were estimated for secondary level hospital and urban health centres. They only reflect the non-traded component of the cost per visit, e.g., labour and overhead — Drugs and laboratory are estimated separately as described below. The annual cost does not include adherence visits by community health workers as these are included in the programme cost component through hiring new staff.

3.2. Annual cost of laboratory monitoring for low income countries: Based on an analysis of reagents and materials needed, the cost of traded goods for full blood count was estimated to be about US$ 0.40 and US$ 0.68 for ALT. Each patient receives a FBC (full or complete blood count), and the 15% presenting with toxicity require an additional ALT. Thus, average costs per patient per year sums to US$0.52 per year (US$ 0.40 + 15%*.68). Non-tradable costs (primarily labour) were calculated for Botswana, and come to $2.09 per patient per year. The non-tradable portion of these costs were scaled to a country-specific price on the basis of a regression to estimate country-specific cost per hospital bed day, rather than using other non-health specific conversion factors such as purchasing power parity exchange rates (1).

3.3. Annual cost of laboratory monitoring for middle income countries: It was assumed that middle income countries had existing infrastructure and capacity to perform a more comprehensive lab testing regimen, and thus would utilize more lab tests than recommended in phase one of the Zambia meeting protocols. The annual lab package in middle income countries was costed based on the following yearly package:
<table>
<thead>
<tr>
<th>Test</th>
<th># Performed Annually</th>
</tr>
</thead>
<tbody>
<tr>
<td>FBC</td>
<td>2</td>
</tr>
<tr>
<td>Viral Load</td>
<td>2</td>
</tr>
<tr>
<td>Differential blood count</td>
<td>1</td>
</tr>
<tr>
<td>Creatinine</td>
<td>1</td>
</tr>
<tr>
<td>ALT</td>
<td>1</td>
</tr>
<tr>
<td>Cholesterol/Triglycerides</td>
<td>1</td>
</tr>
<tr>
<td>Amylase</td>
<td>1</td>
</tr>
<tr>
<td>CD4</td>
<td>2</td>
</tr>
</tbody>
</table>

Costs were derived from South African central laboratory charges\(^9\). Based on previous studies for the UNAIDS Care Model, it was assumed that 70.5% of the total costs for the annual set of tests was traded goods, and 29.5% local. Local costs were scaled to country price levels as described above for lab tests in low income countries.

### 3.4. Labour cost and capacity utilization:

As explained above, this analysis separates traded (e.g., drugs and laboratory services) from non-traded goods (e.g., labour costs) to enable country-specific adjustments in future work, e.g., reflecting the provision of incentives versus new recruitment of personnel. A supplemental analysis of the percentage of human resource capacity used to implement the 3 by 5 strategy was performed to explore the extent to which countries would run into capacity constraints with respect to the different scenarios of speed of implementation.

The percentage of human resource capacity used to implement the 3 by 5 strategy was estimated as the total number of minutes required by nurses and doctors to deliver “3 by 5” (using country-specific target coverage) divided by the current number of human resource availability (in minute equivalents and taking into account country-specific estimates of average number of working days and hours worked per day) by country\(^10\), adjusted downwards by 30% (an arbitrary value to account for those working exclusively in private sector (thus have no access to training or free drug availability), or those not practicing or who have migrated). Assuming an unused capacity of 10-30%, based on a key informant survey\(^11\), the results show that current human resource availability can cope with the 3 by 5 initiative except for Burundi in the second year of implementation were the care model will consume 43%-46% of their total nurse time availability, see Figure 4.

---

\(^9\) Public charges for lab procedures are higher in South Africa than in the private sector, so these costs may over-estimate the costs in practice.

\(^10\) Estimates were obtained from OSD/WHO using the latest updates of total number of doctors and nurses by country.

\(^11\) A key informant survey was administered during the Zambia consultation meeting through a questionnaire administered to programme and district managers from 10 countries.
4. ARV therapy:
The choice of ARV regimen follows the recommendations of the WHO/UNAIDS International Consensus Meeting on Interim Recommendations for Technical and Operational Procedures for Emergency Scaling up ARV Treatment in Resource-Limited Settings, November 2003, Lusaka, Zambia, as well as the October 2003 revision of the WHO Treatment Guidelines\textsuperscript{12}.

