SEXUAL BEHAVIORS DURING ANTIRETROVIRAL THERAPY AMONG HIV-INFECTED PATIENTS, THAILAND

Cheewanan Lertpiriyasuwat[1], Mandhana Pradipasen[2], Weena Thiangtham[2] and Punthip Kaewduangjai[3]

[1]Bureau of AIDS, TB and STIs, Department of Disease Control, Ministry of Public Health, Nonthaburi; [2]Faculty of Public Health, Mahidol University, Bangkok; [3]Bamrasnaradura Infectious Diseases Institute, Ministry of Public Health, Nonthaburi, Thailand

Abstract. An increasing trend in sexual risk behavior has occurred in the era of antiretroviral therapy (ART) in Thailand. This study was conducted to identify sexual risk behavior and examine relationships between unprotected sex and CD4 levels among HIV-infected patients receiving ART in the National Antiretroviral Program. A cross-sectional survey was conducted in 460 HIV-infected patients age 18-49 years who visited the out-patient clinic of Bamrasnaradura Infectious Diseases Institute in February 2006 by using a standardized self-administered questionnaire. The results show that 60.4% of participants were men. The median most recent CD4 cell count during the prior 6 months was 261 cells/mm^3. Twenty-three percent of the participants who had no sexual activity after they knew their HIV positive status started having sex again after receiving ART with a 12-week median duration period from starting ART to having first sex. There was a significant difference between the number of those having sexual activity before and after starting ART (p-value=0.013). Fifty-six percent of participants had sex during the previous 6 months. Of these, 26.5% had sex with commercial partners and 28.4% with non-regular partners. Inconsistent condom use, with commercial partners or non-regular partners, in females (35.3-36.8%) was higher than in males (7.8-11.1%). Participants with a known HIV-negative regular partner were 0.25 times more likely to have unprotected sex than those with a known HIV-positive regular partner (adjusted OR, 0.25; 95%CI, 0.09-0.73). No association between unprotected sex and CD4 levels was found. The findings support the need for reinforcing risk reduction programs among HIV-infected persons, particularly couple counseling, and promoting awareness of risk of acquirring sexually transmitted infections and drug-resistant strains of HIV.

INTRODUCTION

The trend for HIV infection has been increasing in the era of highly active antiretroviral therapy (HAART) in Thailand. In 2004, the HIV prevalence among some high risk groups, commercial sex workers (CSWs) and male attendees at government sexually transmitted infections (STIs) clinics, increased compared to the previous year (Plipat, 2005a). Since 2002, behavior surveillance reports have shown an increasing trend in Thai men having commercial or casual sex, while consistent condom use rates remained low. Condom use rates were about 50-63% when they had sex with female CSWs and about 20-37% when they had sex with non-regular partners in almost every survey (Plipat and Chemnasiri, 2004, 2005).

In 2004, the National Access to Antiretroviral Program for People living with HIV/AIDS (NAPHA) was established with the aim

Correspondence: Dr Cheewanan Lertpiriyasuwat, Bureau of AIDS, TB and STIs, Department of Disease Control, Ministry of Public Health, Tiwanon Road, Nonthaburi 11000, Thailand.
Tel: 66 (0) 2591-8411, 5918412; Fax: 66 (0) 2591-8413
E-mail: cheewa@health.moph.go.th

of providing free antiretroviral drugs and CD4 testing, but not to include viral load testing because of high cost (Bureau of AIDS, TB and STIs, 2004). As of December 31, 2005, there were about 71,300 patients receiving antiretroviral therapy (ART). A previous study showed that consistent condom use rates in partners of HIV-infected people receiving ART were lower than 65%, (Jitsabuy, 2003). It is postulated that ART may be one factor related to increasing risky behavior.

Inadequate adherence to ART has potential impact on transmission of HIV drug-resistant strains to sexual partners (Wainberg and Friedland, 1998; Pomerantz, 1999). The use of ART may increase the number of new HIV cases by reducing prevention resources and increasing the length of an HIV-infected individual's life to transmit HIV to others through their risky behavior (Steven, 2005). Although the concentration of HIV in semen reduces, this suppression is not total or invariable (Vernazza *et al*, 2001).

