Demand for a Preventive HIV Vaccine:
A Review of the Literature

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Acknowledgements

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Contents

Acronyms and Abbreviations

AIDS	Acquired immunodeficiency syndrome
ANC	Antenatal care
ART	Antiretroviral therapy
CSW	Commercial sex workers
CV	Contingent valuation
HIV	Human immunodeficiency virus
IAVI	International AIDS Vaccine Initiative
IDU	Intravenous drug users
IFPMA	International Federation of Pharmaceutical Manufacturers & Associations
MDGs	Millennium development goals
MSM	Men having sex with men
STD	Sexual transmission diseases
STI	Sexual transmission infections
WHO	World Health Organization
WTP	Willingness to pay
WTV	Willingness to be vaccinated
UNAIDS	Joint United Nations Programme on HIV/AIDS

Introduction

HIV/AIDS is one of the most important and preventable causes of morbidity, disability, mortality, and associated productivity loss and medical care cost, especially in the world's poorest countries. As of the end of 2003, about 38 million people worldwide were estimated to be living with HIV/AIDS, most of them prime-aged adults and 95% living in developing countries. Although prevention programs are under way, about three million people died from AIDS in 2003, with more than 15,000 people becoming newly infected with HIV every day.

Vaccines have been a highly cost-effective measure used in fighting infectious diseases such as polio, smallpox, hepatitis B, yellow fever, and a number of childhood illnesses. A safe, effective and accessible preventive HIV vaccine would be a hugely valuable addition to the existing array of prevention measures. In a number of modeling exercises, analysts have suggested that even a vaccine that is only partially effective could decisively lower the rate of new infections, thereby controlling the HIV epidemic [1-2].

In the global effort to develop an HIV vaccine, more than 30 vaccine candidates are currently in trials in 19 developed and developing countries, the majority in small early stage clinical trials [3]. Still, the world is a number of years away from a vaccine that is ready for large-scale production and distribution.

For a vaccine to make a difference it needs to be widely available and accessible and must be taken up. The vaccine must therefore be demanded by individuals and government authorities. This is why the private and public demand for an HIV vaccine is important to ascertain.

Evidence shows that despite the development and licensing of many new health technologies, they often fail to reach the population in need in developing countries. Use of the hepatitis B vaccine, for example, was delayed by more than a decade after it was approved for use in developed nations due to high prices and low level of awareness of its benefits [4].

When it is ready for large scale production, a "successful" HIV vaccine will probably have characteristics that may make the estimation of demand more challenging than that of vaccines against childhood illnesses. Unlike most existing vaccines that are aimed at children on a "universal" basis, an HIV vaccine may be most appropriate for adolescents and adults, and from a public health perspective is likely to have the largest epidemiological impact when targeted at groups with the highest risk of getting infected, such as sex workers and intravenous drug users (IDU). In this sense, the level of public sector "demand" will be linked to the targeting strategies chosen by government authorities. The first generation of licensed HIV vaccines is also likely to be partially effective, multi-dose, and expensive, which could reduce their acceptability to individuals and thus private demand, if the impacts and benefits of such vaccines are perceived to be low. Furthermore, the stigma associated with HIV/AIDS may reduce demand for a vaccine, if not adequately addressed by governments and civil society groups.

Estimating the credible demand for and acceptability of an HIV vaccine – the likely uptake under various assumptions – is important for a range of policy and advocacy objectives, including:

- persuading donors and industry to invest in research and product development, on the basis of expected uptake and sales of the vaccine and its impact on health and economic growth.
- helping industry to determine the scale of manufacturing facilities they need to build to ensure ample production capacity.
- convincing donors to finance the vaccine, given the limited ability of governments and individuals in poor developing countries to pay for an HIV vaccine in the absence of international development assistance.
- guiding governments in planning their HIV vaccination programs including special information campaigns and strengthening of their vaccine delivery systems.

In the first section below, we examine the evidence on the potential level of demand for an AIDS vaccine by the public sector for broad or narrowly targeted vaccination programs. In the second section, we look at private demand – what percentage of the population would be willing to be vaccinated at various price levels? – and survey a number of studies that analyze the level of acceptability of HIV vaccines and what drives individual decisions on acceptability. In the final section, we summarize what is known and point to future directions of research on demand for HIV vaccines.

To prepare this paper, a literature search was undertaken using Medline, PubMed, published journals, electronic journals, and search engines and sites on the World Wide Web. Databases were searched using the following terms: HIV vaccine, AIDS vaccine, demand, willingness to pay (WTP), willingness to be vaccinated (WTV), acceptance, and acceptability. The review excludes studies that assess demand for candidate vaccines used in trials and willingness to participate in trials. Overall, 23 studies were identified for inclusion in this review [see annotated bibliographies].

I. Public sector demand

a. Global estimates

At the global level, three estimates of demand for an HIV vaccine have been made. The first set of estimates focuses on determining the number of vaccination courses that will be required by developing countries in the first five years for national HIV vaccination programs [5]. The second study uses economic concepts of marginal benefit and opportunity cost to estimate the number of global vaccine purchases if an AIDS vaccine arrived in the world on January 1, 2000 [6]. The most recent study reports on health needs and probable uptake over a five-year period in both developed and developing countries [7].

Table 1 summarizes the study objectives, methodologies, and underlying assumptions. Although they have a common purpose in estimating the number of doses during a

specified time period, the estimates were made based on different assumptions on coverage rate and vaccine characteristics.

Table 1 Objectives, methodologies, and assumptions of studies on global demand estimates

Study	Geographic Focus	Objectives	Methodology	Assumptions
WHO-IFPMA Working Group [5]	Developing countries	Generate the number of vaccination courses that will be required in the first 5 years	Quantitative study based on epidemiological data and authors' estimates on risk of HIV infection and accessibility of the health care system	a) Primary emphasis on populations in which vaccination will result in a rapid reduction in HIV incidence b) Progressive increase in coverage rates over 5 years
Bishai et al. [6]	Global	Explore who would get the vaccine and how many doses would be needed if an AIDS vaccine arrived in the world on January 1, 2000; what are the ramifications based on health sector and societal perspectives	Quantitative study using marginal benefits and opportunity costs	a) Vaccine scenarios: 60%, 75%, and 90% reduction in HIV risk for 10 years
WHO/UNAIDS/ IAVI [7]	Global	Make estimates for the need and potential uptake over 5 years; explore related policy issues on delivery capacity	Quantitative and qualitative study based on databases and experts' opinion (through workshops)	a) Vaccine scenarios: low/moderate (30–50%) and high (80–90%) efficacy levels, safe even for HIV-infected people, no therapeutic effect if given to an HIV-infected person, effective against the HIV strain(s) circulating in the community where it is used, three intramuscular injections during the first year, free of charge, delivery costs borne by governments

Note: WHO, World Health Organization; IFPMA, International Federation of Pharmaceutical Manufacturers & Associations; UNAIDS, The Joint United Nations Programme on HIV/AIDS; IAVI, International AIDS Vaccine Initiative.

All three studies were carried out by identifying regions or coverage areas, and target populations. The study by the WHO-IFPMA Working Group focused on the level of accessibility of the target populations, and prioritized countries for vaccination according to current and projected future risk of HIV infection. The WHO/UNAIDS/IAVI study, on the other hand, covered the widest range of potential population groups and examined the

accessibility[1] and acceptability[2] of each target group in estimating the probable level of vaccine uptake. Although accessibility was implicitly linked to delivery cost, no information was presented on vaccine delivery strategies and related cost. Only the Bishai study considered vaccine price as a factor in determining the number of doses demanded globally [6].

Results from each study are presented in Table 2. Despite the variations in methodology applied, the three studies all suggest that when taking a public health approach (i.e., delivering the vaccine to those who might benefit), the estimated "demand" for the developing world amounts to several hundred million courses in the early catch-up years of implementation. The WHO-IFPMA study produced a figure of 326 million vaccine courses and the Bishai study 235 million courses. Because of constraints, i.e., accessibility and acceptability, the WHO/UNAIDS/IAVI study argued that effective global uptake of an HIV vaccine would only be a fraction of the public health need – less than 20% (49 million courses) for a low to moderate efficacy vaccine and around 40% (260 million courses) for a high efficacy vaccine.

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[1] Defined as the percentage of people in each group that could be reached by an existing service or organization through which the vaccine could be provided.

[2] Defined as the percentage of people accessed who would agree to be vaccinated and who would receive the recommended course of at least three doses of the vaccine.

Table 2 Results from global public sector demand studies

Study	Classification of countries	Target populations (age range in years)	Study results
WHO-IFPMA Working Group [5]	a) High priority: Sub-Saharan Africa, South and Southeast Asia, Latin America and Caribbean b) Lower priority: East Asia and the Pacific, North Africa & Middle East	a) Urban school students (10–19) b) Urban women of childbearing age (15–49)	a) Over the first 5 years, 224 million courses would be required in the "higher priority" areas and 326 million courses if the program were expanded to include the "low priority" areas. b) Other activities that need to be initiated include future extension of vaccination to rural areas, safety and immunogenicity studies in children and infants, and phasing out urban adolescents and women of childbearing age (10-15 years after universal HIV immunization of infants and children, with boosters to accessible adolescent groups if required).
Bishai et al. [6]	a) Developing country regions: North Africa/Middle East, Sub-Saharan Africa, South/South-East Asia, Eastern Europe/Central Asia, East Asia/Pacific, Caribbean, Latin America b) Developed country regions: Western Europe, North America, Australia/New Zealand	a) Infants/toddlers (0–4) b) Children/teens (5–14) c) Women (15–49) d) Men (15–49) e) Female Commercial Sex Workers (CSW) f) Men who have sex with Men (MSM) g) Injecting drug Users (IDU)	For a US$10 vaccine: a) From a health sector perspective, 766 million courses (235 million in developing countries) would be purchased. b) From a societal perspective, 3.7 billion courses (3.3 billion in developing countries) would be purchased from an equity model perspective, vaccine would be offered to 4.7 billion people.
WHO/UNAIDS/ IAVI [7]	a) Latin America and the Caribbean b) Africa c) Asia and the Pacific d) North America and Europe	a) MSM b) IDU c) CSW d) People with Sexually Transmitted Infections (STI) e) Truck drivers f) Post-natal women g) Adolescents and young adults (15–24) h) Health care workers i) Discordant couples j) Military recruits k) Prisoners	a) Low/moderate-efficacy vaccine: In most regions, MSM, IDU, and CSW – and in Latin America and Africa, STI patients – were identified as potential beneficiaries. In Africa, truck drivers, post-natal women, and in some areas with high HIV incidence, all adolescents and young adults, were also identified. The global estimated need was 260 million full vaccination courses with probable uptake of 49 million courses. b) High-efficacy vaccine: In most regions, such a vaccine would be used in larger segments of the population, including adolescents, young adults, health care workers, military recruits, and prisoners. Regional differences were also evident and correlated with severity of the epidemic and success of other prevention interventions. The total global need estimate was 690 million full immunization courses with probable uptake of 260 million.

ii. Country level estimates

Four studies were identified that estimate public sector demand for an HIV vaccine at country level [8–11]. All follow a common approach: 1) specify potential population groups that would benefit from vaccination; 2) estimate the size of each group; 3) assess the potential coverage of each group; and 4) calculate the number of vaccines that the government would need to purchase to achieve this level of coverage.