1. Men and women start with standard first-line regimen: d4T/3TC/NVP\textsuperscript{13} (fixed-dose combination)
2. Male TB patients on antituberculosis therapy take d4T/3TC/EFZ for 6 months then switch to the therapy in (1) above
3. Female TB patients on antituberculosis therapy who are pregnant or at risk of pregnancy take 6 months ZDV/3TC/ABC or (saquinavir with ritonavir) then switch to (1)
4. Children take standard regimen at 94\% of cost for adult regimen
5. The standard second line therapy is ABC/ddI/LPV/r

\textsuperscript{12} Scaling up antiretroviral therapy in resource-limited settings: treatment guidelines for a public-health approach, 2003 revision, WHO, Geneva October 2003

\textsuperscript{13} abacavir (ABC); didanosine (ddI); efavirenz (EFZ); lopinavir (ritonavir-boosted) (LPV/r); nevirapine (NVP); lamivudine (3TC); stavudine (d4T); zidovudine (ZVD).
6. In case of confirmed toxicity due to an identified drug, patients switch to another drug as recommended by the revised Treatment Guidelines.

5. Opportunistic Infections:

1. Annual OI prophylaxis cost:
   a. INH for primary tuberculosis prophylaxis to 19% of adult HIV positive patients recruited from the MTCT/VCT entry points, after exclusion of active TB through X-ray and medical examination (cost of X-ray and examination included).\textsuperscript{14}
   b. Cotrimoxazole for primary PCP and toxoplasmosis prophylaxis for all adult and paediatric patients.
   c. Fluconazole for secondary prophylaxis of cryptococcal meningitis to 1% of adults.\textsuperscript{15}

2. Life time OI treatment costs:
   Life time (2 year) cost for all population in need. For patients on ARV, we assumed 10% of this cost to occur prior to initialization of therapy, and 90% during treatment failure under therapy. For those not on ARV, 100% of the cost are incurred during the last two years of life. Incidence data were derived from a review of opportunistic infections in Sub Saharan Africa\textsuperscript{12}; drug costs came from the Joint UNICEF/UNAIDS/WHO/MSF project and from the International Drug Price Indicator Guide 2002, a joint project of WHO and MSH.

6. Nutritional Supplementation Costs:

Calculations are based on supplying patients (with diagnosis of HIV wasting) with nutritional supplementation for 3 months at US$1 per day.\textsuperscript{16,17} The US$1 rate was adjusted to country-specific prices using PPP rates. For each country, the actual percentage of patients requiring supplementation was scaled based on WDI indicators of the percentage of children that are undernourished, using 11% of patients in Zambia as the base case. Costs are incurred at the time a patient starts ARV therapy.

\textsuperscript{14} 1998 UNAIDS/WHO IPT guideline
\textsuperscript{15} Holmes CB, Review of HIV type 1 related opportunistic infections in SSA. CID March 2003: 36 pp 652-662
\textsuperscript{16} http://www.who.int/hiv/topics/nutritional/support/en/
6. **Prevention of Mother To Child Transmission (PMTCT):**

Cost per woman screened: The cost of screening a pregnant woman for HIV, including the cost of the HIV test and the cost of the counseling associated with the testing. At present, the usual practice is to provide one counseling session prior to the HIV test, usually in a group setting. This unit cost, however, include only the counseling cost per woman.

Cost per woman testing HIV+ and receiving ARV regimen: The cost per woman of a confirmatory HIV test, further counseling, and the antiretrovirals provided in the PMTCT program. The default value includes US$1 for the confirmatory test and US$4 for the antiretrovirals, assuming that nevirapine is used.

7. **Post Exposure Prophylaxis (PEP):**

We assumed that the number of kits need per year is equal to 50 plus 1 additional kit for every million population. Assumed $67 as the cost per kit.

8. **Universal Precautions (UP):**

Calculated based on the number of hospital beds in the country. For Africa, a cost of $62.50 per year per hospital bed was used, based on estimates from Swaziland and Uganda. For the rest of the world, $306 per year per hospital bed was used based on estimates for Thailand. A goal of 90% coverage was assumed, achieving 50% coverage by 2005.

---

Prices are based on programme cost regression models (3). Local inflation rates were applied to local or mixed goods (including media, buildings, etc.) to bring all cost figures to year 2003 USD levels (inflation rates were taken from countries' central bank websites or, when not available there, from IMF data). Observed per diems were used when available, otherwise derived from the programme cost regression model. Salaries were updated from year 2000 baseline based on average change using available data.