Some previous studies found ART use, high ART adherence, undetectable HIV RNA in the blood and high CD4 levels were associated with decreased risk for self-reported unprotected anal or vaginal sex (Kalichman and Rompa, 2003; Diamond *et al*, 2005). Some studies have shown that HAART, an undetectable HIV viral load or an increased CD4 cell count have been associated with increased risky sexual behavior in some groups, such as women and men who have sex with men (MSM) (Dukers *et al*, 2001; Scheer *et al*, 2001). Some studies found that unprotected sex was increased in HIV-infected persons who believed that receiving HAART or having an undetectable viral load protected against transmitting HIV (Kravcik *et al*, 1998; Wilson and Minkoff, 2001; Ostrow *et al*, 2002; Tun *et al*, 2003).

Because of conflicting conclusions for different subsets of studies, a study using a meta-analytic technique was conducted by reviewing 25 relevant English-language studies from January 1996 to August 2003. The results showed the prevalence of unprotected sex was not higher among persons with HIV receiving HAART than those not receiving HAART or among HIV-positive persons with an undetectable viral load than those with a detectable viral load (Crepaz *et al*, 2004).

The findings may not reflect the behavior of patients in different countries. This study aimed to identify sexual risk behaviors and to investigate the association between these behaviors and CD4 levels among HIV-infected patients receiving ART in Bamrasnaradura Infectious Diseases Institute, Thailand. The institute's functions are both giving tertiary care and being an international training center for HIV/AIDS treatment.

MATERIALS AND METHODS

Study population and sampling methods

This cross-sectional survey used purposive sampling technique to select all HIV-infected, 18-49 year-old patients receiving HAART who visited the NAPHA out-patient clinic at the Bamrasnaradura Infectious Diseases Institute in February 2006. If the patient was illiterate, not Buddhist, had too severe symptoms to answer the questionnaire, or did not know their CD4 level during the past 6 months, they were excluded. Survey administration continued until the number of subjects reached the expected sample size.

The sample size was calculated based on the results of the Amsterdam cohort study: the proportion of unprotected anogenital sex with casual partners in the past 6 months among men with a CD4 ≥350 and the proportion among men with a CD4 <350, were 44.1% and 30.6% (Dukers *et al*, 2001). The researcher estimated the ratio of the number of men with a CD4 < 350 to the number of men with a CD4 ≥350 to be equal to 1. The calculated sample size, based on these estimates,

was 400 with a 95% confidence interval and 80% power.

The study protocol was reviewed and approved by the Ethical Review Committees of the Faculty of Public Health, Mahidol University and Bamrasnaradura Infectious Diseases Institute. The patients were given project information before deciding whether to participate voluntarily. Written informed consent was obtained from all participants.

Data collection and data analysis

The researchers reviewed the patient's medical record and recorded the CD4 level and body weight (BW) of participant in the questionnaire. No names or other identifying information were collected. Then, data were collected through a self-administered questionnaire. The researchers were available, to answer questions. After completing the questionnaire, the participants placed them in a form collection box.

The questionnaire and procedures were pre-tested before implementation. Sex was defined as oral, vaginal or anal intercourse. A commercial partner was defined as a partner to whom money or goods had been paid in exchange for sex. A regular partner was defined as a sexual partner who was a spousal or cohabiting partner. A non-regular partner was defined as a sexual partner who was not a regular or commercial sex partner. Unprotected sex was defined as not using a condom during sexual activity.

The McNemar's chi-square test was used to assess the differences in sexual activity before and after receiving ART. Since this was an unmatched design, an unconditional logistic regression model was developed by use of the backward elimination method to identify the relationship between unprotected sex and the CD4 level. The adjusted odds ratio (AOR) was determined after adjusting for age, gender, marital status, education, knowing partner's HIV status'and attitude towards ART.

RESULTS

Description of the study participants

Of 462 eligible HIV-infected patients, two men (0.5%) refused to participate, resulting in 460 participants who completed the questionnaire.

Of the 460 participants, 278 (60.4%) were men, with a mean age of 37 years (SD, 6.2). About half of the participants had a regular sexual partner. Of these, 45.9% had a known HIV-positive partner, 32.3% had a known HIV-negative partner and 21.8% did not know the HIV status of their partner. The participants were dominated by those who completed senior high school or had less education (73.6%). The most common occupations were wage-labor (38.7%); 24.2% were housewives or were unemployed. The median income was 6,000 baht/month (IQR, 3,000-10,000) (1 US$=36.5 baht); 17.3% had no income.

