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Estimating resource needs for HIV/AIDS health care services in low-income and middle-income countries

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Abstract

As funding mechanisms like the Global Fund for HIV/AIDS, Tuberculosis and Malaria increasingly make funding decisions on the basis of burden of disease estimates and financial need calculations, the importance of reliable and comparable estimating methods is growing. This paper presents a model for estimating HIV/AIDS health care resource needs in low- and middle-income countries. The model presented was the basis for the United Nations' call for US$ 9.2 billion to address HIV/AIDS in developing countries by 2005 with US$ 4.4 billion to address HIV/AIDS health care and the rest to deal with HIV/AIDS prevention. The model has since been updated and extended to produce estimates for 2007. This paper details the methods and assumptions used to estimate HIV/AIDS health care financial needs and it discusses the limitations and data needs for this model.

Keywords: HIV; AIDS; Health care; Financing; Economics

1. Introduction

The United Nations General Assembly Special Session on HIV/AIDS (UNGASS) committed member nations to reverse global HIV/AIDS trends through the achievement of specified goals by the years 2005 and 2010 [1]. Two models were developed to estimate the financial resources required to reach these goals in 135 low-income and middle-income countries in the year 2005 [2]. One model focused on the costs of HIV/AIDS prevention programmes while the other addressed the costs of HIV/AIDS health care services. The two models attempted to answer the question "if financial constraints in developing countries were relaxed, what is the total amount of resources that would be required to provide HIV/AIDS-related prevention

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and health care services in the year 2005 given existing country health and education infrastructures?" The methodology presented here is that used to derive the revised estimates produced for UNAIDS in late 2002 which is largely the same as that used for the derivation of the UNGASS estimates.

During 2001, another model was developed as background for the Commission on Macroeconomics and Health (CMH) [3]. It estimated the resources needed to scale up a package of core interventions to address HIV/AIDS and other priority illnesses in 83 low- and middle-income countries (including all of sub-Saharan Africa) by the years 2007 and 2015. The model sought to answer a slightly different question: "if financial and infrastructure constraints in poor countries were relaxed, what is the range of resources that would be required in addition to what is currently being spent in order to provide target coverage rates of prevention and health care services for selected priority illnesses including HIV/AIDS?"

As has been detailed elsewhere, the UNGASS models estimated that annual expenditure of US$ 9.2 billion on HIV/AIDS prevention and health care interventions in low- and middle-income countries will be needed by the year 2005 [2]. This compares to an estimated expenditure on HIV/AIDS of US$ 1.8 billion in the year 2000. According to the CMH model, annual expenditure on HIV/AIDS prevention and health care interventions in selected developing countries should increase by between US$ 13.6 billion and US$ 15.4 billion by the year 2007 and by between US$ 20.6 billion and US$ 24.9 billion by the year 2015 [3].

The ranges of these results underline the fact that these are estimates with limitations and they should be interpreted with caution. These limitations notwithstanding, the results of the UNGASS and CMH models have provided international policy makers with estimates that have been central to international HIV/AIDS advocacy and resource mobilization discussions during the last two years. During the 2002 International AIDS Conference, numerous calls were made for an annual expenditure of US$ 10 billion for HIV/AIDS prevention and health care services in developing countries based on the results of the UNGASS and CMH models [4–7]. Similarly, the Global Fund to Fight AIDS, Tuberculosis and Malaria used the UNGASS and CMH model results to inform its first round of resource allocation decisions [8].

To date, however, these estimates have had only a limited role in informing resource mobilization and resource allocation decisions within low and middle-income countries. All researchers involved in the construction of these models recognized that it would be inappropriate to use their results as tools for country-level strategic planning and country-specific resource mobilization without additional country-level work to improve the estimates. Although costs for selected HIV/AIDS prevention and health care interventions were modelled on a country-specific basis in these models, data limitations on intervention costs, current coverage of interventions and capacity of countries to scale up HIV/AIDS interventions meant that many assumptions had to be made regionally or sub-regionally. For example, cost data used in the UNGASS model were derived based on cost studies conducted in sub-Saharan Africa as well as estimates provided by country representatives from Latin America and the Caribbean. Country-specific unit costs were then extrapolated by differentiating portions of prices that remain constant across countries and those that depend on purchasing power within a country. However, ideally, unit costs based on cost studies conducted in countries would be used in the estimations.