Who would be vaccinated? The population groups varied across the four studies (Table 3), in response to local political and epidemiological factors and possibly by the availability of data. While studies in Thailand [8] and Brazil [9] tended to have similar categories of population, the study of seven countries in Southern Africa[3] [10] focused on different groups: employees, teachers, students by gender, and migrants. In the Thailand study, commercial sex workers (CSW) and intravenous drug users (IDU) were further classified into direct (brothel-based) and indirect, and in and out of treatment respectively. The India study[4] proposed fewer target populations and included children 0–14 years of age as one of these [11].

Studies in Brazil, Southern Africa, and Thailand also attempted to prioritize these groups for vaccination, on the basis of vaccine cost-effectiveness, in which cost was defined as relative cost of vaccine delivery, and effectiveness was calculated as the number of infections (primary and secondary) averted by vaccination. The relative costs were adjusted to reflect how difficult it would be to reach those population groups. For example, military and conscripts are less costly than MSM and CSW. In calculating the number of infections averted, the Thailand and Brazil studies additionally considered whether an HIV vaccine would be a complement or substitute for the existing HIV prevention method, i.e., condoms. The Brazil study did not use cost-effectiveness in prioritizing the population groups for vaccination, because the authors believed that the prevailing political philosophy of broad equity would compel the Brazilian government to vaccinate everyone, and would also encourage wide acceptability of HIV vaccination among the population.

The studies made different assumptions, too, about the share of the population group that would be vaccinated at the vaccine introduction. Some assumed a fraction of population would be vaccinated, while others used 100% coverage. The study of Southern Africa argued that targeting strategies should be linked to the cost of HIV screening. The India study developed vaccine delivery scenarios for each population group, recognizing the existing health interventions.

In presenting a vaccination strategy, the Thai study provided a useful guide for decision making by considering policy priorities: the level of benefit of HIV vaccination can be achieved according to the budget constraint. The number of doses required and their cost were calculated according to the size of the non-infected population and an estimated

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[3] Seven Southern African countries are Botswana, Lesotho, Namibia, South Africa, Swaziland, Zambia, and Zimbabwe.

[4] The study covered four southern Indian states of Andhra Pradesh, Karnataka, Maharashtra, and Tamil Nadu.

maximum achievable vaccine coverage rate for priority populations. Under the scenario of widespread vaccination, the authors assumed that the vaccination coverage level would be 100% for population groups at lower risk of HIV infection.

Table 3 Identified target populations for public sector HIV vaccine programs, four national studies

Target Populations	Study			
	Thailand [8]	**Brazil** [9]	**Southern Africa**[10]	**Southern India**[11]
CSW	X (direct & indirect)	X	X	X
IDU	X (in & out of treatment)	X		
MSM	X	X		
Male STI patients	X	X	X	X (male and female in a single group)
Female STI patients		X		
Military		X	X	
Police	X	X		
Health workers	X	X		
Transport workers	X	X	X (high risk)	X (truck drivers)
Pregnant women	X	X	X (ANC)	X (ANC)
Prisoners	X	X	X	
Conscripts	X	X		
High school students	X	X (high school and university students in a single group)	X (girls & boys)	
University students	X			
Men 15–49 years of age		X		X (adult men and women)
Women 15–49 years of age		X		X (women of reproductive age)
Population 0–6 years of age				X
Population 11–14 years of age				X
Formal sector male employees			X	
Formal sector female employees			X	
High school teachers			X	
Legal cross-border migrants			X	
Civil servants	X			

Note: ANC, Antenatal care attendees; X denotes population group included in the studies

Estimated demand for HIV vaccine for all studies was based on simple vaccine characteristics, such as one dose with 100% efficacy and lifetime protection (Table 4). For Southern Africa and Southern India, it was assumed that the vaccine would only protect from HIV infection for five years. A series of prices from $1 to $10 a dose was considered, except in Thailand where the possible price ranged up to $28 per dose.

The potential demand as defined by those studies was calculated by multiplying population size by the estimated coverage rate (Table 5). The required budget was then estimated by multiplying price by the number of doses.

Table 4 Vaccine characteristics, four studies of public sector HIV vaccine requirements

Characteristics	Study			
	Thailand [8]	**Brazil** [9]	**Southern Africa** [10]	**Southern India** [11]
Efficacy level	100%	100%	100%	Not specified
Number of doses	One	One or two	One	One
Duration of protection	Lifetime	Lifetime	5 years	Not specified
Price	US$3–US$28	I$1 or I$10	US$5 and US$100	US$10
Other		I$0.2–I$0.4 delivery cost		- No refrigeration required for delivery - Vaccine would not confer any benefits to those already infected but would not be harmful

The four studies suggest that the number of doses of HIV vaccines needed in the "catch up" phase could be quite large, if a broad targeting was followed. In Brazil, this amounted to over 121 million doses, and in Southern India to 195 million doses. Using a narrower targeting strategy to reach only high-risk populations, whether because of financial constraints or a deliberate decision to give priority to certain population segments, the number of doses needed would be much smaller. For example, 9.1 million doses in Brazil for those at greatest risk, 9.6 million doses in Southern India when focusing exclusively on high-risk individuals and women receiving antenatal care services, and 1.3 million doses for 15-year old school students in Southern Africa. The Thai study argued that 5.9 million doses would cover all priority groups in the country as part of the catch-up, with an additional 1.3 million doses needed annually to maintain coverage of these groups.

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Table 5 Number of doses of HIV vaccine required by the public sector (millions), four country studies

Thailand [8]			Brazil [9]			Southern Africa [10]		Southern India[11]	
Doses required based on estimated vaccine coverage and size of each non-infected population group:			Assuming 100% coverage and one dose vaccine, the number of doses required is:			If the policy was to vaccinate all 15-year-old school students, the number of doses required for seven countries is 1.3 million.		Assuming vaccine was introduced in 2002, the number of doses required for 100% coverage for some population groups is:	

Thailand			Brazil			Southern Africa		Southern India	
Group	**Catch-up**	**Maintenance**	**Group**	**Catch-up**	**Maintenance**	**Country**	**Catch-up**	Group	**Catch-up**
Priority recipients	0.67	0.07	I	9.1	4.0	Botswana	29,500	High risk (CSW, STI patients, truck drivers)	2.6
Other potential recipients	5.2	1.23	II	19.9	12.1	Lesotho	17,000		
			III	92.5	3.5	Namibia	26,000		
Total	5.9	1.3				South Africa	986,000	Adults 15-49	141
						Swaziland	14,500	Children <6 years	45
						Zambia	65,000		
						Zimbabwe	187,500	ANC women	7

Note: Priority recipients include direct CSW, IDU in treatment, IDU out of treatment, male with STI, transport workers, indirect CSW, conscripts, and prisoners; other potential groups are MSM, police/military, pregnant women, civil servants, health workers, university students, and high school students.

Note: Group I included CSW, IDU, prisoners, MSM, males with STI, transport workers; Group II included females with STI, military, police, health workers, pregnant women, high school & university students, conscripts; Group III included men and women 15–49 years of age.

II. Private demand and acceptability

The studies considered in this section focus on estimation of private demand for a hypothetical vaccine using willingness to pay (WTP) technique [12–16], and acceptability [17–27], as well as analysis of the factors influencing such individual demand [12–14, 16] and acceptability [17–27]. All of the studies of WTP used the contingent valuation (CV) method and face-to-face interviews, and were conducted in developing countries [12–16]. All of the other studies but one reported acceptability among populations in the US and Canada [17]. These acceptability studies used various methodologies, namely, conjoint analysis, multiple linear regression, and principal component analysis, with data mainly from self-administered questionnaires.

a. Willingness to pay for an HIV vaccine

Studies were conducted among samples of the general adult population, such as patrons of shopping centers, household members in various communities, students, and adolescents, as well as populations at high risk of HIV/AIDS infection (Table 6). Only one study included respondents at very high risk of HIV/AIDS: CSW and IDU [15].

Table 6 Samples for five studies of the private demand for an HIV vaccine

Study	Research countries	Sample (age range in years)	Size
Forsythe [12]	Rural Thika and Nairobi, Kenya	General population (18–55)	890
Whittington et al. [13]	Guadalajara, Mexico	Shoppers in shopping centers (18–55)	234
Suraratdecha et al. [14]	8 provinces and Bangkok, Thailand	General population (18–60)	2,524
Suraratdecha et al. [15]	6 provinces, Thailand	CSW (18–57); IDU (16–55)	600; 200
Bishai et al. [16]	12 districts and Kampala, Uganda	General population (18–60)	1,677

The CV methods have become the most widely used non-market valuation technique. Many economists believe that CV surveys can produce meaningful, accurate estimates of individuals' WTP. However, respondents must have a thorough understanding of vaccine characteristics and price in order to reduce hypothetical bias, which occurs when respondents do not understand the scenario as intended. Methods to elicit WTP include the referendum model, dichotomous choice, and payment cards. With a large sample size, different vaccine scenarios can be incorporated by random assignment of a scenario to each respondent[5].

