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POLICY FORUM: AIDS

Resource Needs for HIV/AIDS

B. Schwartländer,* J. Stover, N. Walker, L. Bollinger, J. P. Gutierrez, W. McGreevey, M. Opuni, S. Forsythe, L. Kumaranayake, C. Watts, S. Bertozzi

Thirty-six million people are living with HIV/AIDS; 22 million men, women, and children have died, and 15,000 new infections occur each day (*1*). With over two decades of experience, we have developed effective tools for prevention, treatment, and support (*2*). Many countries, including some of the poorest, have shown political commitment and developed plans to scale-up treatment and prevention programs. What they need are resources.

The United Nations, at the Millennium Summit in 2000 and at a special session on population and development in 1999, made commitments to intensify the fight against AIDS and specifically to reduce HIV prevalence in young people. These meetings have culminated in ambitious goals for reducing incidence through the expansion of prevention efforts and increasing access to care and support for all people living with HIV, developed for the General Assembly Special Session on AIDS in June 2001 (*3*). We present estimates of the resources required for reaching these goals.

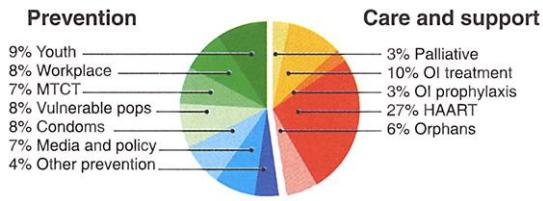

Fig. 1. Distribution of estimated resource need for prevention, care, and support for 2005 (total US$9.2 billion) by type of intervention. Vulnerable populations includes intervention for sex workers, MSMs, and IDUs. Media and policy includes mass media and policy, monitoring, and advocacy. Condoms includes both condom social marketing (CSM) and public sector distribution. Other prevention includes VCT, STI treatment, and blood safety. Abbreviations, see legend to Table 1.

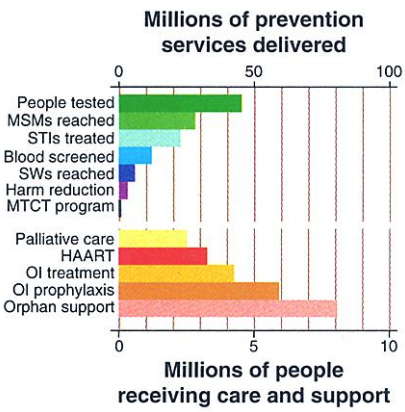

Fig. 2. Number of prevention services delivered and number of people receiving care projected for 2005. Abbreviations: SWs, sex workers; see legend to Table 1.

Methods

We have estimated the cost of HIV/AIDS prevention and care needs in 135 low- and middle-income countries in 2005. Specific interventions for prevention and care were targeted toward different populations. Estimates of the size of these population groups were based on U.N. estimates for general population groups and national estimates or published surveys for groups at higher risk. Subregional estimates were applied where country information was lacking. Interventions targeted at people living with HIV/AIDS and children orphaned by AIDS were based on estimates prepared by UNAIDS/WHO (*4*).

Not everybody has equal access to services. For facility-based services, such as treatment and voluntary counseling and testing (VCT), a composite access indicator was calculated for each country as the median of four health service coverage indicators: the percent of the population with access to (i) tuberculosis treatment (DOTS), (ii) essential immunizations (DPT3), (iii) attended births, and (iv) prenatal care (*5*).

Prevention interventions. Funding requirements for a package of 12 essential prevention categories (Table 1) were calculated for each country, on the basis of methodology developed by the London School of Hygiene and Tropical Medicine, the World Bank, and UNAIDS (*6*, *7*). Calculations were performed for urban and rural populations of each country. Coverage rates are intended to indicate what is feasible and necessary. These rates vary according to the level of HIV prevalence and economic development. For example, in high-prevalence countries it was assumed that all school children should have regular HIV/AIDS education, whereas in low-prevalence countries less intensive education may be sufficient.

Total prevention costs for each country were increased by 10% to account for policy, advocacy, administration, research, surveillance, and monitoring activities. The complete set of equations used to make these estimates, along with detailed descriptions of unit cost figures, coverage targets, and data sources for population target groups, is available in the supplementary material posted at *Science* Online (*8*).