Better estimates and projections of costs for HIV/AIDS health care are becoming more important to country-level strategic planning and resource mobilization given the increasing pressure within and on low- and middle-income countries to provide improved health care to people living with HIV/AIDS including antiretroviral treatment. This paper presents the methodology used to derive the revised estimates prepared for UNAIDS in late 2002 which is very similar to that used for the UNGASS estimates. It is hoped that researchers in countries will run the model to produce more accurate estimates on HIV/AIDS health care resource needs in their country. Researchers using the model can either use the methodology to calculate national level estimates or else use it to compute state-level estimates first and then use those to derive country-wide estimates. In either case, these revised estimates can serve to inform political discussions and decisions on HIV/AIDS health care within developing countries leading to strengthened country-level responses to the epidemic as well as eventually providing more accurate global resource needs estimates for HIV/AIDS health care.

2. Methods

In order to estimate financial needs for health care in an expanded response to HIV/AIDS in low- and middle-income countries, a series of assumptions and definitions had to be made. These included identifying which countries to include in the modelling exercise; selecting the interventions to be included; deriving country-specific estimates and projections of people in need of health care; estimating coverage levels of activities over time in each country; calculating country-specific unit costs for the activities; and approximating total resource needs and country capacity to pay. The methods and assumptions for each of these are described below.

2.1. Countries

Though only global and regional estimates have been published [2], these estimates were derived by summing up resource needs estimates calculated for individual countries. The model included all countries with gross national income (GNI) per capita below US$ 9265 (categorized as low-income, low-middle-income and upper-middle-income in the 2000 World Development Report) [9]. Countries with small populations for which there were no estimates of HIV prevalence could not be included in the analyses. The countries were then organized in six regional categories: sub-Saharan Africa; South and Southeast Asia; East Asia and the Pacific; Latin America and the Caribbean; Eastern Europe and Central Asia; and North Africa and the Middle East, as per UNAIDS practice.

2.2. Interventions

The key elements essential to a strong response in HIV/AIDS health care are now well recognized and the interventions included in the model and listed in Table 1 are based on WHO and UNAIDS recommendations [10].

Diagnostic HIV testing refers to the testing of symptomatic patients to improve the quality of care whether it be treatment of opportunistic infections, prophylaxis for the prevention of opportunistic infections or highly active antiretroviral therapy (HAART) [11]. *Palliative care* is the care and support provided to those people nearing death with the intention of improving their quality of life, excluding treatment of infections or malignancies. *Treatment of opportunistic infections* refers to all of the medications and medical care consumed in the treatment of HIV-related disease, including treatment for opportunistic infections and malignancies. *Prophylaxis for the prevention of opportunistic infections* refers to the cost of providing two drugs: isoniazid, effective in preventing reactivation of latent TB, and cotrimoxazole, effective in protecting against the pathogens responsible for pneumonia, diarrhoea and their complications. *HAART* is a combination of three anti-retroviral drugs. It is the highest standard of treatment for HIV infection at this time and includes the intensive laboratory monitoring required for all HAART patients.

Table 1
Categories of HIV health care activities

Categories of HIV health care activities	Description of activities
Palliative care	The care and support provided to those people nearing death with the intention of improving their quality of life
Diagnostic HIV testing	HIV testing conducted specifically for HIV diagnosis
Treatment of opportunistic infections	All of the medications and medical care consumed in the treatment of HIV-related disease, including opportunistic infections and malignancies
Prophylaxis for the prevention of opportunistic infections	Two drugs: isoniazid, effective in preventing reactivation of latent TB, and cotrimoxazole, effective in protecting against the pathogens responsible for pneumonia, diarrhoea and their complications
Drug costs and lab monitoring for HAART	HAART is a combination of three anti-retroviral drugs that represents the highest standard of treatment for HIV infection at this time

It should be noted that a number of interventions identified as key elements in HIV care were not included in the model [10]. Activities included under psychosocial support, nutritional support and home and community based care were not included given the very limited cost data available for these programs. This means that the estimates derived using this methodology underestimate the total resources needed for HIV/AIDS care. Also not included because they were incorporated in the modelling of HIV prevention costs were activities sometimes categorized as care activities such as voluntary counselling and testing (VCT), prevention of mother-to-child transmission (MTCT), and care for sexually transmitted infections (STI). In addition, social support programs such as orphanage care, orphan living assistance and orphan school fee assistance to support those affected by HIV/AIDS were calculated separately and are not described in this paper.