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[5] The discussions on methods of contingent valuation are beyond the scope of this review. Examples of those discussions can be found in Cameron, T. A. and James, M. D. (1987) "Efficient Estimation Methods for Use with 'Closed-Ended' Contingent Valuation Survey Data," Review of Economics and Statistics, 69: 269-276; Donaldson, C. (1990) "Willingness to Pay for Publicly-Provided Goods: A Possible Measure of Benefit?" Journal of Health Economics, 9: 103-118; Hanemann, W. M. 1984. "Welfare Evaluations in Contingent Valuation Experiments with Discrete Responses," American Journal of Agricultural Economics, 66: 323-341; Mitchell, R. and. Carson, R. T. (1989) Using Surveys to Value Public Goods: The Contingent Valuation Method, Washington, D.C.: Resources for the Future, National Oceanic and Atmospheric Administration. 1993; O'Brien, B. and Viramontes, J. L. (1993) "Willingness to Pay: A Valid and Reliable Measure of Health State Preference?" Medical Decision Making, 14: 289-297; Whittington, D. (1998) "Administering Contingent Valuation Surveys in Developing Countries," World Development, 26(1): 21-30.

Characteristics of the hypothetical vaccines used in each study are reported in Table 7. Efficacy level, number of doses, duration, and price were the commonly used vaccine characteristics. The potential use of vaccine in delaying the onset and progression of disease was not considered. Although most studies were interested in a partial-efficacy vaccine, the Thai study was the first study to develop a tool to explain the concept of the efficacy of a less-than-100% effective vaccine to the respondents and to check people's understanding of that concept [14]. In order to explain vaccine efficacy, the Thai research team used a plastic tray and a set of more than 100 small rubber dolls. This tool was demonstrated to the respondents, who were tested on their comprehension of vaccine efficacy by being asked to identify those vaccinated, those vaccinated and protected, and those vaccinated and not protected.

Table 7 Vaccine characteristics, from five WTP studies

Study	Vaccine characteristics						
	Efficacy level (%)	Number of doses	Duration	Mode	Side effects	Effective for those HIV positive	Price range (US$)
Forsythe [12]	50 or 100	One	Not specified	Not specified	None	Not specified	0–360
Whittington et al. [13]	100	One	Lifetime	Injection or oral drops	None	No	0 to >10,000
Suraratdecha et al. [14]	50 or 95	One	10 years	Not specified	None	No	5–1,500
Suraratdecha et al. [15]	50 or 95	One	10 years	Not specified	None	No	12.5–500
Bishai et al. [16]	50 or 95	One	10 years	Not specified	None	No	2.86–286

Table 8 reports the proportion of individuals who would be willing to pay for an AIDS vaccine (WTP). The proportion the reported proportion of individuals' willing to pay for an HIV vaccine is less than 100% in all given population groups who might otherwise benefit from being vaccinated from a public health perspective. That is, some individuals would not accept the vaccine at a given price and efficacy level. Nevertheless, the reported level of demand at a given price is quite high, even when individuals were asked to pay out of their pockets. In Uganda more than three-quarters of the general population would purchase a vaccine at around $3 a dose while in Thailand more than three-quarters of CSW and IDU would buy a vaccine priced at $25 a dose.

Table 8 Reported WTP and WTV

Findings	Study					
	Forsythe [12]	**Whittington et al. [13]**	**Suraratdecha et al. [14]**	**Suraratdecha et al. [15]**		**Bishai et al. [16]**
				CSW	**IDU**	
WTP	>20% willing to purchase vaccine at >US$7	80% willing to purchase vaccine	~41% willing to purchase 95% vaccine at US$25	80% willing to purchase 95% vaccine at >US$25	75% willing to purchase 95% vaccine at >US$25	~76% at US$2.86; ~20% at US$286
WTV	65.4% (50% vaccine) 68.5% (100% vaccine)	N/A	78%	97%	95%	94%

When an HIV vaccine was offered free of charge to respondents who were unwilling to pay for the hypothetical HIV vaccine at any price, the proportion of respondents who would be willing to be vaccinated (WTV) increased to 78% and 94% of general population in Thailand and Uganda, respectively, and 97% of CSW and 95% of IDU in Thailand (Table 8). The substantially higher WTV for the population at high risk of HIV infection thus confirms that those with higher risk have higher demand. In Kenya study, the vaccine acceptance was elicited without mentioning the price, the WTV was about 65% and 68% for 50% and 100% effectiveness vaccine respectively. The studies offer a cautionary lesson to enthusiasts for HIV vaccines who assume that everyone will come flocking to use a vaccine – even at zero price some fraction of high risk populations may not take up the vaccine.

In identifying factors influencing the demand for an HIV vaccine, considerable attention was given to vaccine characteristics and socioeconomic factors, such as income, gender, age, education, marital status, knowledge of HIV/AIDS, and perceived risk of getting HIV/AIDS. Four of five studies studied the influence of vaccine efficacy on demand [12, 14–16] (Table 9). The regression analysis reveals that the samples from the general population in Africa (Kenya and Uganda), where HIV prevalence is high, and respondents from the population at high risk for HIV infection (CSW and IDU) in Thailand showed indifference to vaccine efficacy [12, 14–16]. In other words, these high-risk populations would take up an HIV vaccine of 50% efficacy at a similar rate to a 95% or 100% effective vaccine, at a range of price levels. In contrast, the sample from the general population in Thailand, facing a longstanding but less severe epidemic, showed a preference for a higher-efficacy vaccine at any given price [14]. This finding confirms the role of perceived HIV risk in determining the demand for an HIV vaccine.

Figure 1 depicts the comparative proportions of respondents in each of the three groups – the general population, CSW and IDU in Thailand – willing to pay for an HIV vaccine at comparable prices of $12.5, $25, $125, and $500 [15]. CSW were the most likely to pay at a given price, followed by IDU and the general population. Vaccine efficacy had almost no impact on the WTP among CSW and IDU but did for the general population.

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Figure 1 Percent of respondents willing to pay for vaccine by efficacy and price
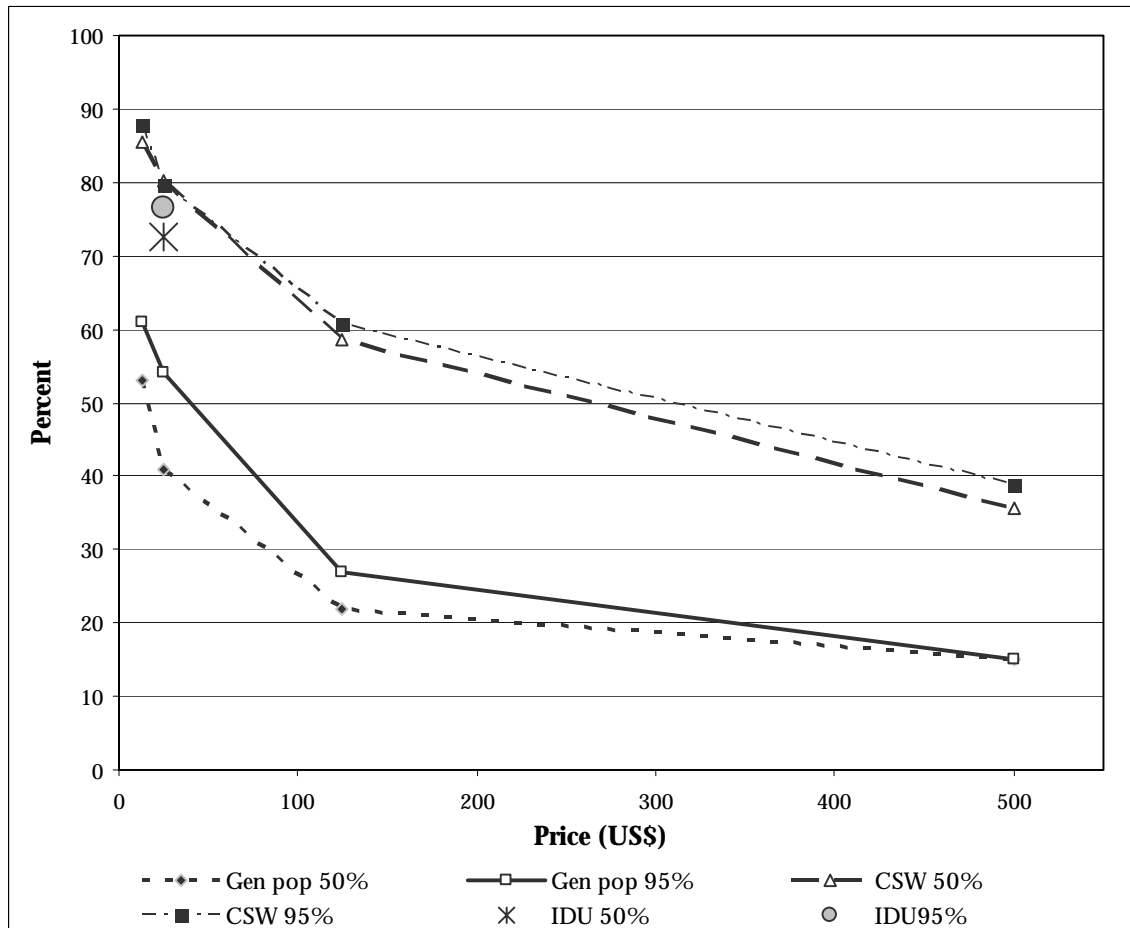
Two of five studies explored the effect of vaccine price and found that higher prices reduce demand [14, 16]. In the same studies, findings also reveal that understanding of vaccine efficacy can raise demand and WTP. Within each population group, the significant factors that positively influence the willingness to purchase a vaccine at a given price include income, perceived risk, and marital status.

The regression result suggests that household income, price, HIV knowledge, personal experience with HIV/AIDS, and marital status are not significant determinants of WTV among general population in Thailand [14]. Perceived risk of HIV infection, vaccine efficacy, understanding of vaccine efficacy, and education show a positive relation with WTV while age negatively influences the WTV. This is important for the design of future promotional campaigns to persuade people to come for HIV vaccination.

