Determinants of personal demand for an AIDS vaccine in Uganda: contingent valuation survey

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Objective To assess the factors affecting demand for an HIV/AIDS vaccine among adults in their prime earning and childbearing years and the impact of vaccination on risk behaviour in a high-prevalence, low-income country.

Methods A contingent valuation survey of 1677 adults aged 18–60 years was conducted in 12 districts in Uganda. Respondents were asked about a hypothetical vaccine to prevent HIV infection. Households were randomly assigned survey questionnaires with one of two levels of vaccine efficacy (50% or 95%) and one of five prices. The influence of demographic characteristics, vaccine efficacy, self-assessed risk of infection, price, and household assets on vaccine demand was assessed using multivariate regression analysis.

Findings Altogether, 94% (1576/1677) of respondents would be willing to be vaccinated with a free HIV/AIDS vaccine; 31% (78/251) would not be willing to be vaccinated at a price of 5000 Ugandan shillings (US$ 2.86). Household wealth, vaccine price, and risk behaviour were significant determinants of individual demand. Demand was equally high for both low-efficacy and high-efficacy vaccines. Respondents believed that condom use would be slightly less necessary with a high-efficacy vaccine (655/825; 79.4%) than a low-efficacy vaccine (690/843; 81.8%). However, reported condom use with partners other than spouses in the absence of a vaccine was much lower (137/271; 50.6%), with 26% (175/670) of men and 9.5% (96/1007) of women reporting having had partners other than their spouses during the past year.

Conclusion The high demand for an AIDS vaccine of any level of efficacy can be explained by the heavy toll of AIDS in Uganda: 72% (990/1371) of respondents had lost a family member to the disease. An AIDS vaccine would be self-targeting: those with a greater chance of becoming infected and spreading HIV would be more likely to seek a vaccine, improving the efficiency of vaccination programmes. However, high levels of risk behaviour in the population suggest that a low-efficacy vaccine alone would have only a limited impact on the epidemic.

Keywords AIDS vaccines/economics; Health services needs and demand/economics; Patient acceptance of health care; Fees, Pharmaceutical; Treatment outcome; Risk-taking; Uganda (*source: MeSH, NLM*).

Mots clés Vaccin anti-SIDA/économie; Besoins et demande services santé/économie; Acceptation des soins; Tarifs pharmaceutiques; Evaluation résultats traitement; Prise risque; Ouganda (*source: MeSH, INSERM*).

Palabras clave Vacunas contra SIDA/economía; Necesidades y demanda de servicios de salud/economía; Aceptación de la atención de salud; Honorarios farmacéuticos; Resultado del tratamiento; Correr el riesgo; Uganda (*fuente: DeCS, BIREME*).

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Introduction

Few countries have been as hard hit by the AIDS epidemic as Uganda. By the end of 2001, UNAIDS estimated that 600 000 of Uganda's 24 million citizens were living with HIV/AIDS, and 880 000 children had lost one or both parents to AIDS (*1*). During 2001 alone, an estimated 84 000 Ugandans died of AIDS, most of whom were in their prime earning and childbearing years. The epidemic has affected every aspect of national life and development (*2*).

A preventive HIV/AIDS vaccine could be the ultimate weapon against this disease. Since 1987, when the first phase I trial of an HIV vaccine was conducted in the United States, more than 30 vaccine candidates have been tested in phase I or phase II clinical trials for safety and immunogenicity (*3*). Uganda became the first African site for a phase I vaccine trial in 1999, when the Aventis-Pasteur ALVAC AIDS candidate vaccine was given to 40 healthy volunteers (*4*). Two phase I AIDS vaccine trials are under way in Uganda. The first is a DNA-modified vaccinia Ankara (MVA) vaccine developed by researchers at Oxford University which is under evaluation by a team consisting of the International AIDS Vaccine Initiative (IAVI) and the Uganda Virus Research Institute (UVRI). A plasmid recombinant DNA

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multiclade (A, B, and C) vaccine, developed by the Vaccine Research Center of the US National Institutes of Health, is being tested by a team from Makerere University in Uganda and Walter Reed Army Institute of Research (F. Wabwire-Mangen, personal communication, December 2003).

An AIDS vaccine must not only be safe, efficacious, easy to administer and affordable but also cost-effective. Equally importantly, those at risk of contracting HIV must be willing to be vaccinated (5). The Ugandan experience with AIDS vaccine trials has shown that public misconceptions can have a big impact on the acceptability of a candidate vaccine (6). Participants in vaccine trials may fear that the vaccine could give them HIV or that they may be stigmatized if the results of conventional blood tests performed after vaccination give positive results (7). Policy-makers also need to understand that the perception of protection afforded by an HIV vaccine might lead recipients or the unvaccinated public to engage in riskier behaviour, which in the absence of a perfectly effective vaccine could actually exacerbate the epidemic (8). Among the potential participants in a vaccine trial in Mombasa, Kenya, 17% of the men and 9% of the women anticipated that they would use condoms less frequently or increase their number of sex partners, or both, were they to enrol in a vaccine trial (7). Similar erosions in safe sexual behaviour have occurred in developed countries after highly active antiretroviral therapy was introduced.