Care and support interventions. We estimated current country-by-country access to five clusters of HIV/AIDS care interventions (Table 2). Country-specific yearly growth rates for each of the interventions were applied to the estimates of current access to derive feasible coverage targets for 2005 (*9*).

The population newly requiring treatment in a particular year was defined as the number of people whose CD4 counts dropped to levels that could cause HIV-specific symptoms. This roughly corresponds to the last 2 years of life in untreated patients. Newly symptomatic people initiating opportunist infection (OI) prophylaxis without highly active antiretroviral therapy (HAART) were assumed to live on average 2 years, using a Poisson distribution to determine the probability of death in a given year. The same is true for those initiating HAART, but the average survival was assumed to be 5 years. These survivals take into account failures in treatment and compliance.

Published and unpublished literature was reviewed for cost data of HIV/AIDS care interventions (*8*) (Table 2). The model assumed differential pricing for HAART in proportion to per-capita gross national product (GNP). The minimum price also applied to middle-income countries with HIV prevalence in excess of 5% (only South Africa and Botswana). Costs of care per child living with HIV/AIDS were estimated to be half of the country-specific adult costs.

How Much Is Needed?

By 2005 US$9.2 billion will be needed annually to support an expanded response to HIV/AIDS in low- and middle-income countries. Of this total, US$4.8 billion will be needed for prevention interventions and US$4.4 billion for care and support. Half of the total resource needs are required for countries in sub-Saharan Africa (Table 3). The majority (66%) of the resources in Africa are needed for care and support. This proportion is much lower for Asia (32%) and other regions.

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AIDS PREVENTION ACTIVITIES

Activity	Coverage 2005	Costs (Constant US$)
Teacher training; peer education	10 to 33% of primary teachers; 2 to 12% of secondary teachers; 10 to 50% of out-of-school youth	$15 to $84 per teacher trained; $8 per out-of-school youth reached
Male and female condoms	60% of sex workers (SWs) reached; 60 to 80% condom use by those reached; 5% are female condoms	$15.83 per SW reached; $0.10 per male condom distributed; $1 per female condom distributed
Condom promotion	20 to 60% of casual sex acts; 10 to 30% of couples with casual partners use condoms in marital sex	$0.15 per male condom distributed
Condom social marketing	10 to 20% of condoms distributed through CSM; 10% of condoms are female condoms	$0.12 to $0.25 per male condom distributed; $1 per female condom distributed
Treatment of STIs	60 to 100% of symptomatic STI cases with access to health care facilities	$8.34 to $9.26 per STI case treated; $0.91 per woman screened for syphilis in prenatal clinics
Voluntary testing and counseling	Twice the number of HIV-infected people, with access to health care facilities, tested every 5 years	$10.60 per person counseled and tested
Workplace: condom promotion and treatment of STIs	3 to 50% for peer counseling; 70% of symptomatic STIs treated	$3.36 per employee reached by peer education; $8.34 to $9.26 per STI treated; $0.10 per male condom distributed
Transfusion screening	100% of blood tested	$4.88 to $15 per safe blood unit available
Prevention of MTCT	10 to 50% of women attending clinics tested; of HIV+ women, 90% accept treatment and 50% use replacement feeding	$3.80 per woman screened; $18.70 per woman receiving ARV; $50 per woman receiving formula
Mass media campaigns	2 to 6 campaigns per country per year	$490,000 per campaign
Harm reduction programs	25 to 75% of IDUs	$3.21 to $12.50 per person reached
Peer counseling	60% of MSMs reached by peer counseling; 60 to 80% condom use among those reached	$15.83 per person reached; $0.10 per male condom

Table 1. AIDS prevention activities. We have selected costs at the low end of the range of published studies in order to provide a conservative estimate of funding requirements. These unit costs are based on over 60 different cost studies throughout the world (*8*). Constant US$ are based on values in 2000. Workplace refers to the formal sector, that is, employment in the economic sector in which workers are paid a stable income wage, or have a contract, or have fringe benefits, as compared with informal employment. ARV, antiretroviral; CSM, condom social marketing; IDUs, injection drug users; MSMs, men who have sex with men; MTCT, mother-to-child transmission of HIV; STIs, sexually transmitted infections.