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Table 9 Regression results on five studies of WTP for an HIV vaccine

Study		Factors										
		Efficacy	Price	Income proxy	Risk	Know someone with AIDS	AIDS is curable	Understood efficacy	Female	Married	Age	Education
Forsythe [12]		Not significant	N/A	Household expenditure (+)	Not significant	Not significant	N/A	N/A	Not significant	Single (+)	Not significant	Less than secondary and more than secondary, compared with secondary (+)
Whittington et al. [13]		N/A	N/A	(+)	(+)	N/A	Knowledge with ART (Not significant)	N/A	Not significant	Spouse or partner (+)	N/A	Not significant
Suraratdecha et al. [14]		95% +	(–)	(+)	Any risk, do not know risk compared with no risk (+)	(+)	Not significant	(+)	Not significant	(-)	20–34 years of age, compared with <20, >34 (+)	Not significant
Suraratdecha et al. [15]	CSW	Not significant	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	IDU	Not significant	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Bishai et al. [16]		Not significant	(–)	Highest quintile (+)	(+)	Number of relatives who have died from AIDS (+)	(+)	(+)	(-)	(+)	(-)	(+)

Note: ART, antiretroviral therapy; (+) and (–) denote significantly positive and negative relationship respectively.

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b. Vaccine acceptability

Approach

Unlike studies on WTP, research on vaccine acceptability draws on experience with social marketing and focuses on small numbers of persons in high-risk target groups, trying to identify the key non-price factors influencing such acceptance to be vaccinated [17-27]. Study individuals are asked whether they intend to get vaccination and are assessed about their attitudes towards HIV vaccination. Key factors include health beliefs and behaviors and expected vaccine characteristics. Individuals may also be asked to rank the most important features of the vaccine driving its acceptability.

Characteristics of hypothetical vaccines and samples used along with methods are reported in Tables 10 and 11. In addition to efficacy levels, number of doses, and cost, other characteristics such as mode of vaccination, effect on HIV-positive people, access, vaccine-induced HIV seropositivity, cross-clade protection, social saturation, type of vaccine, and requirement for parental permission were explored [17–27]. One study did not provide a defined set of characteristics, but instead used probes of some attributes after participants raised issues [27].

Table 10 Vaccine characteristics, from seven of ten acceptability studies

Study	Vaccine characteristics						
	Efficacy level (%)	Number of doses	Type of vaccine	Mode	Parental permission	Social saturation[a]	Price range (US$)
Liau et al. [19]	50, 70, or 90	One or three	Live attenuated virus, whole killed virus, viral fragment	Injection or oral	Not specified	Not specified	0, 25, or 100
Zimet et al. [20]	Not specified	One or three over a 6-month period	Not specified	Not specified	Not specified	Not specified	Not specified
Webb et al. [21]	50 or 90	Not specified	Not specified	Not specified	Not specified	Not specified	Not specified
Zimet et al. [22]	50, 70, or 90	One or three	Killed virus, synthetic, live attenuated virus	Injection or oral	Required or not required	Not specified	0, 50, or 100
Liau and Zimet [23]	Not specified	Three over a 6-month period	Not specified	Not specified	Not specified	Not specified	Not specified
Liau and Zimet [25]	50 or 80	Not specified	Not specified	Not specified	Not specified	10, 50, or 90	0 or 300
Crosby et al. [26]b	50 or 80	More than three	Not specified	Injection	Not specified	Not specified	>50

[a] Or percentage of the population already vaccinated.
[b] The study addressed the issue of vaccine characteristics by presenting statements related to vaccine side effects, mode of administration, cost, and administrative issues, and asked respondents to rate the statements based on a five-point scale.

Table 11 Samples in 11 acceptability studies

Study	Sample characteristics		
	Location	**Population group (age range in years)**	**Size**
Hom et al. [17]	Military barracks surrounding Kampala, Uganda	Uganda male military (19–22)	249
Zimet et al. [18]	Urban Midwestern university, USA	Undergraduate students (18–29)	125
Liau et al. [19]	Urban Midwestern university, USA	Undergraduate students enrolled in introductory psychology courses (18–69)	222
Zimet et al. [20]	Urban community adolescent health clinics, Indianapolis, USA	Adolescents (13–18)	318
Webb et al. [21]	Urban community health clinics in a large Midwestern city, USA	Adolescents (13–18)	140
Zimet et al. [22]	Three community health clinics, Indianapolis, USA	Adolescents (13–21)	661
Liau and Zimet [23]	Urban university in Indianapolis, USA	Undergraduates attending introductory psychology classes (18 or older)	549
Gagnon and Godin [24]	Quebec City metropolitan area, Canada	College students who were residents in a dormitory adjacent to a college located in the Quebec City metropolitan area	136
Liau and Zimet [25]	Urban Midwestern university, USA	Undergraduate students taking psychology courses at lower undergraduate level (18–56)	549
Crosby et al. [26]	Atlanta, USA	Adults 18 and older from three populations: Men attending "gay-identified" venues, African American women attending a wide variety of venues, people who abuse substances and attend venues that provide recovery services	278
Newman et al. [27]	Los Angeles, USA	Males with STI attending an STD clinic housed in a gay and lesbian services organization, IDU attending a needle exchange program, Spanish-speaking Latinos/as (MSM, women, heterosexual men) attending community-based health care clinic, women attending a health clinic serving largely African-Americans, young men and women (18–24) attending a social service agency for gay/lesbian/bisexual/transgender street youth	99

Most studies analyzing vaccine acceptability viewed college students as a high-risk population likely to be targeted for an AIDS vaccine. Two studies included other high-risk adults, such as men attending "gay-identified" venues, males using a sexually transmitted disease clinic housed in a gay and lesbian services organization, IDU participating in a needle exchange program, and young men and women (18–24 years of age) assisted by a social service agency for gay/lesbian/bisexual/transgender street youth [26–27]. One study was conducted in Uganda among the military [17].

Different types of analysis and survey approaches were chosen for studies conducted in developing and developed countries. In developing countries research teams carried out household interviews; in developed countries self-administered questionnaires were the main survey method for acceptability studies. Analytical methods for the latter studies included conjoint analysis[6], principal component analysis, and multiple linear regressions.

Main Results

Health beliefs and behaviors Four studies assessed intention to be vaccinated for HIV (or acceptability of an HIV vaccine) and examined the role of health beliefs [18–20, 23]. One study reported that nearly 30% of respondents were uncertain about or opposed to being immunized for HIV [18]; another found that the overall probability of HIV vaccine acceptance was 53.7% [19]. Multiple regression analysis revealed that perceived susceptibility, vulnerability and benefits, pragmatic obstacles to being vaccinated, non-membership in a risk group, fear of needles not being clean, and fear of the vaccine were significant independent determinants of intent to be vaccinated [18–20, 23]. Two studies [20, 23] also showed that certain health behaviors – in particular, decreased attention to a healthy dietary habits, fewer sexual partners, and prior sexual experience were positive independent health predictors of HIV vaccine acceptability.

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[6] The conjoint analysis, a research technique often used in marketing research, was used to determine how vaccine characteristics might influence respondents' acceptance of the vaccine. Conjoint analysis requires a respondent to choose the most acceptable set of vaccine characteristics from a combination of different features and levels of attributes. Too many sets of characteristics will result in too many choices for respondent to make a decision.

Table 12 Vaccine acceptability and regression results

Vaccine acceptability	Study			
	Liau et al. [19]	**Webb et al. [21]**	**Zimet et al. [22]**	**Liau and Zimet [25]**
Mean acceptance	53.7%	89% for 90% efficacy level; 28% for 50% efficacy	49.2%	55.14%
Most acceptable vaccine	90%, one injection, US$25, viral fragment	N/A	90%, oral, free, killed virus vaccine, with parental permission required	80%, free, 90% social saturation
Least acceptable vaccine	50%, one injection, US$100, live attenuated	N/A	50%, oral, US$100, synthetic vaccine, no parental permission required	50%, US$300, 10% social saturation
Characteristics affecting acceptability				
Efficacy	90% efficacy vaccine has a strong influence than 70% and 50% vaccine effectively or 90%>70%>50% (+)	N/A	90%>70%>50% (+)	80%>50% (+)
Cost	No strong influence	N/A	(–)	0>$300 (-)
Vaccine type	killed virus>viral fragment>live attenuated (+)	N/A	synthetic or killed virus>viral fragment>live attenuated (+)	N/A
Mode	No strong influence	N/A	No strong influence	N/A
Saturation level	N/A	N/A	N/A	90%>50%>10% (+)
Parental permission requirements	N/A	N/A	No strong influence	N/A

Note: (+) and (-) denote significantly positive and negative relationship respectively.

<u>Demographic factors</u> Results from bivariate correlations showed that age was significantly associated with intention to accept HIV vaccination [18, 20, 23, 25]. Greater acceptance of HIV vaccination was found to be related to female gender [20]. African-American adolescents rated the vaccines as significantly less acceptable than non-African-American adolescents [22].

<u>Vaccine characteristics</u> Four studies examined vaccine characteristics in relation to vaccine acceptability using multiple regression analysis (Table 12). Efficacy level strongly influenced acceptance of the vaccine, followed by type of vaccine. Cost, mode of delivery, and permission requirement had little or no influence. The recent focus group study conducted in the US also emphasized that efficacy has a positive relationship with vaccine adoption, which is consistent to the findings from WTP studies.

<u>Concerns and motivators</u> One study assessing participants' concerns about receiving an HIV vaccine using principal component analysis and logistic regression found that personal issues (e.g., concern about minor side effects, sex and drug use history, and mode of vaccination), product concerns (e.g., number of doses, past testing of products, and risk of major side effects), and worry and associated stigma (e.g., worry about getting AIDS from vaccines, and problems caused by being vaccinated) were significant factors in determining the acceptance of an AIDS vaccine and demographic variables (namely age, education, race, sexual orientation, and vaccination against hepatitis B) were associated with the factors identified above [26].

The Ugandan study reported soliders' concerns about vaccines in general, such as expiration, heat damage, and side effects (e.g., fever and swelling) [17]. About 88% of respondents would take the vaccine if they were not already infected with HIV-1. Other interesting perceptions about HIV vaccines among respondents included the findings that 96.8% wanted to be among the first to take the vaccine, 70% did not need prior proof of vaccine efficacy before consenting to be immunized, and 97% believed that a vaccine could protect them from AIDS.

<u>Effects on sexual behavior</u> Two studies examined the issue of behavioral responses after vaccination [17, 21]. One found that one third of participants would consider having more sex and half would not use condoms if immunized [17]; the other reported that 77% of participating adolescents believed that people would increase HIV-related risk behaviors (e.g., decreased use of condoms, more sexual partners, less care taken with partner selection) after vaccination with a 90% effective vaccine [21]. This is worrying, since such behavioral "reversals" could dramatically undermine the prevention benefits of an HIV vaccine, which is only partially effective. It underscores the importance of promoting other forms of HIV prevention, including condoms, numbers of partners, and abstinence, in parallel with future HIV vaccination campaigns.