2.3. People needing health care with access to health care services

2.3.1. Estimating those in need of health care

The starting point for estimating the number of people needing health care was a set of country-specific HIV/AIDS epidemiologic models produced by UNAIDS and WHO [12,13]. The data, methods and assumptions underlying these models have been described in detail elsewhere [14,15]. These models use prevalence data over time and assumptions about the survival function from HIV infection to death to produce estimates of prevalence, incidence and mortality. The models can also be used to produce estimates of people who are one, two or more years away from death, thereby providing an estimate of the number of people who are in need of health care at different points in their progression from initial HIV infection. For the baseline year, the people requiring HIV/AIDS health care were estimated to be those people who were projected to die in the next two years. We assumed that persons in their last two years of life would correspond roughly to persons with CD-4 counts between 200 and 300 based on average survival with AIDS in industrialized countries in the absence of antiretroviral therapy [16–18].

2.3.2. Defining access to health care

It is known that only a fraction of all of the people requiring health care in most low- and middle-income countries actually have access to health services. Unfortunately, coverage rates for the various HIV/AIDS-related services are not known for most countries. In fact, for most countries, even reliable data on population access to general health services are not available. A proxy composite access indicator was therefore derived for each country using WHO data. This composite indicator was the simple median of four health service coverage indicators: the percent of the population in need covered by (1) directly observed therapy for tuberculosis (DOTS) [19], (2) the final immunization dose to prevent diphtheria, pertussis and tetanuss (DPT3) [20], (3) prenatal care and (4) attended births [21]. When an indicator was missing for a given country, that indicator was excluded and the median calculated on the basis of the remaining indicators. These indicators all refer to basic primary health care interventions that do not require highly trained personnel, laboratory support or extensive infrastructure. As a result it was assumed that coverage for palliative care, which requires a similar level of support, could be estimated using this indicator. While this is clearly a crude estimate at the level of any particular country, it was felt to be a reasonable approximation at the aggregate, at least until country-specific estimates could be obtained [9].

Access to health care services was modelled as a cascade which assumes that some health care services are easier to provide and require less sophisticated infrastructure than other services. *Palliative care* is the service that is easiest to provide and health facilities are able to provide access to this type of health care to people needing care even if they are unable to provide them with *OI treatment*, *OI prophylaxis*, or *HAART*. However, it is not realistic to assume that countries provide access to *HAART* to populations to whom they are unable to provide *OI prophylaxis*, *OI treatment*, *diagnostic HIV testing* or *palliative care*. Thus, coverage is assumed to fall as one goes down the cascade from less sophisticated to more sophisticated services.

Coverage levels for *diagnostic HIV testing*, *OI prophylaxis*, and *HAART* were drawn from the 2001 WHO coverage survey [22]. For countries for which data were not available coverage levels were imputed using the same WHO survey. The imputation was done

Table 2
Estimates of people needing health care in 2001 (base year) with access (%)

People needing care with access to palliative care	Access to health care indicator: Median of coverage of *prenatal care*, *DOTS detection*, *attended births* and *DPT*[a]
Symptomatic HIV+ tested HIV+	WHO 2001 coverage survey[b] or imputed
People needing care with access to OI treatment	(Access to health care)[c]
People needing care with access to OI prophylaxis	WHO 2001 coverage survey or imputed
People needing care with access to HAART	WHO 2001 coverage survey or imputed

[a] DPT coverage was regressed against per-capita GNP. The percent difference between the predicted and observed DPT coverage for each country were then used to adjust the expected growth rate for coverage of HIV/AIDS care. In other words, if a country had been able to scale up DPT coverage to 90% of that predicted for its GNP, then the expected GNP growth rate was also lowered by 10% [20].
[b] See [22].
[c] See [19–21].

using the Stata *impute* command which uses best subset regressions to impute missing variables [22,23]. The variables included as independent variables for the imputation included the other coverage variables in the survey. Access to *treatment of OIs* was estimated as a non-fixed percent of access to *palliative care*. We did not assume a fixed percent because as health systems become more sophisticated, the difference in coverage between palliative and OI care decreases (consider a country like Switzerland, for example, where the difference between the two is reduced to almost zero). Thus, the difference was modelled with an exponential function (assuming that coverage for *treatment of OIs* is the square of the basic health access indicator) such that the difference approaches zero as the assumed coverage of palliative care approaches one. These coverage indicators are summarized in Table 2.