The majority had received ART for more than one year (74.9%). The median duration of receiving ART was 24 months (IQR, 12-42); 62.4% had a most recent CD4 cell count within the previous 6 months of ≥200 cells/mm^3. The median most recent CD4 cell count within 6 months was 261 cells/mm^3 (IQR, 148.3-383.0) and the mean BW was 58.1 kg (SD, 10.2) on the date closest to the most recent CD4 examination.

Regarding attitude towards ART, approximately 30% of the participants disagreed that ART can cure HIV/AIDS disease, whereas 53.0% answered they were "uncertain". Thirty-six percent disagreed ART reduces chances of HIV transmission to others, whereas 31.3% answered they were "uncertain".

Sexually active behavior before and after ART

Approximately 55% of participants reported they continued having sexual activity with their partner after they knew their HIV status. Among participants who had no sexual activity after they knew their HIV status, 47

(22.9%) started having sex with partners again after starting ART with a median duration, from starting ART to having first sex, of 12 weeks (IQR= 5-44, Min-Max=1-192). There was a significant difference between the proportion having sexual activity before and after starting ART (p-value=0.013).

When sexual behavior was stratified by gender, 26% of male participants and 18.5% of female participants started having sex again after starting ART with a median duration, from starting ART to having first sex, of 12 weeks (IQR= 7-48, Min-Max=1-144) and 16 weeks (IQR= 4-60, Min-Max=4-192), in males and females, respectively. A significant difference in sexually behaviors before and after starting ART was found in males (p-value=0.007) but not in females (p-value=0.7) (Table 1).

Sexual behaviors during the past 6 months

In the past 6 months, 56% of participants, 58% of males and 52.7% of females, reported that they had sexual intercourse. Of these, 26.5% reported having sex with commercial partners, 28.4% reported having sex with non-regular partners and 23.7% reported having unprotected sex with any partners. The proportion having sex with commercial partners or non-regular partners in males was higher than in females (Table 2).

Of male participants who reported having sex in the previous 6 months, 24.8% had sex with men. However, these men did not have sex exclusively with men, 30% had sex with female commercial sex workers and 42.5% had sex with female non-regular partners.

Condom use during the previous 6 months

During the previous 6 months, 24.3% of participants who had sex with regular partners reported inconsistent condom use with their partner. Of the participants who had sex with commercial partners, 14.7% reported inconsistent condom use with those partners and 14.4% reported they did not know or did not use a condom with last sex. Of participants who had sex with non-regular partners, 17.8% reported inconsistent condom use with these partners and 11.4% reported they did not know or did not use a condom with last sex. The proportion reporting inconsistent

Table 1
Comparison of having sexual intercourse before starting ART and after starting ART.

Number (%) having sex after knowing HIV positive status and before starting ART	Number (%) having sex after starting ART			p-value[a]
	Yes	No	Total	
Both gender				
Yes	225 (90.0)	25 (10.0)	250 (54.9)	0.013
No	47 (22.9)	158 (77.1)	205 (45.1)	
Total	272 (59.8)	183 (40.2)	455 (100.0)	
Males				
Yes	137 (91.3)	13 (8.7)	150 (54.7)	0.007
No	32 (25.8)	92 (74.2)	124 (45.3)	
Total	169 (61.7)	105 (38.3)	274 (100.0)	
Females				
Yes	88 (88.0)	12 (12.0)	100 (55.2)	0.7
No	15 (18.5)	66 (81.5)	81 (44.8)	
Total	103 (56.9)	78 (43.1)	181 (100.0)	

[a]By McNemar's chi-square test

condom use with a current regular partner was higher than those with commercial partners or non-regular partners. The rate of consistent condom use was lower in females.

Among male participants who had sex with men, 12.5% reported inconsistent condom use and 13.5% reported they did not know or did not use a condom with last sex (Table 2).

Table 2
Sexual behavior of participants who had sex in the previous 6 months, by gender.