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III. Discussion and conclusion

a. Public sector demand

The three existing sets of public sector demand estimates for an HIV vaccine at the <u>global level</u> are useful in thinking about the potential uptake of a future vaccine to prevent infection. All three studies suggest that several hundred million doses might be demanded by developing countries during an initial period of a few years, and could be successfully delivered to targeted segments of the population, mostly adults. If true, this has important implications for policy. If public sector sponsors and governments were willing to pay a manufacturer a multiple of dollars per dose that would allow for the full recovery of investment costs – say, ten dollars a dose or more – this would create a multi-billion dollar market in the developing world, generating important incentives for industry. To reach hundreds of millions of people in developing countries, mainly adults, in a short period of time, on the other hand, would be a huge challenge in terms of developing and utilizing the necessary health care infrastructure.

These global studies are based on assumptions about targeting certain priority countries, vaccine characteristics such as number of doses per course, and estimated population coverage rate as a function of accessibility and acceptability. These assumptions drive the projected number of doses demanded. Only one study looked at vaccine efficacy, and found that when it was taken into the consideration, it also had a significant effect on the number of doses required [6].

There are several weaknesses in these studies, however, that call into question the accuracy of the existing global demand estimates and suggest that additional work should be done in this area. The studies assume optimistically that all countries would adopt the vaccine in year 1 – there is no staggering or sequencing of introduction. The WHO-IFPMA report was the only study that attempted to identify priority countries. Although the global public health community faces the challenge of ensuring that all countries adopt an HIV vaccine as quickly as possible, past experience with other vaccines has shown that some countries are fast adopters and other are slower. This pattern needs to be modeled in future analysis and more realistic uptake schedules incorporated. The impact of vaccine price on quantity demanded globally was not rigorously examined, either – this needs to be factored into future analysis.

The four <u>country-level</u> studies reviewed here generated very different estimates of HIV vaccine demanded, depending on whether vaccine delivery was narrowly targeted or offered to broader population groups, mostly adolescents and adults. Using assumptions about broad vaccine delivery strategies, the quantity of vaccine demanded for Brazil, Southern Africa, Southern India, and Thailand alone reached well over 200 million courses, equal to the global estimates for all developing countries cited earlier. With tighter targeting criteria, however, the projected demand for an HIV vaccine during the initial period was much smaller – just 10 to 20 percent of the estimated quantity under the broad delivery scenarios.

The four country studies highlight the importance of differences in epidemiological and behavioral patterns, existing health care infrastructure, cultural factors, stigma associated

with HIV/AIDS, and other variables that can affect demand. This points to the benefits of carrying out further country-level analyses of demand for an HIV vaccine for purposes of generating more accurate estimates that can be used for national advocacy and planning vaccination campaigns. Global models should not simply be re-imposed at country level, without doing in-depth assessments using local data. Some of the country studies also show how cost-effectiveness analysis can be used in selecting target populations for vaccination.

The country level studies of demand contain several shortcomings, however, that limit the value of their results:

- The *national system capacity* to deliver vaccines, which determines the speed of uptake and level of coverage, was not addressed in the country studies. Different population groups require different delivery strategies, and this was not factored into the studies
- The *impact of vaccine price* to governments and prices charged individuals was not analyzed, even though affordability is a key factor driving the demand for an HIV vaccine.
- The definition of *vaccine characteristics* was inconsistent across the country (and global) studies. Assumptions about these characteristics were identified weakly and tended to be simplified, e.g., single dose, complete protection. Expert opinion today suggests that the HIV vaccines initially licensed for use will be multi-dose and only partially effective. These assumed characteristics need to be built into future demand modeling.
- *Target population groups* were not well identified and were inconsistent across the studies. The Southern India paper, for example, included population 0–14 years of age, while the other three did not. Demand estimates that aggregated several population groups may have done some "double counting" (e.g., in the WHO-IFPMA study, two identified population groups were urban students (10–19 years of age) and urban women (15–49 years of age)).
- The *managerial feasibility* of the implied vaccination strategy was also questionable in several of the country studies. Trying to reach a large number of population groups simultaneously (e.g., CSW, IDU, school children) may cause a program to be too difficult to implement because multiple targeting approaches will be required.

Although the country studies calculated the total budget needed (price multiplied by number of doses), they did not develop a credible financing plan that took into account the government's ability to finance the vaccine or individual willingness to pay for it, or information about vaccine acceptability among target population groups.

In estimating public sector demand for HIV vaccines – and hence the expected size of national HIV vaccination programs – there is a need to incorporate the individual decision-making process. All of the studies to date have assumed that those identified as benefiting from a vaccine will be reached and vaccinated. Experience from other vaccination programs, and the results to date on private demand for an HIV vaccine (summarized in this review) suggest otherwise.

b. Private demand and acceptability

Understanding individual preferences toward an HIV vaccine is important for designing future vaccination strategies and financing plans, and for preparing volunteers and their communities for HIV vaccine trials. Private demand estimates can also help to determine potential market size, which in turn sends signals to the private sector about the returns to investment in HIV vaccine development.

This review has shed light on the different techniques that have been used so far to assess individual private demand for and acceptability of HIV vaccines. Willingness to pay may not be a highly relevant issue for consumers in developed countries like the US and Canada, where the anticipated price of an HIV vaccine is not be perceived as a significant barrier to use. In poor countries, however, where a vaccine price of $5-100 or more represents a serious obstacle to affordability, WTP studies can help to generate demand curves for an HIV vaccine and offer insights into possible strategies for government subsidies that can help to increase vaccine uptake.

Findings from private demand studies in East Africa, Mexico, and Thailand show that there is a substantial demand for an AIDS vaccine even if it is of low efficacy, especially in populations with a more severe AIDS epidemic. However, not all individuals will accept the vaccine, even when it is free. Such information should be taken into account in national studies, which have thus far assumed that all individuals targeted for HIV vaccination on public health grounds would willingly be immunized. They also suggest that in certain countries HIV vaccine promotion campaigns may be required to boost individual demand.

Studies of individual demand and acceptability for an AIDS vaccine in the general population share the common finding that efficacy is one of the key determinants. However, efficacy is no longer a significant factor among the population at high risk of HIV infection. Studies need to be undertaken to better measure such risk, both externally viewed and self-perceived. Results on significant factors like individual understanding of vaccine efficacy, health behaviors and beliefs, and other psychosocial factors underscore the importance of information, education, and communication in marketing an HIV vaccine.

The existing private demand and acceptability studies contain two critical weaknesses that need to be addressed in future analyses:

- *Price levels tested* vary widely from one study to the next. It would be useful if future studies are conducted using a similar price range for countries with the same per capita income, in order to compare individual WTP at a given level of purchasing power.
- *The vaccine profile* employed is not consistent across studies, nor does it correspond to the best recent thinking on the kind of vaccine likely to be licensed initially for use worldwide. This makes it hard to generalize from the existing studies. Given that vaccine characteristics are key determinants of demand, there is a need to standardize the potential vaccine profile, using the best knowledge on the state of AIDS vaccine science and product development.

At the same time, the choice of population group to be sampled for studies on individual demand must be based on the groups most likely to be targeted for an HIV vaccine. This will vary from one country to another. Information about the relative cost-effectiveness of different vaccination strategies within a country should therefore be gathered, and discussions should be held with key "informants" at the outset, in order to select the groups to be surveyed using household interview techniques.

In conclusion, this review suggests that while we already have considerable knowledge about public and private demand for HIV vaccines, there is a need for additional research on these topics. Global estimates are important for advocacy and to stimulate greater investment by governments and industry in vaccine research and development. We also require better understanding of HIV vaccine demand (public and private) and factors influencing it at country level, in order to raise awareness and support for vaccine research and trials, and to begin the dialogue and planning for the introduction of a future vaccine. National capacity to conduct this kind of policy research and to plan and manage a future vaccination program must be strengthened, in order to achieve rapid access to an HIV vaccine and other new health technologies that are required to end the AIDS pandemic and achieve the Millennium Development Goals (MDGs).

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V. Annotated bibliography

1. Public Sector Demand

1.1 Global estimates

- Fourth meeting of the WHO-IFPMA Working Group on the development, testing, utilization and supply of dugs and vaccines for HIV infection and HIV-related disease. Background paper: *Potential vaccination strategies using HIV vaccines in developing countries: an update* (information only): GPA/IFP.4/93.8, February 1993.

This paper presents the first available set of demand estimates that focus on the number of vaccination courses that will be required by developing countries in the first 5 years. The authors identified target populations and priority countries under the assumption that a "global HIV vaccination strategy should initially place primary emphasis on populations in which vaccination will result in as rapid a reduction as possible in HIV incidence." Two target priority populations were identified: urban adolescents attending school (10 to 19 years) and women of childbearing age (15 to 49 years) who reside in high and intermediate HIV prevalence regions in urban areas accessed by EPI.

Countries were identified as either "higher priority" or "lower priority" based on the level of risk of HIV infection. The "higher priority" areas for vaccination were sub-Saharan Africa, South & South-East Asia, Latin America & the Caribbean. The "lower priority" areas were East Asia & the Pacific, and North Africa & the Middle East. Assuming a progressive increase in HIV vaccine coverage over the first 5 years, the authors estimated that 224 million courses would be required in the "higher priority" areas and 326 million courses if the program was expanded to include the "lower priority" areas. The authors identified activities that would be needed as part of a vaccination strategy, namely the future extension of vaccination to rural areas, conducting safety and immunogenicity studies in children and infants for possible future integration into EPI, and phasing out urban adolescents and women of childbearing age ten to fifteen years after universal HIV immunization of infants and children, with boosters to accessible adolescent groups if required.

- Bishai, D., Lin, M.K., and Kiyonga, C.W.B. *Algorithms for purchasing AIDS vaccines*, World Bank Policy Research Working Paper 2321, Washington, DC. World Bank, 2000.