Palliative coverage (%)	10	20	30	40	50	60	70	80	90	100
Ol Tx Coverage (%)	1	4	9	16	25	36	49	64	81	100

2.4. Coverage of HIV/AIDS health care services

One of the key assumptions underlying the model is that changes in health system infrastructure occur slowly over time. The model estimates resource needs for services that could be provided with the currently existing health systems infrastructure given predetermined annual growth rates. Because no data exist on annual growth rates for HIV/AIDS services or even for health systems in general, annual growth rates had to be estimated.

We estimated growth rates in coverage for each country using per-capita gross domestic product (GDP), previous success in increasing coverage for essential vaccines, and burden of HIV/AIDS. *Per-capita GDP* was assumed to adjust for differences in general health system infrastructure. In other words, a wealthier country with a sophisticated health system can strengthen its provision of HIV health care more quickly than a poorer country with a rudimentary health system. We also sought to capture countries' previous experience in dramatically increasing coverage for a health service. Increase in *coverage for DPT vaccination* was used since that is the only example we are aware of where countries almost universally sought to implement a health intervention at a large scale at approximately the same time and for which longitudinal coverage data are available. A large proportion of the differences in the ability of countries to scale up DPT vaccination is explained by their relative wealth (GDP per capita). Since the model already explicitly considers relative wealth, the DPT coverage unexplained by per-capita GDP was used as an adjustor.[1]

[1] DPT coverage was regressed against per-capita GNP. The percent difference between the predicted and observed DPT coverage for each country were then used to adjust the expected growth rate for coverage of HIV/AIDS care. In other words, if a country had been able to scale up DPT coverage to 90% of that predicted for its GNP, then the expected GNP growth rate was also lowered by 10% [20].

Burden of HIV as measured by HIV prevalence was used to correct for the difference in scaling-up coverage for HIV/AIDS health care in countries where the percent of the population infected with HIV is low (e.g. 1% prevalence) compared to countries where the percent of the population is high (e.g. 25% prevalence). We assumed that achieving a 10% increase in coverage of HIV/AIDS health care services is more difficult in countries with high HIV prevalence because 10% of HIV/AIDS represents a larger proportion of all health services in higher prevalence countries. To take this factor into account, the maximum growth rate was lowered by the complement of the HIV prevalence.

The baseline parameter estimates for maximum annual growth rates are the most uncertain parameters in the model. The model assumed that the poorest countries could grow up to 10% and the richest countries could grow up to 20% with growth in countries between these two extremes adjusted linearly by purchasing power parity adjusted per-capita GDP (PPP). The 10 and 20% figures are based on informal consultation with health systems experts and the early experiences of a limited number of countries . As more countries start the scaling-up process it will be possible to calibrate the model based on empirical data. We linearly adjusted the resulting (10–20%) growth rate using the gap between the current vaccination coverage rate and the expected vaccination rate based on PPP, and HIV prevalence. Growth rates were expressed as the *proportion of unmet need* newly covered in one year. Thus, a 20% growth rate implies an increase from 10% coverage to 28% in 1 year (i.e. the 10% baseline plus 20% of the remaining 80%) or from 80 to 84%. This formulation takes into account the fact that it is progressively more difficult to achieve coverage of the population as coverage increases since initial expansion of coverage occurs among patients who have better access, are better informed and more likely to be demanding services.

Using the UNAIDS and WHO models mentioned above, we calculated the number of people needing care with access to health care in year Y as the sum of people with access that newly need health care in year Y plus the people who received health care in $Y-1$ and survived. The annual growth rate in access was applied to the proportion of people needing health care who did not have access in the previous year, thus:

$$A^Y = A^{Y-1} + (1 - A^{Y-1}) \times G$$

where A^Y is the proportion of people needing health care in year Y who have access to health care and G is the annual growth rate.

