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POLICY BRIEF 30 | MAY 2012

AIDS Vaccines: Exploring the Potential Cost/Benefit

A preventive AIDS vaccine, even one that is only partially effective, could have a tremendous impact on the number of new HIV infections in low- and middle-income countries. Each infection prevented by an AIDS vaccine would reduce the number of individuals who would eventually require a life-long regimen of antiretroviral treatment (ART). Modeling the potential impact of an AIDS vaccine demonstrates the number of new infections that a vaccine could prevent, which provides a basis for calculating the potential cost-savings that a vaccine could generate by reducing the number of additional people requiring ART. The International AIDS Vaccine Initiative (IAVI) and the Futures Institute have recently updated their AIDS vaccine impact modeling project to incorporate more recent epidemiological data and contextualize the impact a vaccine could have in scenarios whereby global trends in HIV programming continue through 2030 or are scaled up in line with targets in a new Investment Framework proposed by the Joint United Nations Programme on HIV/AIDS (UNAIDS) (Schwartlander et al, 2011).[1] Please see the IAVI Policy Brief "The Potential Impact of an AIDS Vaccine in Low- and Middle-Income Countries" for more information about the epidemiological impact AIDS vaccines could have under both these scenarios.

KEY MESSAGES	DEFINITIONS
• Under current trends in HIV/AIDS programming, an AIDS vaccine could avert between 5.2 and 10.7 million new HIV infections and save between US$46 billion to $95 billion in averted costs of ART provision alone between 2020 and 2030, depending on the characteristics of the vaccine and population coverage levels achieved. • In a scenario in which HIV/AIDS programming is scaled up to the targets presented in the UNAIDS Investment Framework, an AIDS vaccine could still avert between 1.6 and 3.3 million new HIV infections and save between $14 billion and $29 billion in averted costs of ART provision alone between 2020 and 2030, depending on the characteristics of the vaccine and population coverage levels achieved.	• The **cost** of a vaccine is not necessarily just its price; it could also include any related costs such as special storage requirements or delivery mechanisms. Since those related costs for future AIDS vaccines are unknown, for this piece "cost" is discussed in general terms. • **Cost-effective** vaccines provide an additional year of life at a cost less than a country's per capita Gross National Income, using WHO standards. • Vaccines that provide **cost-savings** are those in which the cost of vaccination multiplied by the number of infections averted by vaccination is less than the lifetime cost of treatment averted.

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An AIDS vaccine could provide substantial cost-savings

The cost of a future AIDS vaccine is unknown, preventing us from making estimates around cost-effectiveness, but by looking at the cost of providing HIV/AIDS treatment, it is possible to determine how much a vaccine *could* cost and still be cost-effective or cost-saving. Under current trends in HIV/AIDS programming, and at the present lifetime value of ART, an AIDS vaccine could save between $46 billion and $95 billion in avoided ART costs alone between 2020 and 2030, depending on the characteristics of the vaccine and population coverage levels achieved. In a scenario in which HIV programming is scaled up and focused on the primary drivers of each country's epidemic per the targets set by the UNAIDS Investment Framework, an AIDS vaccine could save between $14 billion and $29 billion in avoided costs of ART provision.

The number of vaccinations required to avert one HIV infection varies by country due to differing epidemic characteristics and differing rates of incidence. In sub-Saharan Africa, this could vary from 14 vaccinations in South Africa (where the current incidence rate is very high) to 240 vaccinations in Ethiopia. The average for sub-Saharan Africa is 47 people vaccinated per infection averted from 2020 to 2030. If the present value of treatment is $8,900 per person over an individual's lifetime[2], and 47 people must be vaccinated to avert one infection, then a vaccine could cost as much as $185 per person vaccinated to equal the savings of not having to provide treatment to an infected individual. Outside of sub-Saharan Africa, the number of vaccinations per infection averted would be much larger among the general population, but could be similar to Africa if vaccination programs are targeted to populations at higher risk of HIV infection.