Resource needs for prevention are rather equally distributed between the major specific interventions, while treatment with HAART will consume approximately half of all resources for care and support (Fig. 1).

This level of spending by 2005 would provide prevention services for over 22 million, and VCT for 9 million. An additional 35 million women would receive testing at prenatal clinics and 900,000 would receive antiretrovirals to prevent mother-to-child transmission (MTCT). Special prevention programs would reach almost six million sex workers, 28 million for men who have sex with men (MSMs) and three million injecting drug users (Fig. 2). These costs also include funds for over 6 billion condoms. Coverage for the different interventions varies substantially by region and country. Coverage for HAART was highest in Latin America with more than 90% in the strongest countries, and was as low as 7% in the weakest countries in Africa (Fig. 3).

The annual resource needs increase over time from $3.2 billion in 2002, $4.7 billion in 2003, $6.8 billion in 2004, to $9.2 billion in 2005 (Table 3). The proportion of the total resource needs for each intervention changes over time, with the share for HAART doubling from 12.5% in 2002 to 26% in 2005.

Other global epidemics must be addressed as well. US$1.3 to 2.6 billion will be needed annually in sub-Saharan Africa alone to expand activities for malaria and tuberculosis treatment and control, including the cost of infrastructure investment (*7*). Although there would be some competition for resources in the short-term if all three programs are expanded, there would be important synergies in the longer term (*10*).

Our estimates draw on fairly limited information about the unit costs and coverage of public health interventions and modes of care. Some of this information is based on little more than pilot programs tried in selected settings that may not be comparable to scaled up national programs. We believe, however, that the requirements underestimate how much spending is needed and how much of a national effort it will take to deter the further spread of HIV/AIDS. For example, we have generally used low unit cost estimates throughout and excluded the potentially large investments needed for such services as hospitals and other basic health infrastructure.

Who Will Pay?

Current expenditure on HIV/AIDS programs in low- and middle-income countries from all sources amounts to about US$1.8 billion (*11*), far lower than the $9.2 billion that we project. Resources for the response to HIV/ AIDS have to come from both international and domestic (*12*) sources. We estimated requirements for donor funding by estimating for each country the proportion of total needs that could be covered by domestic resources. Wealthier countries were assumed to be able to spend a higher percentage of their GNP on prevention and care than poorer countries. However, we also assumed that even in the poorest countries, seriously ill young adults mobilize some re-

CARE AND SUPPORT ACTIVITIES

Category	Annual costs (Constant US$)
Diagnostic HIV testing	3
Palliative care	75*
OI treatment	300*
OI prophylaxis	32
Drug costs for HAART	450 to 3500†
Lab monitoring for HAART	140
Orphanage care	416
Orphan living assistance	58‡
Orphan school fee assistance	25‡

Table 2. Care and support activities and unit costs. Constant US$ are based on values in 2000. *Lifetime costs. †The low value corresponds to the assumed cost of drugs and administration in low-income countries; costs for middle-income countries are assumed to lie between the two values in proportion to a country's per-capita GNP. ‡Coverage rates 5%, 15%, and 20% for national HIV prevalence <1%, 1 to 5%, and >5%, respectively.

sources for medical care. The latter resources represent a minimum domestic contribution (*13*).

We estimate that one-third to one-half of the required funding could come from domestic sources. On the regional level, up to 80% of the resource needs may have to come from international sources in Africa and South and South-East Asia. For the other regions, more than half and up to 90% of the resource needs could be met domestically.

Domestic resources. The governments of sub-Saharan Africa recently pledged, at the April 2001 meeting of the Organization of African Unity, to raise their support for public health to complement increased foreign assistance. They promised to raise the share of total public spending allocated to the health sector to 15%. If this was achieved, the public funding requirements for HIV/AIDS prevention, care, and support described in this policy forum would amount to about 3% of all public spending on health in sub-Saharan Africa.

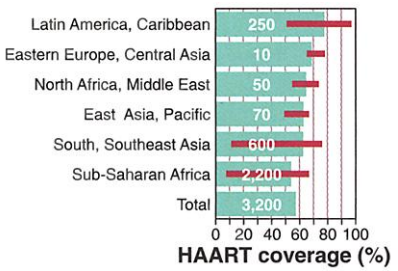

Fig. 3. HAART coverage of all people in need of care by region projected for 2005. The blue-green bars represent the regional averages; red bars represent the range of countries with the highest and lowest coverage. The numbers in the bars represent the total number of people who actually receive HAART (in thousands).