We assumed that each year, the number of people receiving each service—excluding HAART (palliative care, the number of people knowing their HIV status, and the number of people receiving treatment for OI) was equal to the number of people newly needing health care with access to that service. Without HAART, individuals were assumed to survive 2 years while the treatment with antiretroviral therapy increased this survival. Because we modelled costs rather than benefit in healthy life years, we assumed that patients who started HAART on average 2 years before they otherwise would have died would continue on HAART for a total of between 3 and 7 years—implying a survival benefit of 1–5 years plus any survival following cessation of therapy. Average duration on HAART was assumed to vary as a function of the country's pre-existing health services infrastructure which is correlated with factors such as adherence, monitoring, consistency of the drug supply, and psychosocial support. We used the basic health care access indicator described above as a proxy for "pre-existing health services infrastructure" such that the 7-year maximum average is reduced by the difference between 100% and a country's basic health care access indicator, down to a minimum of three years. Duration of treatment for a particular patient was modelled with a Poisson distribution.

Finally, adults (aged 19 and above) and children (aged 0–18 years) were dealt with differently. We assumed that the cost of health care for children infected with HIV is 50% of that for adults. In most countries the large majority of children with AIDS are children infected perinatally (older children infected sexually typically do not progress to AIDS before age 18) and the few studies of the cost of care for young children have consistently suggested that the average cost is substantially lower than that for adults [24–26].

2.5. Unit costs

Published and unpublished literature was reviewed for cost data for the HIV/AIDS health care

Table 3
Annual costs for HIV/AIDS health care activities

Category	Annual costs per person per year (constant 2000 US$)	
	Low-income countries[a]	Middle-income countries[b]
Diagnostic HIV testing	3	3
Palliative care	75	300
OI treatment	300	1200
OI prophylaxis	45	180
Drug costs for HAART	350	2500
Lab monitoring for HAART	140	560

[a] For low-income countries costs derived from estimates formulated using data from sub-Saharan African countries [36–40].
[b] For middle income countries costs derived from estimates formulated by LAC country representatives [35].

interventions included for as many countries as possible [26–31]. Base unit costs were set for two groups of countries: low- and middle-income countries. Table 3 shows the costs assumed for each of the categories of activities in constant 2000 US dollars. The costs included are annual costs with the exception of costs for palliative care and OI treatment which are lifetime costs. The latter two were modelled as lifetime costs because in the absence of better data it was assumed that HAART does not change average lifetime OI treatment and palliative care costs, but instead simply delays these costs to varying degrees. Costs represent costs of service provision and drugs. These costs exclude capital and overhead costs as well as training costs.

The reference costs used for the estimations are based on studies conducted in sub-Saharan Africa as well as consultation with experts from Latin America and the Caribbean. When country-specific costs were not available, costs were imputed based on country wealth. For each unit price, a non-tradable proportion was defined based on the extent to which each intervention depends upon internationally traded goods including drugs and diagnostics versus local goods such as labour and physical infrastructure. Although health care interventions are typically labour intensive, in very low-income settings labour costs can easily be exceeded by the cost of expensive pharmaceuticals. The non-tradable proportion for each unit price was adjusted for each country using its PPP. The tradable portion of the cost was assumed not to vary across countries with the exception of antiretroviral therapy costs as described below. Such an imputation is a relatively blunt tool because it relies upon several strong assumptions. First, it assumes that the tradable and non-tradable proportions are constant across countries even though countries with large, sophisticated health care markets have a larger non-tradable proportion. Second, it assumes that PPP correction for the general consumption basket and for the HIV/AIDS care consumption basket are similar. Third, there is significant uncertainty in the estimates of the tradable proportion and finally, it assumes that the components of any of the packages of services (e.g. *palliative care*) are constant across countries. However, in absence of data from individual countries, it was not possible to have more robust estimates of country-specific unit costs.

2.5.1. *Palliative care (lifetime)*

The total lifetime cost of treating an HIV positive adult with palliative care. Although the duration of the palliative care provided varies, it is certainly concentrated in the last months of life. Therefore, for purposes of costing, it was assumed to be completely incurred in the last year of life.