This second set of estimates was generated using the concepts of marginal benefit and opportunity costs to explore the question "If an AIDS vaccine arrived in the world on 1 January 2000, what are the ramifications of two different decision algorithms, in terms of *who* would get the vaccine and *how many* would be needed?" Efficacy, or the reduction in the risk of contracting HIV over the next decade, was examined in three scenarios – a $10 vaccine that was 60%, 75% or 90% efficacious. It was assumed that the vaccine would provide 10 years of protection; that any adverse effects of the vaccine were

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temporary and self-limited; that the vaccine was safe to administer to pregnant women and provided protection to only the woman; and that there was no change in behavior following vaccination.

Instead of estimating the required number of doses of AIDS vaccine to suit public health needs or demand, the study presented results based on two different strategies – "health sector" and "societal" - and an equity model. Under the health sector strategy, vaccine purchases are made to minimize the impact of HIV/AIDS on government health spending. Under the societal strategy, vaccine purchases are made to minimize the impact of HIV/AIDS on health spending and GDP. Countries were classified into less developed countries (LDCs) and more developed countries (MDCs). LDCs are countries in North Africa/Middle East, sub-Saharan Africa, South/South-East Asia, Eastern Europe/Central Asia, East Asia/Pacific, Caribbean, and Latin America. MDCs are located in Western Europe, North America, and Australia/New Zealand. Target populations for vaccination included infants/toddlers (age 0-4), children/teens (age 5 – 14), women (age 15 -49), men (age 15 – 49), female commercial sex workers, men who have sex with men, and intravenous drug users. The results suggest that for a vaccine with a marginal cost of US $10 to produce and deliver a single course of the first generation, a total of 766 million courses (235 million in LDCs) would be purchased under a health sector allocation strategy and 3.7 billion courses (3.3 billion in LDCs) would be purchased under a societal allocation strategy. Vaccines would be offered to 4.7 billion people under an equity model in which vaccines would be allocated to everyone in the world who was at high risk as if they had the financial resources of Western Europeans.

- Esparza, J., Chang, M.-L., Widdus, R., Madrid, Y., Walker, N., and Ghys P.D. *Estimation of "needs" and "probable uptake" for HIV/AIDS preventive vaccines based on possible policies and likely acceptance* (a WHO/UNAIDS/IAVI study). *Vaccine* 2003; **21**: 2032–2041.

This paper presents results from a collaborative project undertaken in 2001 by WHO, UNAIDS and IAVI to generate estimates of the need for and potential uptake of a future HIV vaccine. In addition to projections from available databases, the project involved four regional workshops (convened in Latin America and the Caribbean, Africa, Asia and the Pacific, North America and Europe) to (1) obtain information on potential strategies for the use of HIV vaccines at different levels of efficacy in the context of the epidemiological situation in different countries and communities, and (2) generate initial estimates of needs and current delivery capacity for HIV vaccines. After a general discussion on HIV vaccines and trials, session participants were presented with the following vaccine scenarios:

- Low/moderate (30-50%) and high (80-90%) efficacy;
- Vaccine is safe, even for HIV infected people;
- Vaccine does not have any "therapeutic effect" if given to an HIV infected person;
- Vaccine is effective against the HIV strain(s) circulating in the community where it is used;
- A full vaccination course is 3 intramuscular injections during the first year;
- Vaccine is provided free of charge to countries;
- Delivery cost within a country is borne by countries themselves.

Country estimates were obtained through a sequential process for both a low/moderate and a high efficacy vaccine and then aggregated to form regional and global estimates. The four steps in the process were to identify target populations to be vaccinated, estimate the size of each target group, estimate the "accessibility" and "acceptability" of each target group, and generate country estimates of "need" and "probable uptake." In general, there was moderate enthusiasm for the use of low/moderate efficacy vaccines (apart from in sub-Saharan Africa) and a sense that while a low/moderate efficacy vaccine would be accepted by public health authorities, it would most likely be recommended for populations at higher risk of HIV infection. A high efficacy vaccine, however, would be more readily accepted and could gather more political support. The target populations identified for vaccination depended on the region and on the level of efficacy of the vaccine.

- Low/moderate efficacy vaccine: In most regions, men who have sex with men, intravenous drug users and commercial sex workers were identified as potential beneficiaries of low to moderate efficacy vaccines in Latin America and Africa STI patients. In Africa, truck drivers, post-natal women and adolescents and young adults in some areas with high HIV incidence were also identified.

- High efficacy vaccine: In most regions it was thought that a high efficacy vaccine could be used in larger segments of the population, including adolescents, young adults, health care workers, military recruits and prisoners. Regional differences were also evident and correlated with severity of the epidemic and success of other prevention interventions.

For a low/moderate efficacy vaccine, the total need was estimated at 260 million courses and probable uptake at 49 million courses over the first 5 years of a vaccination campaign. For a high efficacy vaccine, total need increased to 690 million courses and probable uptake to 260 million courses. Estimates of need and probable uptake are given for each of the 10 regions of the world and estimates of global need are provided for subtype specific vaccines assuming that a vaccine only provides protection against the major subtypes of HIV-1.

1.2 Country level estimates

- Tangcharoensathien, V., Phoolcharoen, W., Pitayarangsarit, S., Khongsin, S., Kasemsup, V., Tantivess, S., and Suraratdecha, C. *The potential demand for an AIDS vaccine in Thailand.* Health Policy 2001; **57**: 111–139.

Tangcharoensathien et al explored the potential demand and financial implications of potential vaccination targeting strategies in Thailand. They estimated potential demand by (1) identifying 15 potential population groups; (2) estimating the size of each population group; (3) estimating the relative difficulty of reaching each of the population groups; (4) estimating the potential coverage for each population group; and (5) estimating the number of primary and secondary cases averted in each population group if condom use is sustained. The authors ranked population groups by calculating the relative effectiveness and cost-effectiveness of targeting each group. Eight of the 15 groups (direct commercial sex workers (CSW), intravenous drug users (IDU) in treatment, IDU out of treatment, males with sexual transmitted diseases transport workers, indirect CSW, conscripts and prisoners) were identified as potential target groups with 0.7 million

courses (1.8 – 17.7 million USD) required to meet the current population needs (catch-up population) and an additional 0.07 courses (0.2 – 1.9 million USD) required each year (maintenance population). The authors suggest subsidies or public financing for low-income risk groups and providing public information on vaccine cost and efficacy to those who may consume a vaccine privately to cope with inefficient and inequitable vaccine consumption.

- Novaes, H., Luna, E., Goldbaum, M., Kilsztajn, S., Rossbach, A., and Carvalheiro, J. *The potential demand for an HIV/AIDS vaccine in Brazil*, World Bank Policy Research Working Paper 2940, Washington DC: World Bank, December 2002.

This paper examines the potential demand and costs of alternative HIV vaccination strategies. Novaes et al employed similar approaches to those in Viroj et al by (1) identifying 15 different population groups; (2) estimating the size of each population group; (3) calculating the number of infections averted with and without condom use in each population group; and (4) estimating ease of access based on relative risk behavior and accessibility. Assuming a 100% coverage rate, they estimated the total number of doses that would be required to vaccinate the total population in each group (the catch up population) and to vaccinate the number of new individuals added annually to each group (the maintenance population).

In addition, the authors also estimated the cost of vaccinating the different target groups assuming a vaccine cost either I\$1 or I\$10 per dose and with delivery costs ranging from 0.2 to 0.4 times the cost of the vaccine. Based on these numbers they estimated that the cost of immunizing all adults 15-49 with a two-dose vaccine would be I\$ 240 million for the catch-up population, or ⅛ of the annual public expenditures on AIDS, and another I\$ 9 million a year to vaccinate all new entrants.

- Desmond, C. and Greener, R. *The strategic use and potential demand for an HIV vaccine in Southern Africa*, World Bank Policy Research Working Paper 2977, Washington DC: World Bank, February 2003.

Desmond and Greener explored strategies for targeting an HIV vaccine in the 7 countries of Southern Africa by (1) identifying potential population groups for vaccination (12 groups were identified); (2) estimating both the total size of each group and the number of annual new entrants; (3) classifying each risk group in terms of difficulty of access (easy, medium, difficult, very difficult) for both one-off access and follow up access; and (4) estimating the total number of infections averted for each group (both primary and secondary) and the number of infections averted per 100 entrants into the program. The figures generated were then used to define the effectiveness and cost-effectiveness ratio for targeting each of the 12 risk groups. The study suggested that the two most effective strategies were to vaccinate all commercial sex workers (CSW) and to vaccinate high school girls. However, when the cost of delivery was considered, they estimated that vaccinating high school girls was more cost-effective than vaccinating CSW, as the cost of delivering a vaccine to CSW was at least twice the cost of delivering the vaccine to high school girls.

The paper discusses the different factors affecting the choice of a vaccination strategy, namely: ease of access of the target population, delivery costs, timing of vaccination,

duration of effectiveness, and impact on behavior change. In addition, the authors discuss current expenditures on HIV/AIDS and the potential willingness of governments and the private sector to pay for an HIV vaccine.

- Seshadri, S., Subramaniyam, P., and Jha, P. *The potential demand for and strategic use of an HIV-1 vaccine in Southern India*, World Bank Policy Research Working Paper 3066, Washington DC: World Bank, May 2003.

Seshadri et al assessed the potential demand for and strategic use of an HIV vaccine in the four southern Indian states of Andhra Pradesh, Karnataka, Maharashtra, and Tamil Nadu by identifying 8 different potential target groups, estimating the size of each target group, and, estimating the coverage rates of existing HIV prevention programs and other health care programs for each target group. This study is the only country public demand study that considered the population of people 0 -14 years old as one of the 8 potential groups. Using this information they estimate the number of courses of vaccine that would be required to vaccinate different population groups assuming 100% coverage rate and the ability of a HIV vaccination program to piggy back onto existing interventions. The authors also estimate the financial implications of introducing a one dose HIV vaccine that costs US$ 10 per dose. Assuming that the vaccine is given to 1% of the 15-49 year age group (1.41 million adults at high risk) and 80% of children aged 11-14 (21.6 million) and that the administration cost of providing the HIV vaccine is half of the annual cost of administering the polio eradication program in the four states (US$ 15 million), they estimate that the total cost of the initial vaccination of these groups would be US$ 245 million and that to maintain the levels of vaccination in the 11 to 14 age group, US$ 67.5 million would need to be spent on buying vaccine each year.

2. Private demand and acceptability

2.1 Willingness to pay

- Forsythe, S., Arthur, G., Mutemi, R., and Gilks, C. *The economics of an AIDS vaccine in Kenya.* Presentation at the XIIIth International Conference on AIDS, Durban, South Africa, July 2000.