This study focuses on two issues concerning the introduction of a preventive HIV/AIDS vaccine in Uganda. The first question is: what are the key factors that will lead adults to accept vaccination against HIV? Possible factors for acceptance might be: the vaccine's efficacy, the vaccine's price, and whether those at higher risk of transmitting HIV will be likely to be vaccinated. Vaccines in the early stages of development may not be very effective. Simulations have shown that reasonably broad coverage of a low-efficacy vaccine can have a significant impact on the incidence of HIV in Uganda (8), but, for example, would people be willing to be vaccinated with a vaccine that has an efficacy of only 50%? The price of the vaccine is important because, as has been the case for antiretroviral treatment for AIDS, the first vaccines produced may be in short supply and, thus, expensive. They may first be available only through private channels. How much demand might there be for expensive early vaccines? In the event that a cost-recovery programme is put in place to help finance vaccine costs, how much might it suppress demand? Finally, will demand be higher from those who are at higher risk? A vaccine that is self-targeting, that is where individuals at greater risk are more likely to seek out vaccination, would be more cost-effective and can greatly increase the cost-effectiveness of services (8).

The second question this study focuses on concerns the behavioural responses to being vaccinated. If a vaccine is only partially efficacious but recipients significantly relax their safe sexual behaviours, then the epidemic might spread more rapidly, reducing the cost-effectiveness of a vaccination programme.

Methods

We undertook a contingent valuation survey of demand for an AIDS vaccine among up to three adults aged 18–60 years living in one of 1532 Ugandan households. Households were drawn from the sampling frame for the 2000 Uganda Demographic and Health Survey in 12 of Uganda's 45 districts. (In the time since the study was originally designed, several districts have

been split. There are now 56 districts in Uganda.) The districts represented in the sample were selected to achieve representation of all geographical regions of Uganda and Kampala. Within each geographical region, districts in which more than one language was spoken were excluded for logistical reasons. The remaining districts within a region were grouped into contiguous language groupings of 2–3 districts, each speaking a common language and sharing geographical proximity. For this survey, Kampala was a mandatory site, representing urban Uganda. We then selected one language grouping of 2–3 districts from each region.

The core research instrument for the study was a contingent valuation questionnaire. Contingent valuation methods are commonly used in the fields of health and environmental economics for determining the willingness of participants to pay for hypothetical commodities, often public goods such as clean air (9). They have been implemented with success in a number of developing countries (10). Contingent valuation studies have been criticized for being too hypothetical and having little relevance to what people would actually do. This weakness is more common in studies where there are poor attempts to standardize the scenario, the perception of risk, the payment mechanism, and the administration of the survey (11). The Uganda AIDS vaccine contingent valuation questionnaire had five parts:

1. a preamble that reviewed all of the ways in which HIV can be transmitted and prevented
2. a description of the hypothetical preventive HIV/AIDS vaccine and its benefits
3. a physical demonstration of the level of efficacy of the vaccine (see below)
4. a set of questions that measured comprehension of the concept of effectiveness
5. questions to assess the participant's willingness to purchase the vaccine for himself or herself at a randomly assigned price and, if unwilling to purchase it, his or her willingness to be vaccinated with a free vaccine.

The hypothetical HIV/AIDS vaccine was described to respondents as being safe (no danger of becoming infected from the vaccine), having no side-effects, comprising a single dose, able to prevent HIV infection among those who are not yet infected (but having no benefit for someone already infected), effective for 10 years, and of a given level of efficacy. Because we were interested in understanding the demand for both high-efficacy and low-efficacy vaccines, households were randomized to be asked either about a vaccine that was 50% effective or one that was 95% effective. A vaccine with 50% efficacy was defined as one that fully protected half of all the people who had it, while the other half had no protection.

During the field test, a number of different visual devices and methods were used to attempt to demonstrate the concept of efficacy to respondents. The method that seemed to work best was one developed by a previous study in Thailand (12). In this method, the interviewer uses a plastic tray and a set of more than 100 rubber figurines slightly larger than the size of a pencil eraser, each representing one person. The interviewer sorts the figurines into two groups of people who are HIV-negative: one group of 100 who will be vaccinated and four or five other representative figurines who will not be vaccinated. The interviewer points out that everyone in the group of 100 will be vaccinated, but that not everyone who is vaccinated will be protected. The interviewer then divides the pile of those who

have been vaccinated into two halves (for a demonstration of 50% efficacy) or a 95:5 split (for 95% efficacy) and notes that 50 (or 95) of those vaccinated will be protected against becoming infected with HIV. The people who are vaccinated but not protected (50 and 5) will have the same risk of acquiring HIV as if they had not been vaccinated. Those who are vaccinated, however, will not know which group they are in (the protected or unprotected group). The respondents are then asked three questions to check their comprehension. They are asked to:

• identify the group of people who had been vaccinated
• identify those who were protected
• describe how many people had been vaccinated but were not protected.

For our study, if the respondent failed to answer any of these questions correctly, then the demonstration and the questions were repeated. However, only one repeat demonstration was allowed, and even if the respondent wasn't able to answer correctly after the second time, the interviewer continued with the survey.