2.5.2. *Diagnostic testing (once-off)*

The cost of testing to diagnose HIV infection. This testing is distinct from preventive testing and counselling as it is performed when there is clinical suspicion of HIV-related disease and thus is part of the process of providing health care. It was assumed to consist of two tests, an initial test and, if positive, a confirmatory test.

2.5.3. *Treatment of opportunistic infections (lifetime)*

The cost of treating opportunistic infections over the lifetime of an HIV positive adult. Even if survival is extended through the use of HAART or OI prophylaxis, it is assumed that a similar cost of opportunistic infections treatment will be borne prior to death. Although OI treatment is not as concentrated in the period immediate prior to death as palliative care, it is still strongly biased towards the last year of life. Thus we assumed that the full lifetime cost is borne in the last year. The bias introduced from not discounting part of these costs to the penultimate year of life is assumed to be insignificant given the degree of uncertainty in the estimates relative to the magnitude of potential bias due to assuming that the OI treatment expenditures occur in the last year.

2.5.4. Prophylaxis for opportunistic infections (annual)

The annual cost per HIV positive adult of prophylaxis against opportunistic infections using cotrimoxazole and isoniazid. The default annual cost was US$ 45 for low-income countries and US$180 for middle-income countries, which includes both the drug costs and the service delivery costs.

2.5.5. HAART (annual)

The annual cost of providing HAART, including both the drugs and the service delivery costs. We used a normative cost for HAART assuming that the cost of HAART varies with a country's purchasing power and HIV prevalence. We assumed that the minimum price for the tradable portion of HAART (US$ 300) will be paid by all low-income countries and by South Africa and Botswana, while this amount will be US$2,000 for the remaining middle-income countries. Prices were assumed to increases linearly in proportion to per-capita gross national income (GNI) from the poorest to the wealthiest middle-income country with prices ranging from US$ 315 in Sierra Leone to US$ 5293 in Malta. This price range was based on the normative assumption that price negotiations with pharmaceutical companies will result in price differentiation based on a country's ability to pay. The cost of HAART for children living with HIV was estimated to be 50% of the country-specific adult cost. The default values for these variables are easily modified for sensitivity analysis.

We should note that we used the "low-income" unit costs for both Botswana and South Africa for two principal reasons. First, HAART costs are a large part of overall costs and all negotiations with the pharmaceutical sector to date have included Botswana and South Africa in the group of most needy countries (because of the magnitude of the epidemic). Second, the two countries are both surrounded by low-income countries and have high levels of socio-economic inequality with the epidemic concentrated among the poor suggesting that health care costs for PLHA have more in common with those in the remainder of the African continent than with middle-income countries in Latin America and Asia. As additional cost data become available it will be possible to adjust these imputed unit costs to country-validated costs.

2.5.6. Laboratory test costs associated with HAART (annual)

The total annual costs of laboratory tests used for monitoring response to therapy and disease progression.

2.6. Total resource needs estimates

Total costs were estimated by multiplying the number of people using the health care service by the unit cost to provide that service. Due to lack of information regarding economies or diseconomies of scale in HIV health care in developing countries, no changes in unit costs were assumed as programs are scaled up.

3. Results

As mentioned above, the estimates initially produced by the model for 2005 have been presented previously [2]. This paper discusses these results together with the results of the updated model for the years 2001–2007.

The baseline estimates generated by the model suggested that by 2005, US$ 4.4 billion will be needed annually for the provision of HIV/AIDS health care in developing countries, and US$ 7.5 billion by 2007 (Fig. 1). To explore the sensitivity of the model to changes in the parameters used, sensitivity analyses were performed. The most revealing is a multivariate analysis in which "uncertainty distributions" were estimated for each parameter and then a probabilistic simulation of the model was conducted drawing parameter values randomly from their uncertainty distributions using @Risk software [32]. While not a confidence interval (because it is not based on empirical variance in the parameters and ignores inter-parameter correlation), 95% of the simulations produced values within $\pm$15% of the baseline estimates for 2005. The model is increasingly sensitive as it is extended into the future both because of the cumulative nature of the growth rates and because the number of patients under treatment also depends upon patients treated in previous years. The model is especially sensitive to the assumed cost of HAART