Management and Evaluation:

Administration: Costs include programme co-ordination and management. Using the staffing levels used in the MSF Luxembourg Malawi operations, it was assumed that these levels reflect fixed need at provincial level except in countries with low HIV prevalence, where the number of participating hospitals (see "training" below) were used to scale the number of staff needed19. An additional set of administrators were included for co-ordination and management at the national level. Costs include staffing salaries and use of consumable goods (stationery items on per person basis) and some capital goods (computers, photocopiers, etc.).

Home based care recruitment and management: Costs include one staff member in each province for the recruitment of volunteers, and the co-ordination/supervision of their activities. Additionally, one staff in each district of a country was included, except in countries with low HIV prevalence, where the number of participating hospitals (see "training" below) were used to scale the number of staff needed. Number and type of staff were derived from MSF Luxembourg Malawi operations.

Information, education and communication: This includes staff needed at the national level to generate IEC materials related directly to 3x5 activities. It is assumed these staff were incremental to existing HIV/AIDS IEC activities already in place. Number and type of staff were derived from on MSF Luxembourg Malawi operations. The cost of 6 posters per hospital and 2 per health centre per year was included. Additionally, the cost of 1 flyer for every person newly tested for HIV and 1 flyer per person receiving ART per year were included.

Monitoring and evaluation: Cost includes those of data entry personnel and of an epidemiologist at the national level to consolidate and analyse information collected at health facilities. It assumed staffing levels from MSF Luxembourg

19 http://www.who.int/hiv/toolkit/arv/en/content.jsp?d=arv.01.04
Malawi for national level, with an additional 25% staff costs at provincial level.

Notes on assumptions: Costs of transportation, office space and furniture, etc. were excluded except for 1 new vehicle in each province (with driver, maintenance, gasoline) for the provincial programme co-ordinator's use (this cost was counted under drug supply for simplification of the costing spreadsheet). Other costs were assumed to be absorbed by existing infrastructure. Costs, such as per diems, etc. were counted in costs listed under Supervision.

Training:
A training algorithm was developed based on the minutes of care per patient to determine the number of patients each staffing category could handle at peak time (late 2005) when maximum number of patients would be under care and enrolling. The following figures were derived:

1 doctor: 1000 patients
1 Nurse: 436 patients
1 Community Counselor: 320 patients

These patient loads are calculated in the following formulas:

<table>
<thead>
<tr>
<th></th>
<th>Average Time per patient (minutes)</th>
<th>Average Patients per day</th>
<th>Number of Patients served</th>
<th>Days spent in client care</th>
<th>Days for other activities (supervision, phone consultations, vacation, etc.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Doctor</td>
<td>90.6</td>
<td>4.6</td>
<td>1019.9</td>
<td>215</td>
<td>40</td>
</tr>
<tr>
<td></td>
<td>7 hour work day</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nurse</td>
<td>202</td>
<td>2.1</td>
<td>457.4</td>
<td>220</td>
<td>40</td>
</tr>
<tr>
<td></td>
<td>7 hour work day</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Counselor</td>
<td>240</td>
<td>1.4</td>
<td>323.1</td>
<td>235</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>5.5 hour work day</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

A doctor sees 100% of patients twice for 40 minutes (since all enrolling patients were assumed to be recruited from a hospital ward, TB clinic, or antenatal centre, all patients were assumed to be presenting with pregnancy or major illnesses), 21% of patients twice for 20 minutes (for further toxicity and complications) and 11% of patients for 20 minutes (due to clinical failure resulting in death or switching to second line drugs), for an average of 90.6 minutes per patient per year in the enrollment year. These estimates were used for all patients even if they were not in their first year of care so as to not underestimate need; however, the amount of time in subsequent years is expected to be less unless the treatment is failing.
Nurses are assumed in the year of enrollment to have 2 diagnosis visits of 20 minutes each with all patients, plus an average of 7 follow-up visits (some follow-up visits will be shifted to the next year) per year for 17 minutes with all patients, and 20 minutes with 15% of patients for toxicity. As per doctors, these estimates were used for all patients regardless of how many years they are on ARV treatment.

Counselors see each patient 12 times for 20 minutes in the first and subsequent years. The amount of time spent working for a counselor is lower per day to account for travel time in the community. All these calculations were rounded down to allow for an overestimate of the time needed per patient, as well as adding 5 to 8 working weeks of time not spent directly in clinical care. The number of lay volunteers receiving training was then tripled; assuming that they will not work full time.