Following the demonstration, the respondent was asked to suppose that the vaccine was in limited supply and people would have to pay for it out of their own income (health insurance would not pay). The respondent was reminded again of the vaccine's characteristics and told that there was no right or wrong answer, and that some people might buy it and others might not. This was followed by the question of utmost interest for this analysis,: "Suppose that the price of this HIV/AIDS vaccine was "BID" Ugandan shillings. Would you be willing and can you afford to pay for the vaccine for yourself?" In addition to being randomly assigned to one of two vaccine efficacies, every household was randomly assigned to one of five purchase prices which were inserted in place of the word "BID" and ranged from 5000 Ugandan shillings (US$ 2.86) to 500 000 Ugandan shillings (US$ 286). (The median daily income of our respondents was estimated at US$ 1.92.) This wide range of prices was set during the field test and was intended to try to reach both extremes of the demand continuum: that of low price–high demand and high price–stifled demand. Anticipating that some respondents might try to please the interviewer, the questionnaire anticipated three possible responses to the contingent valuation question: "Yes", "No", and "Yes, if I had the money". Those responding "No" or "Yes, if..." were asked whether they would be willing to be vaccinated with a free vaccine. At the conclusion of the interview, respondents were reminded that no effective HIV/AIDS vaccine exists and it may never be developed, so they must take precautions to ensure that they do not become infected.

The questionnaire also captured information on other factors proposed to affect vaccine demand: demographic characteristics, knowledge of HIV/AIDS, perceived lifetime risk of becoming infected, risk behaviour, and adoption of risk-reducing behaviours. The questions on HIV/AIDS knowledge and risk behaviour were based on those used in the 2000 Uganda Demographic and Health Survey. The respondent's household income was anticipated to be an important determinant of the ability to purchase an HIV/AIDS vaccine, but time and financial constraints made collection of detailed household consumption data impractical. Instead, the household's ownership of assets and characteristics of the housing were captured in a separate questionnaire administered to the head of the household. This information was used to construct a household-level "asset index" (a proxy for wealth and long-term economic status) that is a continuous variable ranking households from lowest to highest wealth (13).

The questionnaire and methods for explaining vaccine efficacy were developed and field tested in more than 100 households in Entebbe town and the Mpigi District during the summer of 2001. The questionnaire was tested in both English and Luganda, and then translated into Luo and Runyankole-Rukiga. Using these three languages, we encountered only seven otherwise eligible respondents who could not take the survey because of language problems.

Of the 1532 households selected for the survey at random, half were pre-assigned to a questionnaire that asked about a vaccine that was 50% effective and the other half were pre-assigned to a questionnaire that asked about a vaccine that was 95% effective. Within each vaccine efficacy grouping, households were randomly assigned one of five vaccine prices (5000; 50 000; 100 000; 200 000; or 500 000 Ugandan shillings). This resulted in a total of 10 distinct individual questionnaires (2 efficacies x 5 prices), each of which was translated into three languages. The field procedures called for interviewers first to complete a roster on the demographic characteristics of all household members, on the basis of which they were to select up to three eligible respondents per household. Respondents were eligible for inclusion if they were aged between 18 and 60 years, had resided in the household for at least 6 out of the past 12 months, were not mentally impaired, and were willing to give informed consent. All eligible individuals in a given household received a questionnaire with the same vaccine efficacy and price. Fieldwork was launched in December 2001 and completed in March 2002.

The results of this survey were analysed using multivariate probit analysis of the probability of saying "Yes" (instead of saying "No" or "Yes, if I had the money") to the question of whether the respondent was willing and able to purchase a vaccine of stated efficacy at the given price. For ease of interpretation, the probit coefficients have been converted to marginal effects (the change in the probability of saying "Yes" associated with a unit change in an explanatory variable). Robust standard errors (which apply to the underlying probit coefficients) were calculated, adjusting for the clustering of respondents in the same household.

Findings

Of the 1532 households selected for the survey, 1344 (87.7%) were located and had not been abandoned or demolished. Among the 1344 inhabited dwellings, 28 households (2.1%) refused to participate; in 100 cases (7.4%) no one was found at the dwelling despite repeated attempts by the field team to make contact; and 110 households (8.2%) were found to have no eligible respondents. An additional 35 households were not included in the analysis because data were incomplete. This left a working sample of 1071 households (79.7% of the dwellings that could be located) with individual responses from 1677 adults aged 18–60 years.

Slightly more than half of the respondents (847, or 50.5%) were asked about a vaccine efficacy of 50%; the remaining 830 (49.5%) were asked about a vaccine with an efficacy of 95%. The distribution of the sample by price was as follows: 19.7% (329/1677) were asked about a vaccine priced at 5000 Ugandan shillings; 21.4% (359/1677) were asked about a price of 50 000 Ugandan shillings; 20.6% (345/1677) were asked about a price of 100 000 Ugandan shillings; 18.1% (304/1677)

about a price of 200 000 Ugandan shillings; and 20.3% (340/1677) about a price of 500 000 Ugandan shillings. For reference, we compared the assets of our respondents to those of the Uganda National Household Survey (2000) and estimated the median daily household income in our sample as about 3360 shillings (US$ 1.92).