Sexual behavior in the previous 6 months	Male		Female		Total	
	Number	%	Number	%	Number	%
Had sex with partners (n=257)						
With current regular partner	123	75.9	91	94.8	214	83.3
With commercial partners	51	31.5	17	17.7	68	26.5
With non-regular partners	54	33.3	19	19.8	73	28.4
With men (n=161)	40	24.8	-	-	40	24.8
Unprotected sex with any partner (n=257)						
Yes	31	19.3	30	31.3	61	23.7
Frequency of condom use						
With current regular partner (n=214)						
Every time	96	78	66	72.5	162	75.7
Sometimes	22	17.9	19	20.9	41	19.2
Never	5	4.1	6	6.6	11	5.1
With commercial partners (n=68)						
Every time	47	92.2	11	64.7	58	85.3
Sometimes	4	7.8	4	23.5	8	11.8
Never	0	0	2	11.8	2	2.9
With non-regular partners (n=73)						
Every time	48	88.9	12	63.2	60	82.2
Sometimes	4	7.4	7	36.8	11	15.1
Never	2	3.7	0	0	2	2.7
With men (males only) (n=40)						
Every time	35	87.5	-	-	35	87.5
Sometimes	5	12.5			5	12.5
Never	0	0			0	0
Condom use at last sex						
With current regular partner (n=220)						
Used	112	87.5	79	85.9	191	86.8
Not used	13	10.2	13	14.1	26	11.8
Don't know	3	2.3	0	0	3	1.4
With commercial partners (n=69)						
Used	46	86.8	13	81.2	59	85.6
Not used	2	3.8	3	18.8	5	7.2
Don't know	5	9.4	0	0	5	7.2
With non-regular partners (n=79)						
Used	51	91.1	19	82.6	70	88.6
Not used	2	3.6	4	17.4	6	7.6
Don't know	3	5.3	0	0	3	3.8
With men (males only) (n=37)						
Used	32	86.5	-	-	32	86.5
Not used	4	10.8			4	10.8
Don't know	1	2.7			1	2.7

Table 3

Number (percentage), odds ratios (OR) and 95% confidence intervals (CI) for factors associated with unprotected sex with current regular partner in the past 6 months among participants who had a regular partner or spouse.

Variables	Number (%) of time having sex with current regular partner			Crude OR (95%CI)	Adjusted OR (95%CI)[a]
	Total participant	Unprotected sex	Protected sex		
Age (years)					
18-34	72	24 (27.9)	62 (72.1)	1	1
35-49	142	28 (21.9)	100 (78.1)	0.72 (0.39-1.36)	1.0 (0.48-2.05)
Gender					
Male	123	27 (22.0)	96 (78.0)	1	1
Female	91	25 (27.5)	66 (72.5)	1.35 (0.72-2.52)	1.15 (0.56-2.36)
Known HIV status of current regular partner or spouse					
HIV positive	88	26 (29.5)	62 (70.5)	1	1
HIV negative	61	5 (8.2)	56 (91.8)	0.21 (0.08-0.59)	0.25 (0.09-0.73)
Don't know	50	19 (38.0)	31 (62.0)	1.46 (0.70-3.04)	1.63 (0.74-3.60)
Highest level of education completed					
Never attended/primary school	79	16 (20.3)	63 (79.7)	1	1
Secondary school/senior high school	85	26 (30.6)	59 (69.4)	1.74 (0.85-3.55)	1.70 (0.77-3.74)
Vocational college/diploma/bachelor degree or higher	50	10 (20.0)	40 (80.0)	0.98 (0.41-2.38)	1.20 (0.45-3.24)
The latest CD4 count in the past 6 months (cell/mm^3)					
0-99	33	8 (24.2)	25 (75.8)	1	1
100-199	48	14 (29.2)	34 (70.8)	1.29 (0.47-3.53)	1.24 (0.40-3.80)
200-499	115	26 (22.6)	89 (77.4)	0.91 (0.37-2.26)	0.81 (0.30-2.19)
≥ 500	18	4 (22.2)	14 (77.8)	0.89 (0.23-3.50)	1.35 (0.27-6.73)
Attitude towards ART					
ART reduces chance of HIV transmission to others					
Agree	75	13 (17.3)	62 (82.7)	1	1
Uncertain	55	20 (36.4)	35 (63.6)	2.73 (1.21-6.14)	2.06 (0.84-5.05)
Disagree	80	19 (23.8)	61 (76.2)	1.49 (0.67-3.27)	1.45 (0.61-3.43)

[a]Estimated from multiple logistic regression model included terms for the latest CD4 count in the past 6 months, age, gender, knowing HIV status of current regular partner, education, attitude towards ART in reduction of chance of HIV transmission to others.

Table 4

Number (percentage), odds ratios (OR) and 95% confidence intervals (CI) for factors associated with unprotected sex with any partners in the previous 6 months.