Forsythe et al conducted the study in 890 Kenyan adults in Nairobi and rural Thika between the ages of 18 and 55 to examine people's willingness to be vaccinated and willingness to pay for themselves or to subsidize others to be vaccinated with an HIV vaccine that was either 50% or 100% effective. The study used another contingent valuation method in which respondents were asked to select one of 36 cards with different prices that indicated the highest price they would be willing to pay for the vaccine. The interviewer then picked up the card with the next higher value and asked if he/ she would be willing to pay this amount. If the answer was no, the bidding stopped. If the answer was yes, the interviewer picked up the card with the next highest price and asked if he/she would be willing to pay this amount. If the answer was yes, this was recorded as his/ her WTP. If the answer was no, the next lower prices was the recorded as his/ her WTP. About 68% of respondents were willing to be vaccinated with a 100% effective vaccine and 64% with a 50% effective vaccine. Of the people who agreed to be vaccinated, more than a fifth were willing to pay more than $7 per vaccine, while 21% were unwilling to

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pay to be vaccinated at any price. Private demand was found to be highly dependent on vaccine efficacy.

- Whittington, D., Matsui-Santana, O., Freiberger, J.J., Van Houtven, G., and Pattanayak, S. *Private demand for a HIV/AIDS vaccine: evidence from Guadalajara, Mexico.* Vaccine (2002) **20**: 2585-2591.

An in-person contingent valuation survey conducted in Guadalajara,Mexico by Whittington et al examined the private demand for a hypothetical 100% efficacy HIV vaccine that would provide lifetime protection against HIV to uninfected individuals among 243 adults, aged 18-60. A list of prices for a hypothetical vaccine ranging from US $0 to over $10,000 was shown to respondents and respondents were asked to respond to two questions: (1) what was the highest price on the list that they were certain they would pay for the HIV vaccine; and (2) what was the lowest price they would not pay for the vaccine. Results from the study suggest that there is potentially a large private market for an HIV vaccine in middle-income developing countries such as Mexico. In particular, individuals anticipated significant personal benefits from being vaccinated and were willing to allocate a substantial portion of their income to purchasing a vaccine. The mean WTP in the sample population was US$ 669 (6358 pesos) and the median was US$ 316 (3000 pesos).

There was considerable variation across individuals in their stated willingness to pay (WTP). At a price of US$ 10.87 (100 pesos) almost 90% of the sample indicated that they were certain that they would be willing to purchase the vaccine. At a price of US$ 652 (6000 pesos) less than 25% of the population said they were certain they would be willing to purchase the vaccine.   A multivariate statistical analysis of the determinants of individuals' WTP found four explanatory variables were statistically significant: household income; age of respondent; perceived risk of becoming infected, and living with a spouse or partner. Individuals with higher incomes, with higher perceived risks of becoming infected with HIV, and living with a spouse or partner were willing to pay more. Younger respondents, who are likely to be more sexually active and to face a longer period of potential future exposure to the virus, also had a higher WTP than older respondents.

- Suraratdecha, C., Ainsworth, M., Tangcharoensathien, V., and Whittington, D. *The private demand for an AIDS vaccine in Thailand*, Health Policy 2005; **71**(3): 271-287.

In a household survey Suraratdecha et al examined the private demand in Thailand for a preventive HIV vaccine that was described as safe, without side effects, no benefit to people who were already infected with HIV, conveyed 10 years of protection from HIV infection and was either 50% or 95% effective. A vaccine with 50% efficacy was defined as one that fully protected half of all of the people who received it, while the other half would not be protected. A total of 2,524 adults aged 18-60 were interviewed from a random sample of 1,235 households in 8 of the 76 provinces and Bangkok. The provinces were selected to assure variation in both geography and in HIV infection rates. Each respondent was asked to suppose that the hypothetical vaccine would be available in limited supply and that those who wanted it would have to pay for it out of their income.

The authors use a different approach from Whittington et al to determine the WTP by asking respondents if they would purchase the vaccine for their own use at a pre-determined price. Each household was randomly assigned an efficacy level (50% or 95%) and one of 11 prices ranging from US$ 5 to $15000 (from 200 to 60,000 Baht). All members of the household were asked the same efficacy-price scenario. Respondents who were unwilling or unable to purchase a vaccine were asked if they would agree to be vaccinated if the vaccine were free of charge. It was assumed that any individual who said that he/she would purchase a vaccine would also agree to be vaccinated with a free vaccine. The demand for a hypothetical HIV vaccine declined with price from nearly 66% of respondents saying yes to a price of US$ 5 (200 Baht) to 15% or less agreeing to a price of US$ 500 (20,000 Baht) or higher. Demand generally declined monotonically with price and was lower for a 50% effective vaccine at any given price.

Using a probit model it was estimated that the demand for a 95% effective vaccine was nearly 6 percentage points higher compared to a 50% effective vaccine. While this result was statistically significant, the fact that is not very large indicates that respondents valued a partially effective vaccine almost a much as a highly effective one. As expected, demand declined with price and increased with higher consumption/capita. Demand was also significantly greater among those who believed they had any lifetime risk of becoming infected with HIV, who were not sure of their risk, or who personally have known someone with HIV or AIDS. In addition the authors assessed the willingness to be vaccinated (WTV) and found that just under a quarter of the population interviewed (22%) were not willing to be vaccinated if the vaccine was offered for free. The most commonly cited reason for not wanting to be vaccinated was "I think I'm not at risk" (78.8%). Factors raising the willingness to be vaccinated include: vaccine efficacy (the higher the more likely the WTV), age (the younger, the more WTV), sex (women had higher WTV levels than men), education (the higher, the greater the WTV), self-assessed lifetime risk of HIV infection (the higher, the greater the WTV), and understanding the vaccine efficacy scenario (the better an understanding, the greater the WTV). Contrary to expectations, knowing someone with AIDS and the belief that there might be a cure had no effect on WTV.

- Suraratdecha, C., Ainsworth, M., Tangcharoensathien, V., and Whittington, D. The private demand for an HIV/AIDS vaccine in Thailand: Does risk matter? Paper presented at the International AIDS Vaccine Network conference, Barcelona AIDS Conference, July 2002.

Suraratdecha et al conducted the second WTP study in high-risk groups (commercial sex workers (CSW) and intravenous drug users (IDU)) in Thailand. This survey involved 600 CSW in 6 provinces and 200 intravenous drug users (IDU) in methadone clinics and detoxification centers from 4 provinces. The study used the same tools as the general population survey described above. The only difference was the prices used: CSW were randomly assigned one of four prices ($12.50, $25, $125, $500); the IDU were offered a vaccine price of $25. At a price of $25, 80% of CSW and 77% of IDU would be willing and able to purchase a 95% effective HIV vaccine, compared with 41% of the general population. Demand among both these high-risk groups was not significantly affected by efficacy. Among those willing to be vaccinated, 4.8% of IDU and 4% of CSW reported that, if vaccinated, they might be less likely to practice safe injecting behavior or use condoms.

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- Bishai, D., Pariyo, G., Hill, K., and Ainsworth, M. Who wants an AIDS vaccine? Determinants of AIDS vaccine demand in Uganda and the implications for public policy. *Bull. World Health Organ.* 2004; **82**: 652–660.

In a household survey using the same methods and vaccine characteristics as the Thailand study conducted by Suraratdecha et al, Bishai et al looked at the demand for a hypothetical preventive HIV vaccine. A total of 1,677 adults ages 18 to 60 from 12 of the 45 Ugandan districts were interviewed between December 2001 and March 2002. Households were randomly assigned survey questionnaires with one of two levels of vaccine efficacy (50%, 95%) and one of five prices ranging from 5,000 to 500,000 shillings (US $2.86 to 286). The influence of demographic characteristics, vaccine efficacy, self-perceived risk of infection, price, and income on vaccine demand was assessed using multivariate regression analysis. Results revealed that 94% of respondents would be willing to be vaccinated with a free preventive HIV vaccine. Among the 6% who said they would refuse a free HIV vaccine, the most important reasons cited were "not at risk" and the ability to protect themselves in other ways. As expected, the percent willing and able to purchase a vaccine declined as the price rose. Three quarters of individuals would purchase the vaccine if it were available for $ 2.86 (5,000 shillings) while roughly one in five would purchase vaccine at a price 100 times higher. Household wealth, vaccine price, and risk behavior were significant determinants of individual demand. Surprisingly, however, acceptance did not depend on the vaccine's efficacy.

2.2. Vaccine acceptability

- Hom, D.L., Johnson, J.L., Mugyenyi, P., Byaruhanga, R., Kityo, C., Louglin, A., Svilar, G.M., Vjecha, M., Mugerwa, R.D., and Ellner, J.J. HIV-1 risk and vaccine acceptability in the Ugandan military. *J. Acquir. Immune Defic. Syndr. Hum. Retrovirol.* 1997; **15**: 375–380.

Hom et al conducted HIV-1 screenings among 249 HIV-1 non-infected military recruits in the Ugandan Peoples' Defense Forces to determine rates of seroprevalence, seroconversion, knowledge and attitudes related to vaccine acceptability. This paper is the first to examine the potential for increased sexual behavior in response to HIV immunization. Interview results showed that 90% believed that HIV vaccines will not cause HIV infection; 88% reported that they would take the vaccine if offered and if they were not already infected. Approximately 34% of participants reported possibly having more sexual partners if immunized and 50% of the volunteers reported that they would not use condoms if immunized for HIV.

- Zimet, G.D., Liau, A., and Fortenburry, J.D. Health beliefs and intention to get immunized for HIV. *J. Adolesc. Health* 1997; **20**: 354–359.

Zimet et al evaluated the relationship between health belief and intention to accept HIV vaccination among 81 female and 44 male undergraduate students attending an urban midwestern US university. Intention to be vaccinated was evaluated as the subject's intention to get immunized once an HIV vaccine becomes available. Results from the self-administered survey revealed that about 30% of the subjects strongly agreed that they would get vaccinated for HIV once a vaccine is available. Significant correlations between

intent to get vaccinated and health beliefs were found. Using multiple regression analysis, the authors found that age, susceptibility, benefits, pragmatic obstacles, non-membership in a risk group, and fear of the vaccine were significant determinants of intention to vaccinate.