The respondents in our sample were young, with nearly half of them under the age of 30 and 75% under 40 (Table 1). The sample, which was representative only of the 12 districts surveyed, was about 44% male, compared to 46% male among those aged 20–60 years in the nationally representative 2000 Uganda Demographic and Health Survey. Altogether, 72% of respondents were currently married; 16% had never married; and 12% were either separated, widowed or divorced (data not shown). Education levels were low, more so for women (Table 2). About 70% (1173/1669) of respondents had completed fewer than seven years of formal schooling, including 16.6% (279/1669) who had had no schooling whatsoever. Only 7.3% (123/1669) had completed 12–13 years of education (upper secondary school) or more.

Respondents were asked questions to check their understanding of the concept of vaccine effectiveness after the interviewer's demonstration. Of the 1677 respondents, about 41% (681/1669) passed after the first demonstration (data not shown). The pass rate increased to 60.4% (1008/1669) after the second demonstration. The comprehension of vaccine efficacy was highly dependent on the respondent's education, rising from a pass rate of only 27.6% (77/279) for those with no formal education to a rate of 92.6% (114/123) for those with at least some upper secondary level education (Table 3). This relationship, taken with the high share of respondents with low education, helps to explain why the average pass rate in Uganda was so low.

In the demand analysis, two sets of respondents were excluded. We excluded those who reported that they suspected or knew they were HIV-positive because the vaccine described in the scenario was stipulated not to be effective for those who had already contracted HIV. We also excluded those who reported that they would not use the vaccine because they doubted its safety despite the fact that the scenario described the vaccine as being safe. Excluding these two sets of respondents reduced the sample to 1615 people who believed they were HIV-negative and who accepted that the vaccine was safe. The responses of all of these individuals were analysed, even those of individuals who did not correctly answer the questions on effectiveness, because real-world demand for the vaccine will come both from those who do and those who do not fully understand the concept of efficacy. However, we included an indicator of whether the respondent understood the efficacy scenario as a covariate

Table 1. **Distribution of respondents by age and sex**

Sex	Age group				Total
	18–29	30–39	40–49	50–60	
Male	299	231	117	83	730 (43.5)[a]
Female	470	259	142	76	947 (56.5)
Total	769 (45.9)	490 (29.2)	259 (15.4)	159 (9.5)	1677 (100.0)

[a] Figures in parentheses are percentages.

in our analysis. Separate analyses of those who did and did not understand efficacy (data not shown) revealed that the effects of price, income, age, sex and education are similar for both groups.

The percentage of respondents willing and able to purchase an AIDS vaccine for themselves at each of the five prices and two levels of vaccine efficacy is shown in Fig. 1. As expected, the percentage declined as the price rose. But demand was high, even at the prices described in the scenario: three-quarters of individuals would purchase the vaccine if it were available for about US$ 3.00 and roughly 1 in 5 said they would purchase it at a price 100 times higher (US$ 286.00). A surprising finding is that acceptance did not depend on the vaccine's efficacy. Additionally, the willingness to be vaccinated if the vaccine was free was even higher at about 94% (1576/1677) (data not shown), and again this uptake was similarly insensitive to efficacy. Among the 6% (101/1677) of respondents who said they would refuse a free AIDS vaccine, the most important reasons cited were that they were "not at risk" and they were able to protect themselves in other ways (data not shown).

The results of the multivariate probit analysis of the determinants of the willingness and ability to purchase the vaccine at randomly assigned prices are shown in Table 4. The pseudo-R^2 statistic, which assesses the proportion of the variance in the probability of accepting the vaccine, was 0.2059. The probit coefficients have been transformed into marginal effects for ease of interpretation; they represent, for continuous variables, the marginal relation between a 1 unit increase in the explanatory variable and the probability of purchasing the vaccine; for dichotomous variables, they also represent the change in probability associated with a discrete change of the variable from 0 to 1. Table 4 pools the results across all vaccine efficacies and prices, but includes price and efficacy as explanatory variables. Separate regressions for vaccines at the two efficacy levels revealed substantially similar patterns (data not shown).

Table 2. **Distribution of respondents by sex and level of education completed**

Sex	Level of education completed					Total
	None	Primary (1–7 years)	Lower secondary (8–11 years)	Upper secondary (12–13 years)	University (more than 13)	
Male	51 (7.7)[a]	374 (56.1)	168 (25.2)	52 (7.8)	21 (3.2)	666 (100.0)
Female	228 (22.7)	520 (51.8)	205 (20.4)	41 (4.1)	9 (0.9)	1003 (100.0)
Total	279 (16.6)	894 (53.3)	373 (22.3)	93 (5.5)	30 (1.8)	1669 (100.0)

[a] Figures in parentheses are percentages.