Variables	Number (%) of times having sex with any partners[a]			Crude OR (95%CI)	Adjusted OR (95%CI)[b]
	Total participant	Unprotected sex	Protected sex		
Age (years)					
18-34	104	30 (28.9)	74 (71.1)	1	1
35-49	153	31 (20.3)	122 (79.7)	0.63 (0.35-1.12)	0.72 (0.38-1.36)
Gender					
Male	161	31 (19.3)	130 (80.7)	1	1
Female	96	30 (31.2)	66 (68.8)	1.91 (1.06-3.41)	1.70 (0.91-3.20)
Marital status					
Single with no regular partner/divorced/separated/widowed	70	10 (14.3)	60 (85.7)	1	1
Have regular partner or spouse	187	51 (27.3)	136 (72.7)	2.25 (1.07-4.73)	2.29 (1.04-5.03)
Highest level of education completed					
Never attended/primary school	84	18 (21.4)	66 (78.6)	1	1
Secondary school/senior high school	103	31 (30.0)	72 (70.0)	1.58 (0.81-3.09)	1.57 (0.78-3.18)
Vocational college/diploma/bachelor degree or higher	70	12 (17.1)	58 (82.9)	0.76 (0.34-1.71)	0.92 (0.39-2.18)
The latest CD4 count in the past 6 months (cell/mm^3)					
0-99	41	11 (26.8)	30 (73.2)	1	1
100-199	56	16 (28.6)	40 (71.4)	1.09 (0.44-2.69)	0.95 (0.36-2.47)
200-499	139	30 (21.6)	109 (78.4)	0.75 (0.34-1.67)	0.68 (0.29-1.61)
≥ 500	21	4 (19.0)	17 (81.0)	0.64 (0.18-2.33)	0.63 (0.16-2.56)
Attitude towards ART					
ART reduces chance of HIV transmission to others					
Agree	87	15 (17.2)	72 (82.8)	1	1
Uncertain	68	22 (32.4)	46 (67.6)	2.30 (1.08-4.88)	2.33 (1.06-5.14)
Disagree	95	24 (25.3)	71 (74.7)	1.62 (0.79-3.35)	1.60 (0.75-3.38)

[a]Unprotected sex with any partner in the previous 6 months is defined as not always using condoms during sex with current regular partner or commercial partners or non-regular partners or men in the previous 6 months.

[b]Estimated from the multiple logistic regression model, including terms for the latest CD4 count in the past 6 months, age, gender, marital status, education, attitude towards ART in reduction of HIV transmission to others.

Association between factors and unprotected sex with the current regular partner in the past 6 months

Univariate analysis revealed associations between unprotected sex with the current regular partner and subjects who had a known HIV-negative partner (OR, 0.21; 95%CI, 0.08-0.59) and subjects who answered "uncertain" about the effects of ART on reducing the chances of HIV transmission to others (OR, 2.73; 95%CI, 1.21-6.14). No association was found between unprotected sex with the current regular partner and the CD4 cell level when subjects who had a CD4 cell level of 0-99 cell/mm^3 were used as a reference group.

The unconditional logistic regression model, revealed participants with a known HIV-negative partner were 0.25 times more likely to have unprotected sex than those with a known HIV-positive partner (AOR, 0.25; 95%CI, 0.09-0.73) (Table 3).

Association between factors and unprotected sex with any partners in the past 6 months

Of 257 participants having sex with any partner, defined as having sex with a regular partner, a non-regular partner, a commercial sex worker or a male partner in the past 6 months, 61 (23.7%) reported having unprotected sex. Univariate analysis found associations between unprotected sex with any partner and females (OR, 1.91; 95%CI, 1.06-3.41), participants who had a regular partner (OR, 2.25; 95%CI, 1.07-4.73), and participants who answered "uncertain" about the effect of ART on redusing of HIV transmission (OR, 2.30; 95%CI, 1.08-4.88). No association was found between unprotected sex with any partner and CD4 level.

The unconditional logistic regression model found that participants who had a regular partner were 2.29 times more likely to engage in unprotected sex with any partners than those who were single or had no regular partner (AOR, 2.29; 95%CI, 1.04-5.03), and those who answered "uncertain" about the effect of ART on reduction of HIV transmission to others were 2.33 times more likely to have unprotected sex than those who agreed it did have an effect (AOR, 2.33; 95%CI, 1.06-5.14) (Table 4).