PROJECTED ANNUAL EXPENDITURES BY 2005

Region	Prevention	Care and support
Sub-Saharan Africa	1560	3070
South and Southeast Asia	1440	670
East Asia, Pacific	810	80
Latin America, Caribbean	590	550
Eastern Europe, Central Asia	250	20
North Africa, Middle East	160	50
Total	4810	4440

Table 3. Projected annual expenditures by 2005 (in US$ millions).

The HIPC Initiative (Highly Indebted Poor Countries) has already led to initial agreements on spending for education and health (including HIV/AIDS) in many of the 41 poor countries eligible for debt relief. The annual value of reduced debt service obligations is about US$1 billion for 18 sub-Saharan African countries. If 10% of this is used for AIDS, debt relief would generate $100 million annually. These comparisons suggest that financial constraints need not be a barrier to success in low-income countries.

Middle-income countries, such as Brazil, Mexico, and Thailand, have demonstrated that public health ministries and social insurance can play a major role in financing HIV/AIDS services. Brazil's social health insurance program, for example, finances over US$300 million annually in HIV/AIDS programs.

The private sector can also play an increased role. With the recent reductions in prices for antiretroviral therapy, many insurance companies in countries such as South Africa and many large corporations throughout the region are planning to add this treatment to their existing benefits. In virtually all countries, including low-income sub-Saharan Africa, the private sector and personal financing have played a major role in home-based care, support for orphans, and psychosocial support.

Donor assistance. Official development assistance, as measured by the Organization for Economic Cooperation and Development (OECD), was almost US$52 billion in 1998 (*14*). Our estimate of funding required from international donors represents just a 7 to 10% increase in official development assistance. Private foundations are also beginning to contribute significant amounts to HIV/AIDS programs.

There is scope for considerably more funding from all major donors. The United States currently spends about $20 billion annually domestically on AIDS, many times the amount it contributes to international assistance (*15*). The amounts public and private donors provide will depend critically on evidence of effective use of the funds in the recipient countries and willingness of their governments to cofinance HIV/AIDS interventions. For low-income countries in sub-Saharan Africa, donor support needs to increase from a few hundred million dollars now to more than $3 billion by 2005.

Can These Resources Be Mobilized?

The success of the struggle against HIV/AIDS will depend fundamentally on effective national leadership in the most affected countries. Recent signs of positive movement in that regard are encouraging. The recent and unprecedented actions of governments of Africa to increase their commitment to health care is one important step. The focus on HIV/AIDS within the Poverty Reduction Strategy Papers being prepared by 22 governments in the region to justify debt relief is another. International acceptance of the emergency nature of the crisis has led virtually all pharmaceutical companies to substantially reduce the barrier of high cost for antiretrovirals. Acting individually and collectively, the world's high-income countries have also signaled that they recognize the need for an extraordinary boost to the fight against AIDS.

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3. Draft Declaration of Commitment, available on the UNAIDS Web site at www.un.org/ga/aids. Although the draft declaration contains few quantitative goals, it clearly calls for a massive expansion of services to help as many people as feasible with existing infrastructure.
4. A complete list of sources of data is provided in the supplementary material available on *Science* Online at www.sciencemag.org/cgi/content/full/292/5526/2434/DC1.
5. Because access to HIV/AIDS care is not just a function of health system capacity but also of openness about HIV/AIDS and government commitment to the epidemic, the composite proxy indicator was adjusted by an indicator of a country's HIV/AIDS program strength as estimated by the UNAIDS Program Officers and other national and international experts. Current coverage was estimated to be highest for palliative care and progressively lower for increasingly sophisticated care with the lowest coverage for HAART.
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9. Access to HIV/AIDS care is a function of health system capacity, openness about HIV/AIDS, and government commitment. The capacity of health services to expand is limited by many factors including current infrastructure. The model estimated country-by-country maximum growth rates with a baseline range from 10% of coverage of unmet needs annually in the poorest countries to 20% for the wealthiest. For additional details see supplementary material at www.sciencemag.org/cgi/content/full/292/5526/2434/DC1.
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