The World Health Organization's Commission on Macroeconomics and Health proposed that cost-effective health interventions are those that provide an additional year of life at a cost less than the Gross National Income (GNI) per capita (World Health Organization 2001). For all low- and middle-income countries, GNI per capita is about $3,300, while for sub-Saharan Africa GNI per capita is about $1,200. The life expectancy of a newly infected 30-year-old HIV-positive individual in sub-Saharan Africa would be about 11 years without

ASSUMPTIONS

Timing	
Treatment initiation after HIV infection	8 years
Survival on first-line treatment prior to moving to second-line treatment	28 years
Survival on second-line treatment	12 years
Probabilities	
Annual survival rate on ART (varies by CD4 count at initiation)	92-99%
Costs (US$)	
Annual cost of laboratory tests	$180
Annual cost of service delivery	$102
Annual cost of first-line ART	$141
Annual cost of second-line ART	$1,378
Annual cost of second-line ART by 2015*	$930

*Discounted 3% annually to account for inflation

[1] This Policy Note is based on data presented in a technical paper that is available upon request.

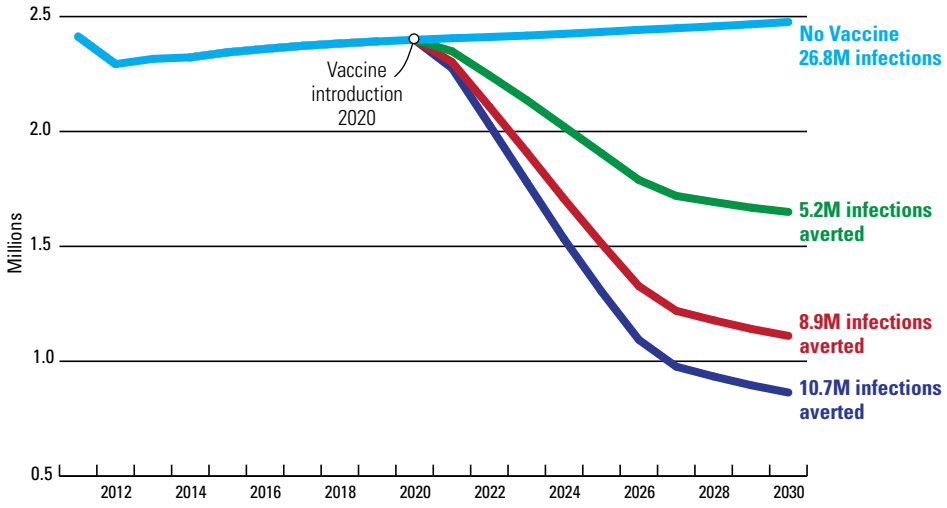
[2] This figure is calculated using the 2010 prices of ARVs for low- and middle-income countries of $155 for first-line and $1678 for second-line [WHO, Towards Universal Access: Scaling up priority HIV/AIDS interventions in the health sector, Progress Report 2010, WHO, UNAIDS, UNICEF] and assuming that prices for second line ARVs decline to $980 by 2015. The cost of diagnostics and monitoring tests is $180 per patient, per year and the service delivery costs are $176 per patient, per year [Stover J, Bollinger L, Avila C. Estimating the Impact and Cost of the WHO 2010 Guidelines for Antiretroviral Therapy, AIDS Research and Treatment, Vol 2011, Article ID 738271, doi:10.1155/2011/738271]. Need for treatment begins eight years after infection and annual survival on first and second line is assumed to be 92% to 99% depending on the patient's CD4 count at treatment initiation (IeDEA Consortium). With these assumptions a typical patient survives for about 28 years on first-line treatment and 12 years on second-line. All costs are discounted at 3% per year to the time of infection. For more information, see the interactive ART costs calculator, which can be accessed through the 'Policy Tools' link on the Futures Institute website, www.FuturesInstitute.org.

[3] Discounted life-years refer to the higher weight given a life year lost early in life (when an individual is younger) versus one lost later in life (when said individual is older). The standard among health economists is to discount life years 3% annually.

access to ART, whereas preventing that infection would increase that person's life expectancy approximately 38 additional years. Thus, each infection averted saves 27 life-years, or about 13 life-years if future life-years gained are discounted at 3%[3]. In sub-Saharan Africa, where GNI per capita is $1,200, up to $15,600 ($1,200 x 13 life-years gained) could be spent to avert HIV infection and prolong a life. If 47 vaccinations are required to avert one new infection, up to $330 per person vaccinated would be considered cost-effective by the Commission's standards.