Table 3. **Percentage of respondents who answered correctly the questions designed to test their understanding of vaccine efficacy, by level of education completed and vaccine efficacy in the scenario**

Level of education[a]	Vaccine efficacy		Total
	50%	95%	
None	32.9 (46/140)	22.3 (31/139)	27.6 (77/279)
Primary (1–7 years)	55.8 (256/458)	53.4 (233/436)	54.7 (489/894)
Lower secondary (8–11 years)	91.3 (169/185)	84.5 (159/188)	87.9 (328/373)
Upper secondary and university (≥12 years)	93.5 (58/62)	91.8 (56/61)	92.6 (114/123)
Total	62.6 (529/845)	58.2 (479/824)	60.4 (1008/1669)

[a] The relation between level of education completed and the overall rate of answering correctly is highly statistically significant ($P = 0.000$). The difference in overall rate of answering correctly between demonstrations of 50% and 95% efficacy is weakly significant ($P = 0.067$).

The demand for an HIV/AIDS vaccine was about 9 percentage points lower among women than men, but it was nearly 12 percentage points higher among those who were married, holding other variables at their means. The demand for an AIDS vaccine was highest among those aged 18–34 years, after which it declined. Education was a strong predictor of vaccine demand: those who had completed upper secondary level education were 20% more likely to want to purchase the vaccine, and those who had had a university education were 35% more likely to want to purchase it, than those with no formal education, when household assets, vaccine price, and efficacy were controlled for. Respondents who believed that they were at an increased risk of infection and those who had lost relatives to AIDS, were significantly more likely to be willing and able to be vaccinated. Vaccine efficacy was not statistically significant, as observed in Fig. 1, but respondents who understood the vaccine scenario were significantly more likely to demand a vaccine. One counterintuitive result was that respondents who believed that AIDS is curable were more likely to want a vaccine; one might expect that the reverse would be true. However, this finding is consistent with that of at least one study of potential participants in an AIDS vaccine trial (*14*); this study found that participants seemed to understand the concept of vaccines but "[did] not clearly distinguish the use of vaccines for prevention or curing". As would be predicted by economic theory, demand declined

significantly with increases in the price but rose with the respondent's wealth. That said, it was surprising that the lowest four wealth quintiles had similar proportions of individuals demanding the vaccine at each price. Only those in the highest fifth of the wealth distribution had significantly higher demand for an AIDS vaccine.

The results of questions on sexual behaviour revealed that 26% (175/670) of men and 9.5% (96/1007) of women (irrespective of marital status) reported having had one or more sexual partners other than a spouse during the previous 12 months (data not shown). Among the 271 respondents who reported they had had sex with someone other than a spouse, only 50.6% (137/271) reported always using condoms with their other partner; this included 57% (100/175) of the men and 39% (37/96) of the women. All respondents were asked whether someone vaccinated as described in the survey (with a vaccine that was either 50% or 95% effective, depending on the respondent) should use a condom when they have sex with a partner who is not their spouse. The answers, reported in Table 5, reveal that 80.6 % (1345/1668) of respondents think that vaccinated individuals "should" use condoms with partners who are not their spouses; this is a much higher rate than what is actually reported to be practised in the absence of an AIDS vaccine. The percentage endorsing condom use was slightly higher for the lower efficacy vaccine (81.8%; 690/843) than the higher efficacy vaccine (79%; 655/825), but this difference was not statistically significant.

Discussion

These results show there is a high level of demand for a preventive HIV/AIDS vaccine among Ugandan adults, and that this demand is sensitive to the price of the vaccine and (at the highest quintile) to the respondent's wealth, but it is insensitive to vaccine efficacy. What can account for this puzzling finding?

First, the impact of the epidemic has been extraordinary. Adult infection levels have declined recently to about 5%, due in part to high levels of mortality from AIDS. A total of 72% of respondents had lost a family member to HIV/AIDS, and 93% understood it to be incurable. The epidemic has touched virtually every Ugandan; even those at low risk of HIV infection may feel vulnerable, boosting demand for a vaccine of any efficacy. A survey in Thailand among commercial sex workers at very high risk of becoming infected found similarly high acceptance rate and insensitivity to efficacy (*12*).

A second explanation has to do with the interaction between education and comprehension of vaccine efficacy. The

Fig. 1. **Percentage of respondents willing and able to purchase an AIDS vaccine, by price and efficacy[a]**
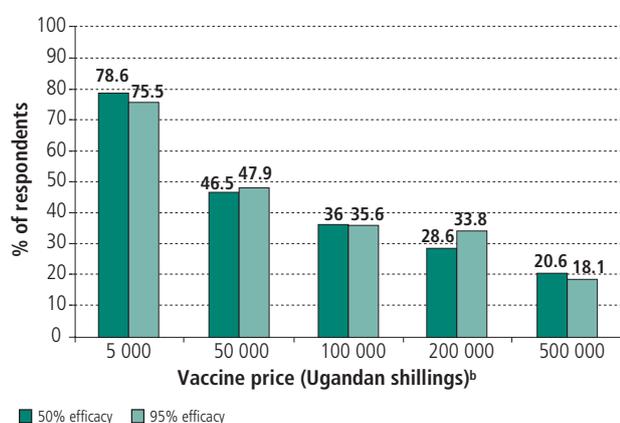
[a]The total number of respondents was 1615 (812 for 50% efficacy; 803 for 95% efficacy). Cell sizes for each efficacy–price combination range from 146 to 185.

[b]1750 Ugandan shillings = US$ 1.

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Table 4. **Probit regression of the probability of respondent purchasing an AIDS vaccine for himself or herself**

Explanatory variable[a]	Marginal effect[b]	Student's t-test	Mean of explanatory variable
Female	-0.089[c]	3.17	0.559
Married	0.118[c]	3.55	0.721
Age 25–29	-0.020	0.51	0.196
Age 30–34	-0.066	1.53	0.157
Age 35–39	-0.139[c]	3.13	0.131
Age 40–44	-0.195[c]	3.81	0.091
Age 45–49	-0.179[c]	3.12	0.064
Age 50–60	-0.239[c]	4.81	0.095
Primary school completed (1–7 years)	0.084[d]	2.04	0.535
Lower secondary school completed (8–11 years)	0.137[c]	2.53	0.222
Upper secondary school completed (12–13 years)	0.202[c]	2.57	0.053
University education (>13 years)	0.345[c]	2.51	0.024
Any risk of infection	0.069[d]	1.99	0.616
Doesn't know risk of infection	0.060	1.17	0.137
No. of relatives who have died from AIDS	0.006[d]	2.15	2.87
Respondent thinks AIDS is curable	0.102[d]	2.03	0.076
Vaccine price (logarithm)	-0.146[c]	15.02	11.2
Vaccine efficacy (= 1 if 95% effective)	0.005	0.18	0.497
Understood vaccine efficacy demo	0.081[c]	2.57	0.595
Second asset index quintile	-0.012	0.26	0.209
Third asset index quintile	-0.005	0.12	0.214
Fourth asset index quintile	0.040	0.80	0.175
Highest asset index quintile	0.168[c]	2.97	0.196
Pseudo R^2	0.2059		
Mean of dependent variable	0.421		
No. of observations	1615		

[a] Reference categories for dichotomous variables are: male; not married; aged 18–24 years; no education; no risk of infection; respondent thinks AIDS is incurable or is not sure; vaccine efficacy of 50%; did not understand vaccine efficacy demonstration; and first (lowest) asset index quintile. The regression includes a control for region of the country (not shown to conserve space). Standard errors have been corrected for clustering of responses within households.

[b] Marginal effect means the change in the probability of purchase associated with an incremental change in the independent variable, calculated at the mean of all explanatory variables. For continuous variables, it is the marginal change in probability due to a 1 unit change in the explanatory variable; for dichotomous variables, it represents the change in probability of purchasing the vaccine for a discrete change of the variable from 0 to 1. T-statistics are the test of the underlying probit coefficient being 0.

[c] $P \leqslant 0.05$; Age variables are jointly statistically significant at $P = 0.0000$; Asset index quintiles significant at $P = 0.0124$.

[d] $P \leqslant 0.01$.

results show that those who understood the concept of effectiveness were more likely to want to be vaccinated. However, the efficacy demonstration that was most easily understood by respondents who had had less education was the demonstration for the least efficacious vaccine. This may have muted the differences in demand between the two levels of efficacy.

A third possibility is that respondents who successfully answered the three questions designed to check their understanding of efficacy still did not fully comprehend the concept. However, the observation by respondents that condom use would be less necessary with a high-efficacy vaccine suggests that there was an understanding of the differences in effectiveness at some (non-significant) level.

The results also suggest that there would be substantial demand among Ugandan adults for an AIDS vaccine with limited efficacy, even if the vaccine had to be purchased. Further, those at highest risk of infection would be more likely to purchase or accept a vaccine than those at lower risk. In that sense, an AIDS vaccine is self-targeting: those for whom vaccination is likely to have the greatest positive externalities in terms of preventing

HIV in the rest of the population are those who are most likely to be vaccinated. However, the continued high level of sexual activity with partners who are not spouses and the low rate of condom use in Uganda create concern about the impact and cost effectiveness of a low-efficacy vaccine. Our study suggests that while respondents are aware that high levels of condom use are desirable, current behaviour does not approach 100% condom use with partners who are not spouses. The danger exists that introducing a partially effective vaccine may reduce incentives for further changes in behaviour and thereby reduce the population-level effectiveness of the vaccine. Thus, an AIDS vaccine will not be a magic bullet. While modelling has shown the potential benefits even of low-efficacy vaccines, renewed and more vigorous emphasis on other preventive measures will be necessary in Uganda to realize the full potential of this promising new technology when it becomes available (15). ∎

Acknowledgements

Table 5. **Percentage of respondents according to response to question on using condoms with a partner who is not their spouse by level of vaccine efficacy**

If a person received a vaccine that is X% effective, do you think that he or she should use a condom to prevent AIDS when they have sexual relations with others who are not their spouse?	Vaccine efficacy		Both vaccines[a] (*n* = 1668)
	50% (*n* = 843)	**95% (*n* = 825)**	
Yes	81.8 (690/843)	79.4 (655/825)	80.6 (1345/1668)
Do not know or not sure	7.8 (66/843)	9.0 (74/825)	8.4 (140/1668)
No	10.3 (87/843)	11.6 (96/825)	11.0 (183/1668)
Total	**100.0**	**100.0**	**100.0**

[a] The difference in response by vaccine efficacy is not statistically significant (*P* = 0.287).

Résumé

Déterminants de la demande personnelle concernant un vaccin anti-SIDA en Ouganda : enquête d'évaluation contingente

Objectif Procéder à une estimation des facteurs influant sur la demande de vaccin anti-VIH/SIDA chez les adultes en âge de mener une activité professionnelle et d'avoir des enfants et de l'impact de la vaccination sur les comportements à risque dans un pays à faible revenu où la prévalence du SIDA est élevée.

Méthodes Une enquête d'évaluation contingente a été réalisée sur 1677 adultes de 18-60 ans dans 12 districts d'Ouganda. Les questions portaient sur un vaccin hypothétique destiné à empêcher l'infection par le VIH. Les ménages recevaient par tirage au sort un questionnaire mentionnant l'un ou l'autre de deux niveaux d'efficacité (50 % ou 95 %) et un prix parmi un éventail de cinq. L'influence des caractéristiques démographiques, de l'efficacité du vaccin, du risque d'infection auto-évalué, du prix du vaccin et du revenu du ménage sur la demande de vaccin a été déterminée par analyse de régression multivariée.

Résultats Au total, 94 % des personnes enquêtées (1576/1677) se feraient vacciner par un vaccin anti-VIH/SIDA gratuit ; 31 % (78/251) ne se feraient pas vacciner au prix de 5000 shillings ougandais (USD 2,86). Le revenu du ménage, le prix du vaccin et les comportements à risque étaient des déterminants significatifs de la demande individuelle. La demande était aussi forte pour un vaccin peu efficace que pour un vaccin efficace. Les personnes enquêtées pensaient que l'utilisation du préservatif serait légèrement moins nécessaire avec un vaccin efficace (655/825 ; 79,4 %) qu'avec un vaccin peu efficace (690/843 ; 81,8 %). Cependant, le pourcentage d'utilisation rapportée du préservatif avec des partenaires autres que le conjoint en l'absence de vaccin était beaucoup plus faible (137/271 ; 50,6 %), alors que 26 % des hommes (175/670) et 9,5 % des femmes (96/1007) indiquaient avoir eu d'autres partenaires que leur conjoint pendant l'année écoulée.

Conclusion La forte demande concernant un vaccin anti-SIDA quel qu'en soit l'efficacité peut s'expliquer par le poids très élevé du SIDA en Ouganda : 72 % des personnes enquêtées (990/1371) avaient perdu un membre de leur famille à cause du SIDA. Un vaccin anti-SIDA serait auto-ciblé, c'est-à-dire que les personnes ayant le plus de risques d'être infectées et de propager le VIH seraient davantage enclines à se faire vacciner, ce qui augmenterait l'efficacité des programmes de vaccination. Cependant, le niveau élevé des comportements à risque dans la population laisse à penser qu'un vaccin de faible efficacité n'aurait à lui seul qu'un impact limité sur l'épidémie.

Special Theme – Economics of Immunization

David Bishai et al.   Determinants of personal demand for an AIDS vaccine in Uganda

Resumen

Determinantes de la demanda personal de una vacuna contra el SIDA en Uganda: encuesta de valoración contingente

Objetivo Evaluar los factores que influyen en la demanda de una vacuna contra el VIH/SIDA entre los adultos en los años de su vida más importantes para obtener ingresos y tener hijos, así como el impacto de la vacunación en los comportamientos de riesgo en un país de prevalencia alta de la enfermedad e ingresos bajos.

Métodos Se llevó a cabo una encuesta de valoración contingente entre 1677 adultos de 18 a 60 años en 12 distritos de Uganda. Se formularon a las personas encuestadas diversas preguntas acerca de una vacuna hipotética para prevenir la infección por VIH. Se asignaron aleatoriamente a los hogares cuestionarios con uno de dos posibles niveles de eficacia de la vacuna (50% ó 95%) y uno entre cinco posibles precios. La influencia de las características demográficas, la eficacia de la vacuna, el riesgo autoevaluado de infección, el precio y el patrimonio doméstico en la demanda de vacuna se evaluó mediante el método de análisis de regresión multifactorial.

Resultados En total, el 94% (1576/1677) de los encuestados estarían dispuestos a vacunarse con una vacuna gratuita contra el VIH/SIDA; un 31% (78/251) no estaría dispuesto a vacunarse a cambio de 5000 chelines ugandeses (US$ 2,86). La riqueza doméstica, el precio de la vacuna y el comportamiento de riesgo fueron factores determinantes significativos de la demanda

individual. La demanda fue elevada tanto para las vacunas de eficacia baja como para las de eficacia alta. Los encuestados consideraban que el uso de preservativos sería ligeramente menos necesario con una vacuna de eficacia alta (655/825; 79,4%) que con una de eficacia baja (690/843; 81,8%). Sin embargo, el uso declarado de preservativos con parejas distintas del cónyuge en ausencia de una vacuna fue mucho menor (137/271; 50,6%), y un 26% (175/670) de los hombres y un 9,5% (96/1007) de las mujeres declararon que habían tenido relaciones con otras personas aparte del cónyuge durante el último año.

Conclusión La alta demanda de una vacuna contra el SIDA con algún grado de eficacia puede explicarse por el enorme tributo que se cobra esta enfermedad en Uganda: el 72% (990/1371) de los encuestados habían perdido a un miembro de la familia como consecuencia del SIDA. Una vacuna contra la enfermedad se centraría espontáneamente por su propia índole en determinados grupos de la población: las personas con más posibilidades de contraer la infección y propagar el VIH son las que más tenderían a buscarla, lo que redundaría en una mayor eficiencia de los programas de vacunación. Sin embargo, el alto nivel de comportamientos de riesgo detectado en la población indica que, por sí sola, una vacuna de baja eficacia tendría un impacto limitado en la epidemia.

ملخص

العوامل المحدَّدة للطلب الشخصي على لقاحات الإيدز في أوغندة: مسح تقديري طارئ

الغرض: تقييم العوامل المؤثِّرة في الطلب على لقاحات الإيدز والعدوى بفيروسه بين البالغين في السنوات الأولى للكسب والحمل، وتأثير التلقيح على السلوك المحفوف بالمخاطر في بلد يعاني من انخفاض الدخل وارتفاع معدل انتشار المرض.

الطريقة: أُجري مسح تقديري طارئ لبالغين في الفئة العمرية ١٨ إلى ٦٠ عاماً، عددهم ١٦٧٧ بالغاً، من ١٢ منطقة صحية في أوغندة. وتم في إطار المسح سؤال المستجيبين عن لقاح افتراضي للوقاية من عدوى فيروس الإيدز. ووُزِّعت على الأُسَر بشكل عشوائي استبيانات المسح التي اشتملت على مستويين لنجاعة اللقاح (٥٠٪ أو ٩٥٪) وعلى سعر واحد من خمسة أسعار مختلفة. وتم إجراء تحليل التحوف المتعدد المتغيرات لتقييم تأثير الخصائص الديموغرافية، ونجاعة اللقاح، والمخاطر الذاتية التقييم للعدوى، وسعر اللقاح، ومستوى دخل الأسرة، على الطلب على اللقاحات.

الموجودات: أظهرت نتائج المسح أن ١٥٧٦ مستجيبا من جملة ١٦٧٧ مستجيباً (أي نسبة ٩٤٪) يرغبون في الحصول على لقاح الإيدز مجاناً؛ وأن ٧٨ من جملة ٢٥١ مستجيباً (أي نسبة ٣١٪) لا يرغبون في الحصول على اللقاح بسعر ٥٠٠٠ شلن أوغندي (٢,٨٦ دولار أمريكي). كما تبيَّن أن مستوى ثروة الأسرة، وثمن اللقاح، والسلوك المحفوف بالمخاطر، هي من المحدِّدات المهمة لطلب الأفراد على اللقاح. وكان الطلب مرتفعاً بشكل متساوٍ على اللقاحات المرتفعة النجاعة والمنخفضة النجاعة على السواء.

ويعتقد ٦٥٥ من جملة ٨٢٥ مستجيباً (أي نسبة ٧٩,٤ ٪) أن استخدام العوازل سوف تقل ضرورته بشكل طفيف عند تلقِّي اللقاح المرتفع النجاعة؛ في حين يعتقد ٦٩٠ من جملة ٨٤٣ مستجيباً (أي نسبة ٨١,٨٪) أن استخدام العوازل ستقل ضرورته عند تلقِّي اللقاح المنخفض النجاعة. غير أن عدد من أبلغوا عن استخدامهم للعوازل مع قرينائهم في العلاقة الجنسية، غير زوجاتهم، مع عدم تلقِّي اللقاح، كان ١٣٧ من جملة ٢٧١ مستجيبا (أي نسبة ٥٠,٦٪)، إذ أبلغ ١٧٥ رجلاً من جملة ٦٧٠ رجلاً (أي نسبة ٢٦٪)، و ٩٦ امرأة من جملة ١٠٠٧ نساء (أي بنسبة ٩,٥٪) عن انخراطهم في علاقات مع قرينات أو قرناء آخرين غير زوجاتهم أو أزواجهم خلال العام السابق.

الحصيلة: يمكن توضيح ضرورة تلقي أي لقاح للإيدز، بأي مستوى من النجاعة، من خلال بيان الخسارة الناجمة عن الإيدز في أوغندة: إذ تشير المعطيات إلى أن ٩٩٠ شخصاً من جملة ١٣٧١ من المستجيبين (أي نسبة ٧٢٪) قد فقد أحد أفراد أُسـرته من جراء مرض الإيدز. فينبغي على الأفراد طلب لقاح الإيدز من تلقاء أنفسهم: فمن الأرجح أن يكون الناس الأكثر عرضة للإصابة بعدوى فيروس الإيدز ونقله للآخرين هم أول من يسعى للحصول على اللقاح، مما يؤدي إلى تحسين كفاءة برامج التلقيح. ومع ذلك فإن المستويات العالية للسلوكيات المحفوفة بالمخاطر بين السكان توحي بأن إعطاء اللقاح المنخفض النجاعة وحده سيكون محدود التأثير على الوباء.

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