Additionally, it assumed one senior community health worker was needed training at each health centre involved for management purposes; one manager, one pharmacist, and one laboratory technician at each hospital involved needed training. Over 80,000 health workers and lay volunteers would receive training under these assumptions for the countries included in this analysis.

**Number of hospitals included:** The coverage level of hospitals was matched to the percentage coverage of patients in need. That is, if the target population accounts for 75% of people potentially recruited through the defined entry points, then it was assumed that 75% of hospitals would participate in the programme. This is likely an overestimate of the number of hospitals that would participate because larger, central hospitals (usually located in large urban areas) are likely to implement the programme first, and to cover a disproportionately large number of patients compared to the average for all hospitals. However, this assumption was made to ensure some level of equity in accessing care. The proportion of patients recruited from hospital in-patient and out-patient facilities plus 50% of patients from TB and antenatal were assumed to be treated at hospitals, with the remainder treated at health centres.

**Number of health centres included:** The patients not treated in hospitals were assumed to be treated at health centres. The presence of one full time nurse was assumed per health facility. However, since data from Zambia showed between 20% and 30% of their time was slack or could be shifted to other personnel (i.e., a nurse at a health centre could do task shifts and as a result, free up 20% to 30% of their time to ART), the number of health centres was calculated such that the number of patients per health centre would account for only 20% to 30% of a full time nurse’s time (e.g., 436*20-30% determined number of patients that could be served). Using this analysis, it was estimated
that over 9,900 hospitals and health facilities in the countries analyses would participate in delivering ART to meet the 3x5 goal.

**Note 1**: Countries with high levels of PHC participation (over 30% of facilities needing to participate) include: Lesotho (98%), Zimbabwe (90%), Tanzania (75%), Cameroon (51%), Central African Republic (45%), Burkina Faso (41%), Swaziland (40%), and Côte d'Ivoire (38%).

**Note 2**: When data on the number of hospitals and/or health centres in a country were not available, the average number per capita were derived for countries in the same Commission for Macroeconomics and Health (CMH) health infrastructure classification\(^{20}\) and applied to fill in data gaps.

**Duration of training**: The duration of training was assumed to be 12 days (2 weeks) for nurses and counsellors, 5 days for doctors, managers, pharmacists, and lab tech., with 2 day follow up in the year after training. Further, it was assumed that all staff would be trained in the second half of 2004 (leaving six months for the development of training material in the 1st half of 2004), (for the 25/75% scenario, this assumes that existing programmes are scaling-up rapidly in the first half of 2004) and all follow-up training are in 2005. The duration of the classes together with average class size (25 for counsellors, 15 for doctors, 20 for all other categories) were used to determine the number of trainers needed.

**Cost include:**

- **Per diems**: The analysis used district per diem rates for staff at health centres, provincial per diems for hospital staff. GIS model was used to determine length of travel in order to calculate gasoline costs (vehicle maintenance and purchase assumed to be provided by pre-existing infrastructure) (4).

- **Cost of training materials**: It was assumed that the cost per page was 50% the cost of printing a flyer; per trainee, one pack of training material was provided with the following number of pages:
  - RN/Aide: 20
  - Counselor: 20
  - Manager: 50
  - Pharmacist: 100
  - Lab: 50
  - Medical Officer: 100

**Trainer salaries** were included; as well as classes for the training of trainers.

---

Honoraria for community health workers and lay volunteers:
It was assumed that 100% of the counselors would be newly recruited into the system and require payment. Due to the quick and sudden demand for these services required by 3x5, they were assumed to need honoraria equivalent to an unskilled labourer and varied according to the time worked. The number included was derived from the training calculations described above.

Laboratory and Infrastructure Investment:

Infrastructure and buildings
Additional space for VCT/DCT: Due to low level of PHC participation at this stage, 5% of participating health centres in middle income and 10% of participating PHCs in low income countries were assumed to need additional space to carry out activities (percentages were also applied to balance beam scales and microscopes, below). Each was assumed to need 50 square meters of additional working space.

Laboratory equipment and machines:
Purchase of capital items needed for scale up were calculated and national import tax were added to the prices listed below:
Balance Beam Scales--535 USD each.
Microscopes--150 USD each.