While the variables surrounding cost and delivery of future AIDS vaccines are unknown, historically vaccines have been extremely cost-effective and have the added benefit of being deployable at a population level through existing delivery systems. Recent history shows that innovative organizations such as the GAVI Alliance have enabled wider and expedited distribution and lower procurement prices of newly introduced vaccines against rotavirus and the human papillomavirus (HPV). The Advance Market Commitment (AMC), an innovative vaccine purchasing mechanism, successfully drove down the cost of a new vaccine to prevent pneumococcal infection for low- and middle-income countries.

Figure 1. Number of Global New HIV Infections by Year and Vaccine: Current Trends Scenario (2020-2030)



Preserving lives and resources

Although HIV infection rates have stabilized in recent years, 2.7 million new HIV infections occurred worldwide in 2010, and more than 33 million people are current living with HIV (UNAIDS 2011). Much of the incurred cost of treating HIV positive individuals in low- and middle-income countries falls upon donor governments based in high-income countries, which have shown unprecedented political and financial commitment to fighting HIV over the last decade: In 2010, the donor community provided around $15 billion annually to this effort. Increasingly, governments in low- and middle-income countries are taking greater ownership of their domestic HIV prevention, treatment, and care budgets (UNAIDS 2011).

Despite this substantial mobilization of resources, for every one person that is able to access ART, two individuals are newly infected with HIV. The need to increase the number of people accessing ART is critical not only to saving lives, but also to keeping individuals' viral loads low, which greatly lessens the risk of HIV transmission. Still, even

Table 1. The Global Impact of a Vaccine on AIDS Incidence and Mortality: Current Trends Scenario

Scenario	Population coverage	Vaccine effectiveness	Annual infections by the year 2030	AIDS deaths in 2030	Cumulative AIDS deaths, 2020-2030	Cumulative HIV infections 2020-2030	Cumulative infections averted 2020-2030
No Vaccine	n/a	n/a	2.5M	2.3M	24.9M	26.8M	-
Low	30%	50%	1.6M	2.2M	24.5M	21.6M	5.2M
Medium	40%	70%	1.1M	2.1M	24.3M	17.9M	8.9M
High	40%	90%	0.9M	2.0M	24.1M	16.1M	10.7M

M=Millions

those currently accessing treatment must eventually move from first-line to second-line regimens, which can cost more than three times more than first-line regimens, and if necessary, to third-line regimens that can cost up to twenty-three times more than first-line regimens (MSF 2011). Investments in ART preserve lives and prevent new infections, but the fiscal burden of HIV/AIDS can be enormous. A recent World Bank report projects that the cost of HIV/AIDS programs in a subset of African countries can, by themselves, represent between 1% and 3.6% of national GDP (Lule 2012).

New HIV-prevention tools, such as vaccines, working in combination with existing interventions can forestall the need to begin this costly but necessary progression, averting a large number of infections, stabilizing the number of people in need of ART, and supporting a more predictable and focused response by both donor countries and countries most affected by HIV/AIDS. Critical investments toward new HIV-prevention technologies such as vaccines represent an opportunity to change the trajectory of new infections and illuminate the path toward the end of the AIDS pandemic.

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About IAVI

The International AIDS Vaccine Initiative (IAVI) is a global not-for-profit organization whose mission is to ensure the development of safe, effective, accessible, preventive HIV vaccines for use throughout the world. Founded in 1996, IAVI works with partners in 25 countries to research, design and develop AIDS vaccine candidates. In addition, IAVI conducts policy analyses and serves as an advocate for the AIDS vaccine field.

About Futures Institute

The Futures Institute is dedicated to enhancing social and economic development in the fields of HIV and AIDS, family planning and reproductive health, child survival and health systems strengthening by providing tools and technical assistance in policy, planning, modeling, resource allocation and evaluation. Recent Futures Institute projects have involved modeling the health and cost implications of the UNAIDS Investment Framework and working closely with international agencies and national programs in strategic planning and resources allocation around new prevention and treatment options. For more information, visit http://www.futuresinstitute.org.

Insights

IAVI's policy brief series outlines key public policy issues in the research, development, and eventual distribution of AIDS vaccines.

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