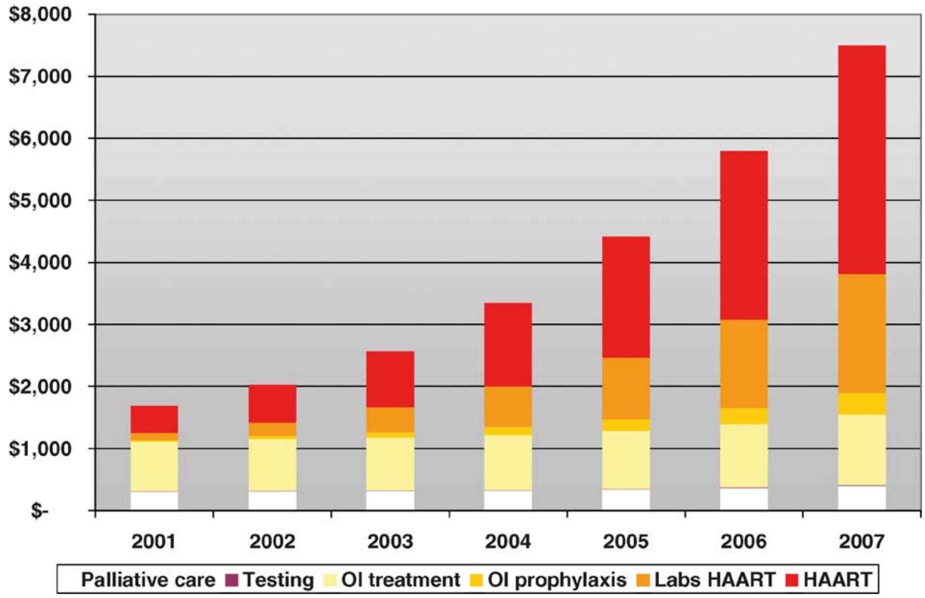

Fig. 1. Estimated needs for HIV/AIDS related health care by type of care, 2001–2007.

and to the assumed survival benefit (average number of years treated with HAART). For example, a modification on the HAART unit cost by reducing it by half would reduce the total for 2007 from US$ 7.5 billion to US$ 5.6 billion. If the average number of years on HAART were 8–12 instead of 3–7, the total for 2007 would rise from US$ 7.5 billion to US$ 8.4 billion.

While the estimated resource needs for each health care category increase in each year modelled, by far the greatest increase occurs in the estimated resource needs for HAART. These increased from US$ 434 million in 2001 to US$ 3.7 billion in 2007 which represents an increase in the share of HAART in total resource needs from 25% in 2001 to 49% in 2007. HAART-associated laboratory costs increase proportionately even more, from 7 to 26%. Prophylaxis for OI increases its share from 1% to almost 5% in 2007. The proportion of total resource needs allocated to the other interventions decreases over time (Fig. 2).

Not surprisingly given the epidemiology of the pandemic, it is estimated that sub-Saharan Africa will require most of the resources for HIV/AIDS health care—representing 56% of health care resource needs in 2001 and 43% of health care resource needs in 2007. North Africa and Middle East is the region estimated to require the least resources with 0.5% and 1.4% in 2001 and 2007, respectively.

Though resource needs for sub-Saharan Africa are estimated to be significantly higher, limitations in health system capacity mean that even these high levels of investment will cover a smaller proportion of total people needing HIV/AIDS health care. In 2005, coverage for HAART is calculated to be highest in Latin America with a regional average of

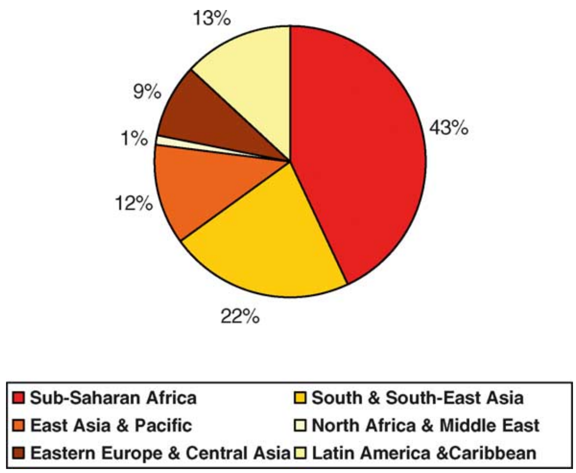

Fig. 2. Share of 2007 estimated resources needs by region.

almost 60% and almost 100% in the highest capacity countries. The regional average is approximately 41% for sub-Saharan Africa with some countries having a coverage rate of as low as 5%.