CD4 Machines--No new CD4 machines were provided to middle income countries. In low income countries, one CD4 dyna-bead machine (15,000 USD) was purchased for every province, and the costs were counted in 2005. In countries with HIV prevalence greater than 5%, an additional 1/3 of participating district hospitals also received CD4 machines. Recurrent costs are counted in the cost per lab procedure (5).

Card Machines--Two smart card readers were provided to every participating hospital and health centre (100 USD). The costs were counted in year 2005. Additionally, every patient enrolled in ART received one smart card in 2005 (US$ 1).

Cell Phones/radio--These were provided only for participating health centres. The percentage of health centres needing to purchase a phone (250 USD) was based on the CMH health infrastructure classifications (6). Five minutes of phone time were allocated to each patient in a health centre, with cost per minute calculated at 10x the costs of a local landline call.

Viral Load Machines--One viral load machine for every three provinces in low income countries with high prevalence (>5%), one viral load machine (25,000 USD) for each low income country with low prevalence (5).
Hematology counters: Coulter counters (900 USD) were added to hospitals based on the CMH health infrastructure classifications, with the lower the health infrastructure quartile and the lower the income, the more machines purchased.

Biochemistry analysers: Automatic biochemistry analysers (10,000 USD) were added to hospitals based on the CMH health infrastructure classifications, with the lower the health infrastructure quartile and the lower the income, the more machines purchased.

**Drug Supply:**

*Cost include:* Logistic officers, co-ordinators, and drivers were hired in each province based on MSF Luxembourg Malawi operations. In middle and low income countries, one car and driver per province were provided for the co-ordinating staff use (described above). Additionally, in low income countries, additional cars and drivers were hired based on the size of the area that needed to be covered (i.e., bigger countries need more cars, scaled linearly based on the average size of a province in a country compared to the size of a province in Malawi).

Staff includes salaries and use of disposable materials, and some capital items, as described above in management and evaluation.

Cost of cars were calculated as around 20,000 USD, with adjustments for import taxes added. Maintenance was assumed at 5% of purchase price per year, and distances driven based on a GIS model, with the car assumed to be used every working day.

Additional storage for the drug based on shelving for blister packs was costed and 3 month reserve stock was ensured at all times. The cost of insurance and freight to ship the drugs to the country was added, using 900 USD per cubic meter shipped.

**Supervision:**

*Cost include:*
Supervision trips to hospitals, health centres, and laboratories. Distances were based on a GIS model, and the costs include gasoline but not new car purchase or maintenance (assumed to exist in current capacity). Number of supervision visits and number of supervisors going on a supervision visit to the sites listed are as follows:
<table>
<thead>
<tr>
<th></th>
<th># of Supervisors</th>
<th># of Trips per year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Health Centres</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>Hospitals</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>Laboratories</td>
<td>1</td>
<td>4</td>
</tr>
</tbody>
</table>

The high number of trips represents the care needed in conducting a rapid scale up. Per diems for trips to health centres were assumed to be district rates, and to hospitals and laboratory, provincial rates. An additional multiplier of 2 was applied to all trips to account for travel time. Salaries for supervisors to health centres were not costed, because they would be doctors in hospitals (on-going cost, which was accounted for by adding eight weeks of slack time to a doctor's yearly routine) while salaries for upper level supervision were included, based on an availability of 25 weeks for supervisory trips (the remainder of time spent for preparation, drafting reports, etc.). These supervisors were also included as students in calculating Training of Trainers costs.

**Results of Programme cost analysis**

Programme level costs represent 6% of total costs in 2004 and 3% of costs in 2005. They are higher in 2004 because of the high level of initial investment and training in the first year (and the lower total costs in that year). However, in a few countries, programme costs are a much more significant proportion of costs, with the following countries have programme level costs representing over 10% of total costs: Angola (23%), Botswana (12%), Central African Republic (15%), Namibia (12%), Uganda (11%).

Of these, Botswana and Uganda already have ART programmes in place, and and more detailed incremental analysis may lower these costs. Further, Russia and Ukraine have programme costs at less then 1% of total costs--reflecting the fact that these countries won't need large, complicated scale up.

The following pie chart shows the distribution of total programme costs for both years:
Figure 5: Programme Costs of 3 by 5

Breakdown of Programme Costs (includes 2004 and 2005 costs)

- Lab & Infrastructure: 26%
- Management & Evaluation: 17%
- Training: 16%
- Drug Supply: 19%
- Labor & Infrastructure: 26%
- Honoraria: 15%
- Supervision: 7%
References:


