Willingness to Pay for a Free HIV Vaccination Programme

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Abstract

Of all contingent valuation method (CVM) studies on HIV vaccines, this study has led the way in estimating the willingness to pay (WTP) for a free HIV vaccination scheme at a national level in Thailand. Using the double bounded format with an open-ended follow up question, this study created a CVM scenario, a one-year free HIV vaccination programme, vaccinating both male and female commercial sex workers (CSWs) over the age of 15 for free in red light districts around major cities in Thailand. The vaccine attributes used in this scheme were 30% or 70% effectiveness, no side-effects, 15 years of protection, protection from multiple strains of HIV/AIDS, and a one dose injection.

With a 600-split sample survey in Bangkok, this study asked 20-60 year old tax payers in the Bangkok metropolitan area how much they would be willing to pay for this free scheme by a single yearly income tax payment of either THB 500, 1,500, 2,000, 3,500, 5,000, or 6,000. The results of the probit model for public demand for this free scheme have found that the mean WTP value with 70% vaccine effectiveness was THB 2,050 for a double bounded format estimate, while mean WTP value 30% vaccine effectiveness was of THB 1,746. INCOME and RATE are the major factors affecting the willingness to pay for the free HIV vaccine scheme, while AGE showed a negative relationship willingness to sponsor this scheme.

Keywords: Contingent Valuation Method, Free; HIV Vaccine, Willingness to Pay (WTP)

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ความเต็มใจที่จะจ่ายสำหรับโครงการฉีดวัคซีน
# ป้องกันเชื้อไวรัส HIV ฟรี

เจริญชัย เอกมาไพศาล

บทคัดย่อ

รายงานฉบับนี้เป็นการศึกษาความเต็มใจที่จะจ่ายสำหรับโครงการฉีดวัคซีนป้องกัน เชื้อไวรัส *HIV* ฟรี ในประเทศไทยซึ่งถือว่าเป็นการศึกษาชิ้นแรกโดยใช้วิธีการแบบ *Contingent Valuation* ภายใต้วิธีการถามแบบ *(Double Bounded)* แล้วตามด้วยคำถามปลายเปิด *(open-ended)* โดยที่โครงการนี้มีระยะเวลาเพียงแค่ปีเดียวที่จะฉีดวัคซีนป้องกันเชื้อไวรัส *HIV* ฟรีให้แก่ผู้ขายบริการทางเพศทั้งชายและหญิงตั้งแต่อายุ 15 ปีขึ้นไป ตามย่านสถาน บริการทางเพศ และบันเทิงต่าง ๆ ภายในเมืองใหญ่ ๆ ทั่วประเทศ โดยวัคซีนที่ใช้ในโครงการนี้ จะมีประสิทธิภาพป้องกันเพียง 30 หรือ 70 เปอร์เซ็นต์ วัคซีนที่ว่านี้ ฉีดเพียงเข็มเดียว สามารถ ป้องกันการติดเชื้อไวรัส *HIV* ได้นานเป็นระยะเวลา 15 ปี โดยจะไม่มีผลข้างเคียง

งานวิจัยชิ้นนี้ได้ทำการสำรวจโดยการสัมภาษณ์คนจำนวนทั้งหมด 600 คน ใน กรุงเทพมหานคร ที่มีอายุระหว่าง 20-60 ปี ซึ่งเป็นผู้เสียภาษีเงินได้ โดยศึกษาในความเต็มใจ ที่จะจ่ายเพื่อสนับสนุนโครงการฉีดวัคซีนป้องกันเชื้อไวรัส *HIV* ฟรีนี้ โดยการจ่ายผ่านภาษี บุคคลธรรมดาเพียงครั้งเดียวในอัตราภาษีที่เรียกเก็บหลายระดับ ได้แก่ 500, 1,500, 2,000, 3,500, 5,000 และ 6,000 บาทต่อปี ผลการศึกษาพบว่า ความเต็มใจที่จะจ่ายโดยเฉลี่ยเพื่อ สนับสนุนโครงการที่ใช้วัคซีนประสิทธิภาพ 70 เปอร์เซ็นต์ เป็นเงิน 2,050 บาท และวัคซีน ประสิทธิภาพ 30 เปอร์เซ็นต์ เป็นจำนวนเงิน 1,746 บาท ตัวแปร รายได้ และอัตราภาษีที่ เรียกเก็บ มีผลต่อการตัดสินใจในการเต็มใจที่จะจ่าย ในขณะที่ ตัวแปรด้านอายุ มีผลตรงกัน ข้ามในการตัดสินใจที่จะสนับสนุนโครงการนี้

คำสำคัญ: วิธีการประเมินค่าแบบ *Contingent Valuation Method (CVM)* ฟรี วัคซีนป้องกันเชื้อไวรัส *HIV* ความเต็มใจที่จะจ่าย,

Background and Rationale

Thailand so far has made significant progress in the fight against HIV/ AIDS, with a decline in the annual number of new HIV infections. As can be seen in Figure 1, in 1984 the first AIDS cases in Thailand was found among homosexual men, but attention at first was given to injecting drug users (IDUs). Then the HIV/AIDS disease spread through female sex workers (FSWs) and their clientele, and also men that had had sex with other men (MSM). Then HIV became limited within the general population to heterosexual people and to children born to HIV infected mothers. Despite this, the patterns of HIV transmission in Thailand have changed dramatically over time, with the virus increasingly spreading to people once considered to be at lower risk. Therefore females, as a low risk group, have increasingly contracted more new HIV infections through either their male partners or husbands who either had unprotected sex or had injected drugs. On top of this, they also have to face another risk exposure from MSM. This accounted for 21% of new HIV infections in 2007 (WHO-SEARO, 2007). One interesting study in 2005 claimed that approximately 22% of MSM in Bangkok have had sex with both men and women, while almost 40% of them also had unprotected sexual intercourse with either steady or casual male partners during the 3 months prior to that study (Van Griensven et al., 2005).
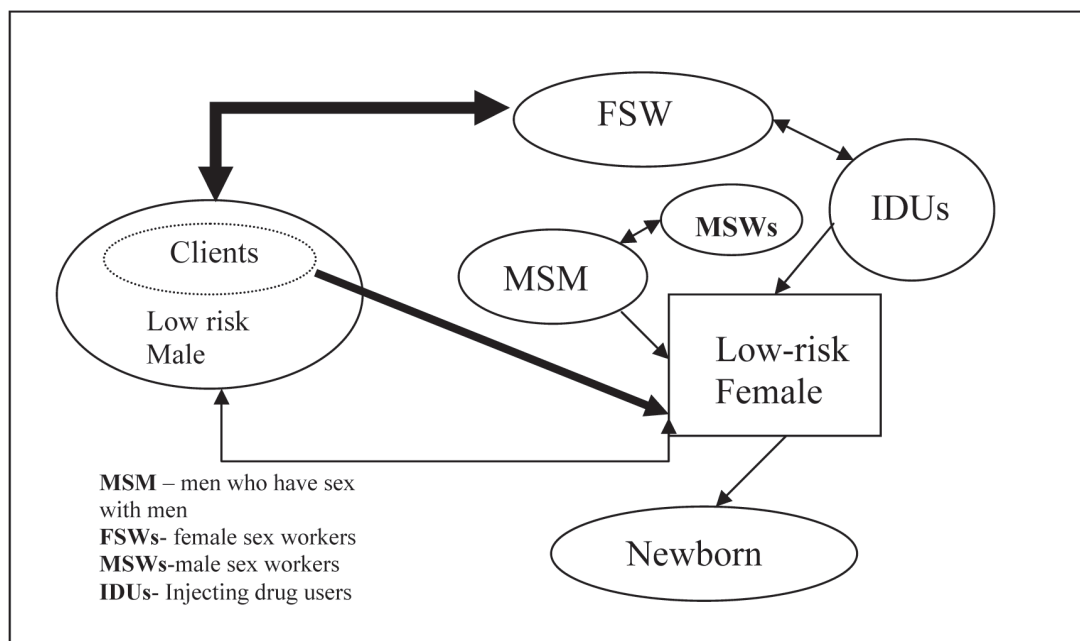
Source: Dr. Wiwat Peerapatanapokin, 2007, and author.

Figure 1: The General Pattern of HIV/AIDS Transmission in Thailand

Although the majority of sex workers in Thailand are female, there is also a considerable number of male sex workers (MSWs) catering to MSM. So there are the highly possibly sexual relations between MSM and MSWs, which our study took into consideration. In spite of this, no sentinel HIV surveillance has been conducted for MSM, and due to the stigmatized nature of homosexuality in Thailand, AIDS cases among MSM may hence be under-reported (WHO-SEARO, 2007).

Even though current prevention measures can slow the spread of HIV/AIDS, the best hope of ending this epidemic lies in a vaccine. Conducted by the U.S. army and the Thai government, the HIV vaccine has now been found to able to successfully cut infection by 31.2%. This result has instilled new hope in the HIV vaccine research field and has provide a promise that a safe and highly effective HIV vaccine may become available for populations throughout the world. In this respect, this study created a hypothetical scenario, a one-year free

HIV vaccination programme targeting only sex workers[1] or commercial sex workers (CSWs) as the high risk group, if an HIV vaccine existed. Although an HIV vaccine itself as regards health has been considered as a private good, this free HIV scheme would be considered as an impure public good because it is nonexclusive, but rivalry. That is, this free vaccination scheme could, if used countrywide, reduce the risk of HIV/AIDS infection and prevalence among individuals in society, so all people would benefit from it. Consequently, individuals realize that they would benefit personally if these sex workers were vaccinated, because if the HIV/AIDS epidemic eventually decreases, it will reduce their own risks and the economy in fact would not be as adversely affected (Lorete, 2004). On the one hand, the use of additional units of HIV/AIDS vaccine with this high risk group still involves marginal social costs of production.

Until now, only five papers have been written estimating the public sector demand, and also the government's demand, for an HIV vaccine at a national level. These studies have been conducted in Brazil (Novaes et al., 2002), India (Gandhi et al., 2007), the Southern African region (Desmond & Greener, 2003), Southern India (Seshasri et al., 2003), and Thailand (Viroj Tangcharoensathien et al., 2001). However none of these studies has examined a country's ability to finance HIV vaccines or the willingness to pay for HIV vaccine at alternative price levels.

Objective of the Study

The objective of this study was to obtain in-depth information from the public and the general population, including both males and females, on how much they would be willing to pay for supporting a one-year free HIV vaccination programme with the diverse initial income tax payment of THB 500, 1,500, 2,000, 3,500, 5,000 and 6,000, respectively. On this account, this study used the double-bounded contingent valuation method (CVM) format, followed by

[1] The definition of sex workers is female, male and transgender adults and young people who receive money or goods in exchange for sex services either regularly or occasionally (UNAIDS, 2009).

open-ended and debriefing questions in order to elicit the maximum willingness to pay for this free programme. With a one-off payment from their yearly income tax financing the programme, this free programme would be provided countrywide for CSWs consisting of both males and females above 15 years of age and regarded as a high risk group categorized into two different levels of HIV vaccine effectiveness: 30% and 70%. The CVM was also employed to measure the economic benefits of this free HIV vaccination programme and to ascertain the key factors influencing an individual's payment for this free scheme.

Methods

Contingent Valuation Method (CVM)

In order to obtain the amount of willingness to pay (WTP), our study used double-bounded dichotomous choice followed by open-ended and debriefing questions to estimate the WTP for a one-year free HIV vaccination scheme. Given an initial payment of either THB 500, 1,500, 2,000, 2,500, 3,500, 5,000 or 6,000, if a respondent answers "Yes" to the initial rate (B), then the individual will be faced with a follow-up question, offerings him/her a higher rate (B_H), one and a half the original amount. If a respondent answers "No" to the initial rate (B), the individual will be asked again a second question about a lower amount (B_L), two-thirds the original amount (See Table 1 and Figure 2).

Table 1: Bid Structure in Baht

	Initial rate (B)	Higher rate (B_H)	Lower rate (B_L)
1	500	750	300
2	1,500	2,250	1,000
3	2,000	3,000	1,300
4	3,500	5,250	2,300
5	5,000	7,500	3,300
6	6,000	9,000	4,000
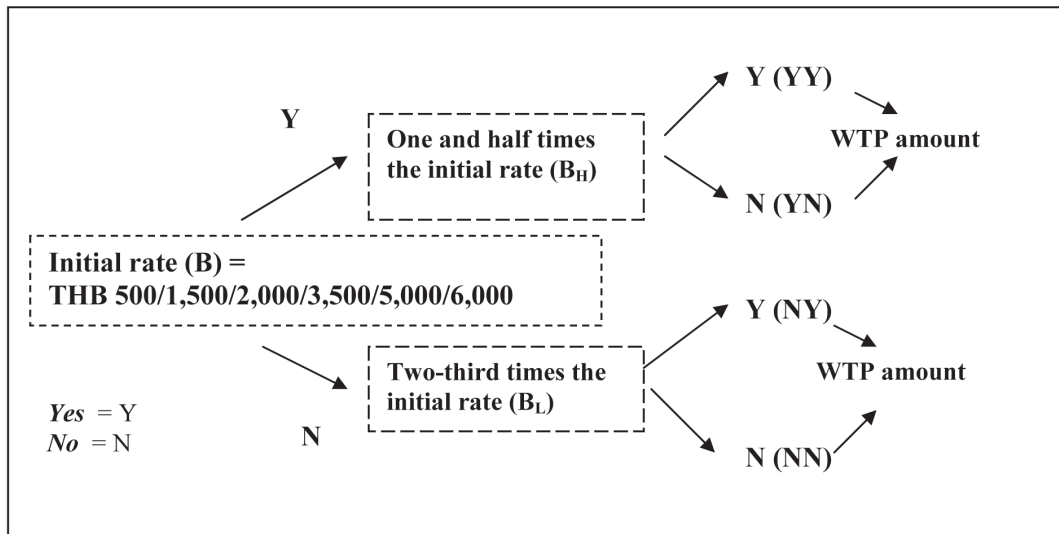
Note: YY = yes/yes, YN = yes/no, NY =no/yes, and NN = no/no

Figure 2: Diagram of Double-Bounded Format with Open-Ended Follow Up

In the end, the individual was asked to state what the maximum amount he/she would like to pay for this free vaccination programme through his/her income tax payment. If the individual stated that the maximum amount of the WTP which was not zero, he or she would again be questioned concerning the reasons why he/she came up with these amounts. If the maximum amount of the WTP the respondent elicited was zero, the respondent would be asked the reasons why he/she chose to make a zero payment. This was a debriefing question that confirmed whether the zero WTP was valid or biased. If the zero WTP was verified as a bias, their answer to the WTP question would be dropped and considered as a "non-response" Beforehand, each respondent was instructed to consider his or her budget constraints and was informed that there was no right or wrong answer. In addition, each respondent had been told in terms of cheap talk scripts to encourage the respondent to tell the truth before he/she started to divulge his/her WTP amount.

Survey Sampling

A 600-sample unit-study was conducted in Bangkok, the capital city of Thailand. Even though Bangkok does not represent the whole of Thailand, it has

the highest population density[2] in the nation. Therefore our sampling procedure was basically based on multistage area sampling, which did not require a complete sampling frame. This is also more convenient as well as more economical than a one-stage simple random sampling when a contingent valuation (CV) survey is conducted for large populations (Bateman et al., 2002). Since our target population was taxpayers aged between 20 and 60 years that were working in Bangkok, we employed a three-stage design for our multi-stage sampling.

Table 2: Multistage Area Sampling, 15 Sampled Districts Conducted with this Survey

Sampled district	Total population	Male	Female	Density[1]	Sampled quota[2]
Bang Kapi	149,093	68,489	80,604	5,227	23
Bang Na	101,667	48,170	53,497	5,411	24
Bang Rak	50,023	23,621	26,402	9,036	40
Chatuchak	169,113	80,559	88,554	5,139	23
Din Daeng	146,031	69,142	76,889	17,480	78
Don Mueang	159,506	79,150	80,356	4,334	19
Huai Khwang	76,213	35,522	40,691	5,070	23
Khlong Toei	122,919	59,466	63,453	9,460	42
Lat Phrao	117,711	54,420	63,291	5,386	24
Pathum Wan	63,192	29,686	33,506	7,551	34
Phaya Thai	77,232	38,228	39,004	8,049	36
Phra Nakhon	67,357	32,504	34,853	12,167	54
Ratchathewi	99,827	48,604	51,223	14,009	62
Sathon	95,089	45,616	49,473	10,196	45
Thon Buri	136,971	65,272	71,699	16,018	71
Total	**1,763,589**	**849,495**	**914,094**	**134,533**	**600**

Note: 1. Density population per square kilometer

2. It is in proportion to its density population.

Source: Department of Provincial Administration. Bureau of Registration Administration, 2005

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[2] According to the Ministry of Interior Thailand, Bangkok, as of 2008, has a population of 5,700,523 and the population density is 3,635.07lnh/km².

As for the first stage, we randomly sampled 15 of the 50 districts or "khet" in Bangkok, as seen in Table 2. Then during the second stage within each sampled district we did a quota sampling concerned with its population density in order to select the sample units. Consequently, we selected the number of sample units within a sampled district in proportion of the population density. We therefore ended up with a total of 600 selected sample units. Regarding these 600 sample units, we randomly chose any person between 20 and 60 years of age from each sampled quota for our final stage selection. A randomly-chosen person, then, had to be a taxpayer of Thai nationality who has been working in Bangkok regardless where he originally came from.

Research Design

Our one-year free HIV vaccination programme had been assigned two different levels of vaccine effectiveness (30% and 70%) with regard to our target group, CSW. These levels had been under discussion with many HIV/AIDS vaccine experts. Also, a range of six one-off income tax payments THB 500, 1,500, 2,000, 3,500, 5,000 and 6,000 were applied to these two types of vaccination programmes, yielding 12 possible combinations of tax payment and vaccine effectiveness (see Table 3).

Our total sample size of 600 was mainly based on a target of approximately 50 completed interviews per point, therefore, for each of a combination of the payment and vaccine effectiveness. The split-sample technique was also used in our study with the aim of estimating respondents' willingness to pay, as well as testing the reliability and consistency of respondents' answers (Whittington, 1988; 2004). As a result each respondent in our study was randomly asked about their WTP by only one type of free vaccination programme with respect to the vaccine effectiveness and income tax payment from the array of 12, as shown in Table 3.

Table 3 Distribution of Respondents in Sample with Respect to Various Tax Payments and Vaccine Effectiveness

	Total = 600	
Target group	CSW (n =600)	
Effectiveness	30% (n= 300)	70% (n=300)
Payment= THB 500	50	50
Payment= THB 1,500	50	50
Payment= THB 2,000	50	50
Payment= THB 3,500	50	50
Payment= THB 5,000	50	50
Payment= THB 6,000	50	50

Contingent Valuation Scenario

As has been said previously, we used a CVM technique to collect data from the general population with regard to public support for a free HIV vaccination scheme. While explaining our CV scenario, we showed a "storyboard," which was composed of 4 illustrations in order to build up a clear picture of our contingent valuation scenario.
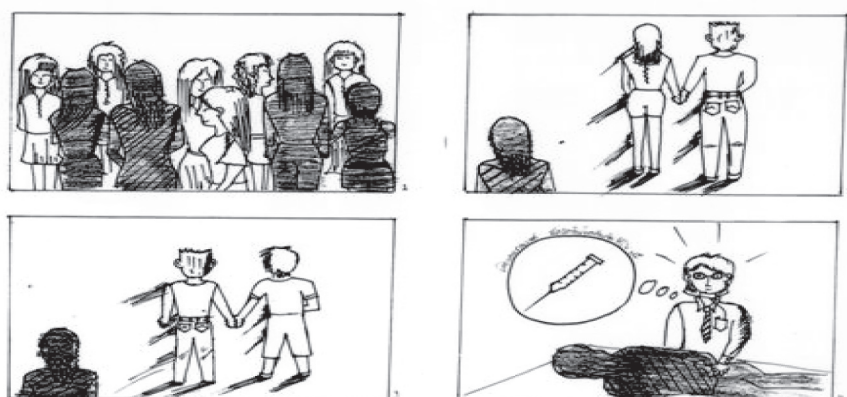
Source: Author.

Figure 3: A Contingent Valuation Scenario Storyboard

As for Figure **3**, this storyboard explained the CV scenario as follows:

Nowadays four in ten of new HIV/AIDS infections are
Found in females. They have been infected through their male partners
who have had unprotected sex with either male or female
commercial sex workers. Because of this, the government provided
a free HIV vaccination scheme to vaccinate only commercial
sex workers over the age of **15** in major cities around Thailand.
The HIV vaccine attributes used in this programme were either
30% or **70**% effectiveness, no side-effects, **15** years of protection,
protects from multiple types of HIV/AIDS, and one dose injection,
respectively. By vaccinating these CSWs with a highly effective
either **30**% or **70**% vaccine under this free scheme, it will prevent
either **370,000** or **1.9** million new infections nationwide per year.

This storyboard also ensured the consistency and accuracy of the description of our free HIV vaccination programme among our enumerators when our CV scenario was presented and explained to the respondents by them.

Therefore this storyboard was not only easily comprehensible to our respondents, but also created consistency and in on the description of our free HIV vaccination programme when our scenario was presented to the respondents by our enumerators. Regarding content validity, the "storyboard" used in our study guarded against scenario misspecification problems when a respondent not responded to the correct valuation scenario or he/she not understood the scenario as our study intended it to be understood.

The Demand Model

The demand model for a one-year free HIV vaccination scheme, which a respondent as part of the general population is willing to pay as a single shot remittance through his/her yearly income tax payment, depends on the rate of the tax payment (R); personal monthly income (Y); household size and composition (H), in particular the total number of 15-19 year-old teenagers living in the same household; respondent characteristics (**Z**), for example age, gender, marital status,

occupation, and education level; a vector of HIV/AIDS variables (A) such as the knowledge of HIV/AIDS, the awareness of HIV/AIDS problems, the respondent's experience with the HIV/AIDS disease; the identified variable, whether the respondent is perceived as a beneficiary or a non-beneficiary of our free scheme; *(B)*; and vaccine effectivene *(V)*, which is either 30% or 70% (see details in Table 4).

The demand model for the free HIV vaccination scheme with respect to both 30% and 70% vaccine effectiveness.

$$\Pr(WTP_{ij}) = f\ (R_{ij},\ Y_{ij},\ H_{ij},\ Z_{ij},\ A_{ij},\ B_{ij},\ V_{ij})$$

where i = 1,2,3..n; n = 600, and j = 1, 2

Our study estimated the log-linear model as a function of the probit model since we assumed that $\Pr(WTP_{ij})$ is a normally distributed random variable, so that the probability that WTP_{ij} is less than (or equal to) WTP_{ij} can be computed from the cumulative normal probability function. Most commonly, the parameters in the probit model are estimated by the method of maximum likelihood. Although the maximum likelihood estimator has the property of being consistent, there are two major problems, heteroskedasticity and misspecification, causing this maximum likelihood method to become inconsistent. Because of this, we at first had to test for heteroskedasticity in our probit model using the Lagrange Multiplier (LM) test with the binary response model regression or BRMR (Davidson & Mackinnon, 2004). Suppose there is a problem concerning heteroskedasticity; our study will use the STATA 10.0 command in order to correct it. Second, the probit model is usually sensitive to misspecification problems which reflect heteroskedasticity or non-normality of standard error terms, so our study will use "robust variance estimators," which are also known as Huber, White, or sandwich standard errors, to guard against misspecification problems (Greene, 2008; Long & Freese, 2006). Consistent with the "central limited theorem," our model, whose sample sizes were large, was qualified for the assumption of normality in the probit model.

Table 4: Variable Definition and Description

Variable	Description	Mean	S.D
Dependent variable	Whether respondent is willing to pay for this free scheme through his/her yearly income tax payment or not		
Independent variable			
RATE (R)	Yearly income tax on the initial rate (Logarithm form, baht) 500, 1,500, 2,000, 3,500, 5,000 and 6,000	7.751	0.84
Personal income (Y)			
INCOME	Personal monthly income	9.747	0.538
	(continuous in logarithm form, baht)		
	Personal monthly income (continuous, baht)	20151.58	14941.62
Demographic and socioeconomic (H, Z)			
MALE	Gender = 1 if male, 0 if otherwise	0.475	0.5
	(Female as a base)		
AGE	Age of respondents (continuous, years)	31.677	7.006
SINGLE	Marital status = 1 if single, 0 otherwise (Divorce/Widow/Separated as a base)	0.688	0.464
MARRIED	Marital status = 1 if married,	0.307	0.461
	0 otherwise(Divorce/Widow/Separated as a base)		
HIGH_EDU	Education level = 1 if respondent completed at least university level,	0.728	0.445
	0 otherwise (Low educational level is a base)		
PRIVATE	Occupation status = 1 if private, 0 otherwise	0.863	0.344
	(Public as a base)		
HOUSEHOLD	Number of household members	3.164	1.673
	(continuous, persons)		
TEENAGERS	Number of teenagers aged 15-19 years living in the same household (continuous persons)	0.178	0.383
Knowledge, Experience and Awareness (A)			
ONE_PARTNER	1 if respondent believed that the risk of HIV transmission has been reduced by having sex with only one uninfected partner, 0 otherwise	0.957	0.204
CONDOM	1 if respondent believed that a person can reduce the risk of getting HIV by using condom every time they have sex, 0 otherwise	0.937	0.244
HEALTHYLOOK	1 if respondent believed that a healthy looking person has HIV, 0 otherwise	0.938	0.241
MOSQUITO	1 if respondent believed that a person gets HIV from mosquito bites, 0 otherwise	0.157	0.364
EATING	1 if respondent believed that a person can get HIV by sharing food with someone who is infected, 0 otherwise	0.085	0.279
KNOWLEDGE	HIV/AIDS knowledge = 1 if respondent answered all 5 questions correctly =1, 0 otherwise	0.630	0.483
KNOWN	1 if respondent knows someone who has had HIV/AIDS, 0 otherwise	0.232	0.422
CURABLE	1 if respondent has heard that HIV is now curable, 0 otherwise	0.280	0.449
CSW_MAIN	1 if respondent believed that CSW is still the major HIV spreading source, 0 otherwise	0.645	0.479
YOUNG_RISK	1if respondent believed that Thai teenagers tend to have more casual sex compared to the past, 0 otherwise	0.980	0.140
LOW_EFFECTIVENESS	1 if respondent believed that to vaccinate CSW as the first and priority group is the least cost effective approach, 0 otherwise	0.300	0.459

Table 4: Variable Definition and Description (continued)

Variable	Description	Mean	S.D
Vaccine characteristic and programme (V)			
70% EFFECTIVENESS	1 = vaccine is 70% effectiveness, 0 otherwise (30% vaccine effectiveness is a base)	0.500	0.500
Identifying respondent as either beneficiary or non-beneficiary (B)			
BENEFICIARY	1 = as for male respondent, if he has known and been place or venue in Bangkok providing CSW, 0 otherwise 1 = as for female respondent, if she is married or	0.450	0.498
	she (except for married one) rated herself as having the possibility of contracting HIV via sexual transmission = or > 50%, 0 otherwise		

Results

A total of **600** individuals aged **20-60** years were successfully interviewed during the period from December, 2008 to February, 2009. The respondent rate for individuals was **90%**, but only **10%** were non-responses. In spite of this, our study compensated for this by adding more survey interviews to obtain a total of **600** survey interviews.

Socio-Demographic Characteristics

Of the **600** people randomly selected for our Bangkok survey, the majority of respondents were female (**52.5%**), with an average age of **32** years and whose martial status was single (**68.8%**). More than half of the respondents (**72.8%**) had completed at least a university degree and were employed (**86.3%**) in the private sector. The average household size was **3.16** persons, and those with household members aged **15-19** years living in the same household accounted for **17.8%** (Table 4).

Table 5: Comparison of Sampling Results and Target Population

	Our sampling results	Target population: Bangkok metropolitan area
Male	0.475	0.464[a]
Female	0.525	0.536[a]
Age	31.67 yrs	32.50 yrs[b]
Number of household members	3.16 persons	3.29 persons[c]
Monthly income (before taxes)	20151.58 baht	22021.39 baht[c]

Source: a) NSO, 2005-2007; b) NSO, 2003-2006; c) NSO, 2007.

Since the target population in our study consisted of people in Bangkok aged 20-60 years and whose jobs were in the formal sector, we had to compare our sampling data with the target population in order to verify whether our survey sample could accurately and reliably be extrapolated to the entire population. As for Table 5, it compares our sample and the target population. In this regard, gender, age, the number of household members, and monthly income in our sample, for instance, had almost the same average number as the target population. Of the target population aged 20-60 years in Bangkok, females that were income earners represented a slightly higher proportion than males. On average, people in the Bangkok metropolitan area were almost 33 years of age, with an approximate monthly income of 22,000 baht and had 3 members in their households. Consequently, our results were an appropriate sample, representing the target population of Bangkok.

Knowledge, Experience, and Awareness of HIV/AIDS

Of the 600 respondents in our survey, only 63% of respondents answered correctly all 5 questions regarding knowledge, experience, and awareness of HIV/AIDS (see Table 4). As for the knowledge of HIV, more than 90% of the respondents believed that the risk of HIV transmission had been reduced by having sex with only one uninfected partner and using a condom every time they had sex, and also knowing that as a healthy looking person can have HIV. Surprisingly, almost 16% of the respondents believed that a person could get HIV from mosquito bites and 8.5% thought that sharing food with HIV infected people could result in HIV infection. As regards experience of HIV/AIDS, 23% of the respondents knew someone that has had HIV/AIDS and almost 30% believed that HIV/AIDS is now curable. On the other hand, more than half of respondents had never had a friend that had contracted HIV/AIDS and had not heard that HIV was currently curable. Almost 100 percent of the respondents, in terms of HIV/AIDS awareness, believed that teenagers now tend to have more casual sex compared to the past. In addition, almost 65% thought that CSWs were still the crucial cause of the spread of HIV. Because of this, only 30% reckoned that vaccinating CSWs as the first and only priority would be the most cost effective approach.

Beneficiary and Non-beneficiary

Our test questions showed that 45% of the respondents were perceived as individual that would benefit from our free HIV vaccination programme. Of the 600 respondents, 21.2% were male and 23.8% were female beneficiaries, accordingly (Table 6). All male respondents were personally asked about whether they had known any place that provides male and female CSWs. Of these, 66% of the male respondents knew of a place, while 127 male respondents knew of a place and had already been there. On the one hand, 158 male respondents were non-beneficiaries that did not know where both male and female CSWs were working.

The female respondents, despite this, had been asked only one question to identify whether they were beneficiaries. However, the married women in our survey were immediately perceived as beneficiaries because they would have benefited from our free HIV vaccine scheme in terms of HIV/AIDS sexual transmission. Therefore, a lower rate of HIV prevalence would have obtained for them if the CSWs had already been vaccinated

Table 6 A Detailed Description of the Respondents

Gender	Beneficiary	Non-beneficiary	Total
Male	127(21.2%)	158(26.3%)	285(47.5%)
Female	143(23.8%)	172(28.7%)	315(52.5%)
Total	270(45%)	330(55%)	600(100%)

Our study asked 213 unmarried female respondents to rate themselves concerning the extent to which they thought that they would be at risk of contracting HIV/AIDS through sexual transmission. Respondents that rated themselves at greater than a 50% risk were defined as being beneficiaries of our free HIV vaccine scheme. On a scale from 0 to 100%, 44 single females reported that they had at least a 50% chance of contracting HIV via their sexual behaviors, while 80% of the single female respondents thought that they had a less than a 50% possibility of becoming infected with HIV. Those single women whose risk of becoming infected with HIV was at least 50% accounted for 20.65% of the

female beneficiaries. Of these female beneficiaries, 70% were married and 30% were single females that had a high possibility of contracting HIV through-sexual transmission.

Estimation of the Demand Model

As shown in Table 7, the results present both full and fitted models. The full model depicts all explanatory variables included in the model, while the fitted model, nested in the full model, has better goodness-of-fit since it has lower Akaike and Bayesian information criteria (AIC and BIC). Also, the fitted model is statistically preferred to the full model because the difference in the BIC between two of them is positive (Raftery, 1995). Although the pseudo R^2 in the full model is slightly higher than in the fitted model, this measurement, R^2, is not particularly meaningful in the probit model (Gujarati, 2003).

Regarding the dependent variable as to whether the respondent is willing to pay for the free HIV vaccine scheme, these findings also depict the probit estimates of all of the coefficients (using maximum likelihood methods), as well as estimate the marginal effects relating to the probability of the WTP change when one (X) explanatory variable is changed in the model, holding the other explanatory variables constant.

Table 7: Determinants of the WTP for this free HIV vaccination scheme

Model: Dependent: Probit of the WTP for the free HIV vaccination programme						
Variable	Full model		Fitted model			
Independent variable	Coefficient	Robust Std Err.	Coefficient	Marginal effect	Robust Std Err.	P-value
Constant	3.428*	1.667	2.655s		1.500	0.077
INCOME						
(Logarithm form)	0.862***	0.166	0.871***	0.329	0.154	0.001
RATE						
(Logarithm form)	-1.489***	0.108	-1.446***	-0.546	0.107	0.001
AGE	-0.026	0.014	-0.021*	-0.008	0.011	0.044
MALE	0.308*	0.140	0.280*	0.106	0.134	0.037
SINGLE	-0.341	0.502				
MARRIED	-0.489	0.484				
HIGH_EDU	0.105	0.173				
PRIVATE	-0.136	0.202				
TEENAGERS	0.007	0.187				
BENEFICIARY	0.23	0.144				
HOUSEHOLD	0.067	0.044				
KNOWLEDGE	0.253	0.223				
ONE_PARTNER	0.336	0.321				
CONDOM	-0.173	0.303				
HEALTHYLOOK	-0.221	0.286				
MOSQUITO	0.307	0.228				
EATING	0.183	0.267				
KNOWN	0.309	0.167	0.309s	0.119	0.160	0.053
CURABLE	0.384*	0.152	0.393**	0.151	0.150	0.009
CSW_MAIN	-0.143	0.140				
YOUNG_RISK	-0.248	0.350				
LOW_EFFECTIVENESS	-0.012	0.153				
70% EFFECTIVENESS	0.264	0.143	0.227s	0.085	0.134	0.09

Remarks: s p<0.1; * p<0.05;**p<0.01;***p<0.001

Summary Statistics	Full model	Fitted model
Number of obs	600	600
Log-likelihood	-232.645	-237.491
Wald chi2	221.860	199.280
Prob>chi2	0.001	0.001
Pseudo R square	0.426	0.414
BIC	-3219.341	-3312.000
AIC	0.855	0.818

With the robust variance estimators in this probit model (see fitted model), only INCOME, RATE, AGE, MALE and CURABLE are statistically significant, with a 5% significance level. INCOME and RATE are both major factors in the willingness to pay for the free HIV vaccine scheme. As ceteris paribus, people with a higher income are willing to financially support our scheme with one-third possibility. With a 55% chance, the individual, in contrast, is not going to pay for this scheme if the rate of the tax payment has been marginally increased.

MALE and CURABLE both have the same positive sign coefficients, whereas the coefficient on AGE is obviously negative. With a 10% possibility, if an individual is male, he is more likely to sponsor this free scheme than a female. Then, as for CURABLE, if the respondents have also heard that HIV is now curable, they are more willing to finance the free HIV vaccine scheme.

Other things being equal, AGE in fact showed a negative relationship to the WTP for the willingness to sponsor this scheme. The old in Thailand are more likely to pay less for this free programme than do the young.

Therefore, both KNOWN and 70% EFFECTIVENESS have an effect on the free HIV scheme, although they are statistically significant at merely 10%. As for the WTP, an individual that knew someone with HIV/AIDS would be more likely to sponsor this free programme. In addition, if a 70% effectiveness HIV vaccine is used in this scheme, it will have a higher chance of being financially supported by the Thai people.

Calculated by the probit model in Table 7, Figure 4 presents the predicted probability of respondents that are willing or able to support a free HIV scheme with regard to the tax payment in the range of 500 to 6,000 baht and by vaccine effectiveness.
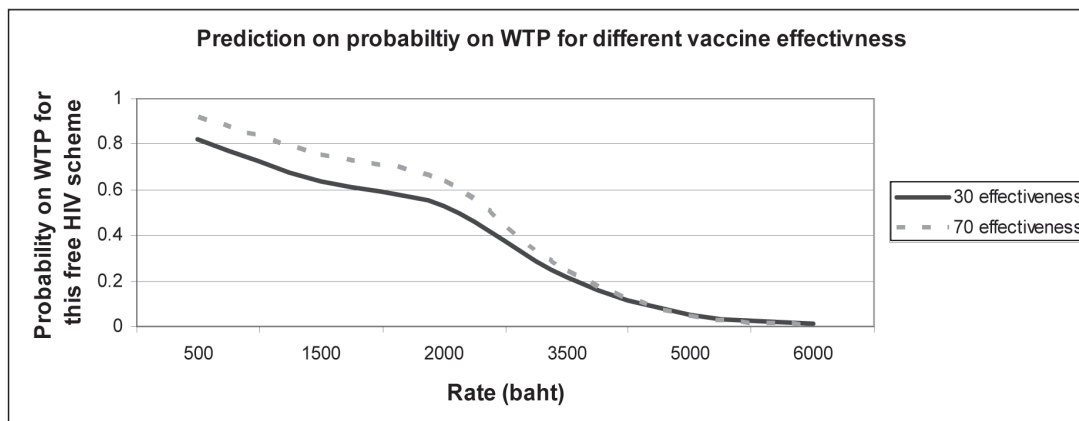
Figure 4: Prediction of Probability that Respondent is Able to Support Our Free HIV Vaccine Scheme with Respect to Rate of Tax Payment and Vaccine Effectiveness

The Estimation of Mean Willingness to Pay (WTP)

As can be seen in Figure 5, the percentage of respondents' WTP for a free HIV vaccine scheme rapidly diminished from at least 90% of the respondents at a tax payment of 500 baht to only 2% at a tax payment of 6,000 baht. This percentage obviously declined with respect to an increase in tax payment and was lower for the 30% vaccine effectiveness at any given the rate of tax payment.

With the double bounded estimation, our study hence calculated the mean WTP with regard to 30% and 70% vaccine effectiveness. The mean WTP amount for 30% vaccine effectiveness was 1,746.43 baht, while 70% vaccine effectiveness was 2,049.78 baht, respectively. Despite this 70% EFFECTIVENESS is marginally significant with a 90% confidence level (see Table 7). Hence the difference in mean WTP between 30% and 70% vaccine effectiveness is statistically significant.
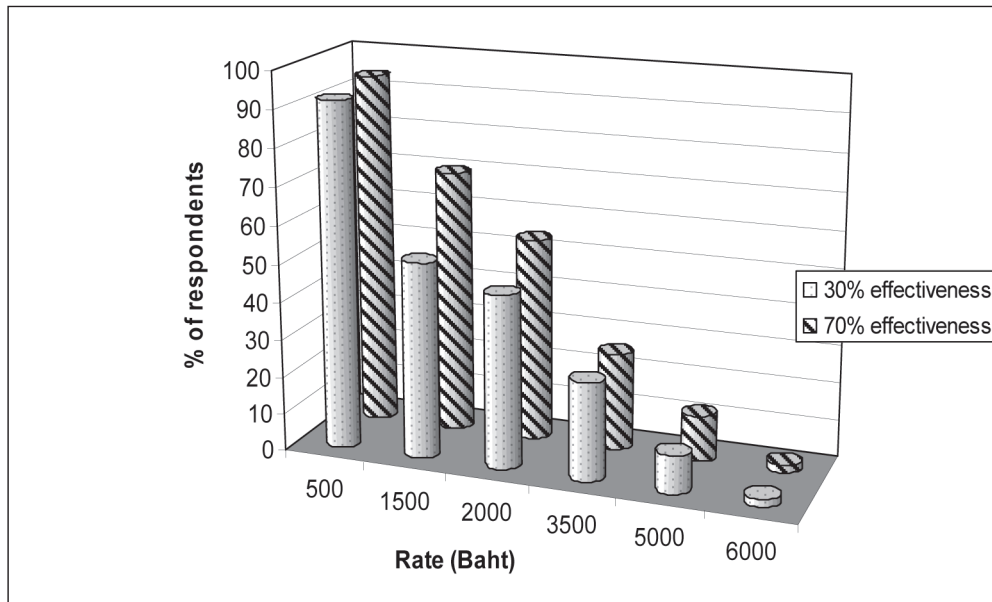
Figure 5: Percentage of Respondents' Willingness and Ability to Finance a Free HIV Vaccination Scheme by Rate of Tax Payment and Vaccine Effectiveness

Discussion and Conclusion

The study based on the CVM results would suggest some policy implications if an HIV/AIDS vaccine already existed. First, it strongly recommends to our policy makers that they provide a free HIV vaccination scheme because it benefits people in terms of reduction in mortality and morbidity; lowers HIV/AIDS prevalence in society; and increases the free access to comprehensive HIV prevention, treatment, care, and support for high risk groups such as sex workers. Secondly, along with this free HIV vaccination scheme, the government should advocate and support a comprehensive approach to HIV prevention through a combination of strategies. Condoms are the most indispensable part of this combined prevention strategy. Although Thailand launched a 100% condom use campaign nationwide in 1992 with respect to promoting the universal use of condoms among CSWs, this country has still encountered a dilemma in the remarkably low rate of condom use among men having sexual contact with casual female partners or girlfriends, or with other men. As a result, the Thai government should relaunch the condom use campaign along with access to

information about HIV/AIDS, especially for the young. The government should also promote knowledge and skills for behavior change nationwide, such as knowing your HIV status, knowing your risk, being faithful to one's partner, and using condoms consistently and correctly. As has been noted, there is no single magic bullet for HIV prevention, but the government should use a mix of all the above elements, along with a free HIV vaccine scheme when a vaccine becomes available, to halt this infectious disease.

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