- Liau, A., Zimet, G.D., and Fortenburry, J.D. *Attitudes about human immunodeficiency virus immunization: The influence of health beliefs and vaccine characteristics.* Sex. Transm. Dis. 1998; **25**: 76–81.

In addition to health beliefs, Liau et al looked at vaccine characteristics as one of the potential influencing factors affecting intent to get vaccinated. The subjects were 222 undergraduate students attended the US urban Midwestern University. In this paper, the authors looked at demographic factors, health beliefs about HIV and HIV immunization, and vaccine characteristics (efficacy, cost, vaccine type, mode of vaccine). The overall rating of the probability of HIV vaccine acceptance was 53.7%. Conjoint analysis was used to determine how vaccine characteristics might influence acceptability to vaccine. The most acceptable vaccine was that with 90% efficacy, 1 injection, viral fragment type and cost US$ 25. The least acceptable vaccine was the one that had 50% efficacy, 1 injection, live attenuated type, and cost US$100. Multiple regression analysis showed that among health beliefs indices, susceptibility, non-membership in a high risk group, and fear of vaccine were significant factors of probability of HIV vaccination. Of the vaccine characteristics, efficacy influences acceptability the most, followed by the type of vaccine.

- Zimet, G.D., Fortenburry, J.D., and Blythe, M.J. *Adolescents' attitudes about HIV immunization.* J. Pediatr. Psychol. 1999; **24**: 67–75.

This paper evaluated the relationship between health beliefs and behaviors and attitudes toward HIV immunization using a self-administered written survey. Participants were 318 adolescents receiving health care at urban community adolescent health clinics based in Indianapolis, Indiana. Based on a 6-point response scale, mean vaccine acceptability was 5.0. The multiple regression analysis shows that perceived susceptibility to HIV and perceived benefits of vaccination were positively associated with vaccine acceptance while fear of the vaccine causing AIDS and non-membership in a high-risk group were negatively related to acceptability. Among 235 sexually experienced adolescents, perceived susceptibilty and benefits were significant determinants of vaccine acceptability. Fear of needles was significantly and negatively associated with acceptance. Of the health behaviors, decreased attention to a healthy diet and fewer sexual partners were also identified as significant predictors to vaccine acceptability.

- Webb, P.M., Zimet, G.D., Mays, R., and Fortenberry, J.D. HIV immunization: Acceptability and anticipated effects on sexual behavior among adolescents. *J. Adolesc. Health* 1999; **25**: 320–322.

Webb et al assessed the association between vaccine acceptability and behavioral responses to immunization among 140 adolescents (ages 13 -18 years) who were receiving medical services at urban community health clinics located in a large midwestern US city. Subjects were asked three related questions: (1) Imagine that a vaccine to prevent AIDS has been developed that works 90% of the time. Some people may decide to get it and some people may not. Do you think adolescents would want to get this vaccine? (2) Same question was

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asked but for 50% efficacy vaccine; and (3) Imagine if adolescents got an AIDS vaccine that prevented AIDS 90% of the time. How do you think getting this AIDS vaccine would influence their sexual behaviors?

Eighty-nine percent of respondents said that a 90% efficacious vaccine would be acceptable, while only 28% indicated that a 50% efficacious vaccine would be acceptable to their peers. Additionally, the authors report that 77% of adolescents indicated that people would increase their HIV-related risk behaviors after being immunized with a 90% efficacious vaccine.

- Zimet, G.D., Blythe, M.J., and Fortenburry, J.D. *Vaccine characteristics and acceptability of HIV immunization among adolescents.* Int. J. STD AIDS 2000; **11**: 143–149.

In this paper, Zimet et al discuss their study on the association between HIV vaccine acceptability and vaccine characteristics. Subjects were 661 adolescents (13 -21 years) receiving health care at 3 community adolescent health clinics based in Indianapolis, Indiana, USA. Vaccine characteristics described in self-administered questionnaires included the following dimensions: efficacy (90%, 70%, or 50%); mode of delivery (oral, 1 injection, or 3 injections); cost (free, US$ 50, or US$ 100); type of vaccine (killed virus, synthetic, or live attenuated virus); and requirement for parental permission for vaccination (no permission or permission required). Of 16 presented vaccines, the most acceptable vaccine (killed virus, oral, free, 90% efficacious, permission required) received the mean rating of 64.6 out of 100. The authors concluded that efficacy had the strongest effect on acceptability, followed by the type of vaccine and cost.

- Liau, A. and Zimet, G.D. *Undergraduates' perception of HIV immunization: Attitudes and behaviors as determining factors.* Int. J. STD AIDS 2000; **11**: 445–450.

In this paper, Liau and Zimet evaluated the relationship of health beliefs and lifestyles to vaccine acceptability among a sample of 549 undergraduates (18 to 56 years) attending introductory psychology classes at an urban university in Indianapolis, Indiana, USA. Vaccine acceptability was measured by the likelihood of getting vaccinated: (1) when such a vaccine becomes available; (2) if it requires 3 shots over a 6-month period; and (3) as long as there is no cure for AIDS. A majority of participants (65%) reported 'agree' or 'strongly agree' on all 3 items described above. The results from multiple linear regression indicated that health beliefs (perceived benefits, non-membership in a high-risk group, fear of the vaccine, perceived vulnerability) and health behavior (prior sexual experience) were significant indicators of intent to vaccinate. For the multiple regression analysis among 145 subjects who had prior sexual experience, the authors reported the same significant results on health beliefs. However, the other variables are not significant indicators of intent to get vaccination.

- Gagnon, M.-P. and Godin, G. Young adults and HIV vaccine: Determinants of the intention of getting immunized. *Can. J. Public Health* Nov/Dec 2000; **91**: 432–434.

This paper focuses on the acceptability of a hypothetical vaccine and the relationship between psychosocial determinants and intent to vaccinate based upon Ajzen's theory of Planned Behavior, which emphasizes the relatively important effect of attitudes, subjective norms and perceived behavior control on intent to vaccinate. Respondents were 136 college students who were residents of a dormitory adjacent to a college located in the Quebec City metropolitan area. The intent to vaccinate was measured by these two questions: (1) If a vaccine for HIV became available, I would want to receive it (likely/unlikely); and (2) I evaluate my chances (low/high) of wanting to receive the HIV vaccine once it becomes available. Eighty-eight percent of participants had a score higher than 4 on a 7-point scale. A logistic regression indicated that attitudes and perceived behavioral control were significant determinants of intent to vaccinate.

- Liau, A. and Zimet, G.D. The acceptability of HIV immunization: Examining vaccine characteristics as determining factors. *AIDS Care* 2001; **13**:643–650.

Similar to the previous study by Zimet et al, Liau and Zimet evaluated the association of vaccine characteristics to the acceptability of hypothetical vaccine immunization. In this paper, they used a sample of 549 undergraduates (18 to 56 years) attending an urban midwestern US university and taking psychology courses. Vaccine characteristics were described in 3 dimensions: cost (free or US$ 300), social saturation (10%, 50% or 90%), and efficacy (50% or 80%). The most acceptable vaccine (free, 90% social saturation, 80% efficacy level) received a mean rating of 83.4 whereas the least desirable vaccine (US$ 300, 10% social saturation, 50% efficacious) received a mean rating of 32.8. The younger participants were more likely to give significantly higher ratings to the hypothetical vaccines than the older adults. Free vaccines were preferred over US$ 300 vaccines; 80% efficacious vaccines were preferred over 50% efficacious vaccines; and 90% social saturation vaccines were preferred over 50% and 10% saturation respectively.

- Crosby, R.A., Holtgrave, D.R., Bryant, L., and Frew, P.M. Factors associated with the acceptance of an AIDS vaccine: An exploratory study. *Prev. Med.* 2004; **39**:804–808.

This paper looked at behavioral issues relating to the acceptance of an AIDS vaccine. Participants were recruited from three population groups in Atlanta, Georgia, USA: men attending gay-identified venues, African American women attending various venues (e.g., small neighborhood grocery stores, fast food restaurants in a low-income downtown area, homeless shelters, and a university campus), and persons who abuse substances and attend venues that provide recovery services. Data assessed participants' concerns about receiving an FDA-approved AIDS vaccine and were analyzed using a principal component analysis with oblique rotation. The authors identified three factors that received satisfactory inter-item reliability and constructed validity as personal issues, product concerns and stigma-associated worry. Using stepwise logistic regression, demographic factors associated with three factors included personal issues (not completing high school, race, and not being vaccinated against hepatitis B); product concerns (female); and worry and associated stigma (lack of hepatitis B vaccination).

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- Newman, P., Duan, N., Rudy, E., Roberts, K., and Swendeman, D. Posttrial HIV vaccine adoption: Motivators, and intentions among persons at risk for HIV. *J. Acquir. Immune Defic. Syndr.* (in press).

Newman et al explored potential concerns, motivations and adoption intentions regarding post-trial HIV vaccines before a vaccine is publicly available. Nine focus groups were conducted among 99 participants recruited from 7 diverse settings in Los Angeles, California, USA using a purposive venue-based sampling method. Venues were selected based on the following criteria: a high proportion of individuals at elevated risk for HIV/AIDS; inclusion of ethnically and sexually diverse communities across Los Angeles; and likely settings for future dissemination of HIV vaccines. Participants were 18 years of age or older and included men attending a sexually transmitted disease clinic housed in a gay and lesbian services organization, male and female IDUs at two needle exchange programs, Spanish-speaking Latinos (men who have sex with men, women and heterosexual men) at two community-based health care clinics, women at a community health clinic serving predominantly African Americans, and young men and women (18 – 24 years) attending a social service agency for gay street youth.   The focus group protocol consisted of seven questions: three questions on general and HIV-specific vaccine knowledge and beliefs, and four questions on concerns, motivations and intentions regarding uptake of hypothetical US FDA-approved HIV vaccines. Results indicate that participants' concerns regarding vaccine uptake centered on vaccine efficacy, vaccine-induced infection, vaccine-induced HIV seropositivity, side effects, cost/access, trustworthiness and relationship issues. Motivators included protection against HIV infection and the ability to safely engage in unprotected sex. Additionally, participants expressed reluctance to adopt partial efficacy vaccines and there was a likelihood of increased sexual risk behaviors in response to vaccine acceptability.

International AIDS Vaccine Initiative