4. Discussion

In order to estimate financial needs for health care in an expanded response to HIV/AIDS in low- and middle-income countries in 2005 and 2007, we developed a model that derives country-specific estimates and projections of people in need of health care; estimates coverage levels of activities over time in individual countries; calculates country-specific unit costs for selected interventions and approximates total resource needs and country capacity to pay. Though we used this model to derive global estimates, it can be run by researchers in low- and middle-income countries to produce estimates on HIV/AIDS health care resources needs for their own countries. This paper was written to make the methodology available to these researchers.

For those who will run the model and those interpreting results from the model, we do note that some limitations must be considered. On the supply side, the model assumes that though there are no financial constraints on the expansion of HIV/AIDS health care services, all services must be provided within the confines of the current infrastructure in a country. In addition, the model assumes that all additional funds used for HIV/AIDS health care service provision will be used as efficiently as they were in the health care programs whose unit costs drive the model; that additional resources will not be wasted any more than current expenditures due to inefficiency or diversion of funds. Similarly, it also assumes that there will be no efficiencies of scale associated with scaling-up (or at least that any scale efficiencies will be offset by increasing marginal costs as scaling-up occurs). On the demand side, the model assumes that if HIV/AIDS health care services are provided, then those people needing health care will demand the services.

The most important limitation of the model is the lack of available data and this exercise underscores the real need to strengthen health data management systems in low- and middle-income countries. Because of the extreme paucity of relevant data, proxies for many variables were used. Clearly, the more that country researchers can use country-specific data that were not available to us instead of the proxies we derived, the more accurate and reliable their estimates of resource needs will be.

Another shortcoming associated with the model is that virtually no information is available on how unit costs change as interventions are scaled up. Such information could and should be collected as efforts to scale up HIV/AIDS care services begin. And similarly, one missing component is that the model does not allow for an analysis of the potential impact of the interventions included. Ideally, estimates of resource needs should go a step further, approximating not only resource needs but also the benefits provided by the resources spent. Focusing on the benefits expected from new investment would provide data critical to decisions on the distribution of resources within and across countries and sectors.

Finally, it should be noted that the perspective of these modelling exercises is limited to direct HIV/AIDS programme costs. This perspective ignores both costs incurred by patients to access these care services, costs which may vary substantially across and within countries and which are very large in some countries. The perspective also ignores the cost of increasing health system infrastructure to be able to cover a higher percentage overall. The omission of infrastructure costs here is in no way meant to imply that existing infrastructure is adequate—far from it. However, this approach points out that even within the existing infrastructure we could potentially treat a far greater proportion of people living with HIV/AIDS than are currently receiving therapy, especially in poor countries.

A series of regional workshops are being held to refine the methods and assumptions used to make estimates of health care needs [35]. To date regional workshops have been held for countries in Latin America and the Caribbean, among countries of Eastern Europe and Central Asia, and among countries of South and Southeast Asia. These workshops have been sponsored by various United Nations organization and their partners and should help provide more credible and comparable estimates of need for health care related to HIV/AIDS. In these workshops, we have seen that in many countries, policy-makers and researchers working on HIV/AIDS within countries do have access to information that is usually unpublished and was unavailable to the team working on the UNGASS care resource needs model.

Funding mechanisms like the Global Fund for HIV/AIDS, Tuberculosis and Malaria are increasingly making funding decisions on the basis of burden of disease estimates and financial need calculations. International institutions are also increasingly setting explicit goals and targets with regards to HIV/AIDS. UNGASS committed member nations to a list of specified goals to be achieved by the years 2005 and 2010. And more recently, WHO has committed to having three million people on HAART in developing countries by the year 2005 [33]. Similarly, at the national level, low- and middle-income countries are strengthening their HIV/AIDS strategic plans to include explicit goals and objectives [34]. In this context, the demand for reliable and comparable methods for estimating resource needs is growing. More robust country-specific estimates derived from additional information can serve to better inform national decisions on HIV/AIDS health care and these more accurate country-level estimates will also allow for better global resource needs estimates to inform decision making at the international level.

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