DISCUSSION

The results of this study demonstrated several patterns of sexual risk behaviors among HIV-infected patients currently treated with ART which have important implications for HIV prevention which should be integrated into the ART program. A substantial number of HIV-infected patients were engaging in casual sex with commercial or non-regular partners, and condoms were not always used with their partners, including their regular partners. Based on a statistical analysis, HIV-positive persons were more likely to engage in protected sex if their regular partner was not HIV-infected, compared with those with known HIV-positive partner, but 8.2% did not do so. These results raise considerable public health concerns regarding the potential for HIV and STI transmission and transmission of drug-resistant strains of HIV in the general public of the country.

Although more than 70% of participants have received ART for more than one year under the NAPHA, 70% of them did not have a correct understanding of the effects of ART in the reduction of HIV transmissibility and not curing HIV. This finding reflects the need to distribute more information regarding ART to health care providers and their patients.

Being incurable and stigmatized by the disease and having severe symptoms due to the opportunistic infections of HIV disease may decrease sexual activity among HIV-infected persons. However, after starting ART, some subjects had sex again. This may indicate that the effects of ART had a significant impact on restoration of sexual life in HIV-infected pa-

tients. There was a lag of time after starting ART until having first sex again which may be affected by some factors such as gender, society, family, income, and ART effectiveness. Further investigation needs to be done to clarify this issue, including groups of participants in which ART have no influence on their sexual activity.

In our study the patterns of sexual behavior over the previous 6 months showed the HIV-infected group were more likely to have sex with commercial partners than in the general population (Lertpiriyasuwat *et al*, 2003; Plipat, 2005b). Same-sex behavior among males was more common than in previous surveys done in young men with unknown HIV status (Kitsiripornchai *et al*, 1998; Jenkins *et al*, 1999; Nelson *et al*, 2002; Plipat and Chemnasiri, 2005). This finding indicates that men with male partners were at increased risk for HIV infection in Thailand.

The high level of inconsistent condom use with regular partners is worrisome, particularly with discordant couple. Only 78% of participants who knew the HIV status of their regular partner, and 30-40% of participants who had a known HIV-positive partner or an unknown HIV status partner, used condoms irregularly with their regular partners. These findings suggest a problem in the couple counseling that needs to be strengthened.

This study did not find an association between CD4 level and unprotected sex, which a consistent with the results of a previous study in 1999 (Ostrow *et al*, 2002) but in contrast to the results of studies in 2001 (Dukers *et al*, 2001; Tun *et al*, 2003). This study demonstrated that HIV-positive persons were less likely to engage in unprotected sex if their regular partner was HIV-negative, compared with persons with a known HIV-positive partner. This is similar to the results of a study in 1999 (Ostrow *et al*, 2002). Engaging in unprotected sex with a known HIV-positive partner may be due to the belief that re-infection with another HIV subtype or STI transmission risk is not significant. We found a significant association between participants who answered "uncertain" about the effects of ART on the reduction of HIV transmission and unprotected sex with any partners. This may reflect a group of HIV-infected persons who ignore ART information or lack ART knowledge which made them engaged in unsafe sex. For the association found between participants who had a regular partner and unprotected sex with any partner, most participants who had a regular partner did not consistently use condoms.

This study had several limitations. First, due to the cross-sectional nature of the design, we cannot infer casual inferences regarding factors and high-risk sexual behavior. Second, information regarding sexual behavior may be inaccurate since it was self-reported by participants (Catania *et al*, 1990). Thus, sexual activity may be under reported. Third, there was some measurement error influenced by participant factors and the instrument, especially question wording (Catania *et al*, 1990). Finally, the results may not represent all HIV-infected patients in NAPHA of Bamrasnaradura Infectious Diseases Institute or be generalized to HIV-infected patients receiving ART in other hospitals due to the non-probability sampling of this study. Since we used purposive sampling to select subjects, it is possible to have selection bias and socio-demographic characteristics of subjects may differ from other patients in general.

The study suggests an urgent need for HIV prevention programs to address issues of risk-reduction counseling, couple counseling which focuses on HIV transmission risk, voluntary counseling and testing (VCT), and safer sexual practice regardless of HIV status of their partner. Health care providers need to explore individual patient reasons for unsafe sex, such as beliefs about HIV transmission, and tailoring intervention programs to the specific popu-

lation. Availability of condoms to HIV positive persons should be supported. The benefit package of the National Health Security (30 baht) Scheme in Thailand in which prescriptions for condoms for HIV-infected patients should be utilized in real practice.

Based on data for participants about 10 condoms per month would be used on average. These data should be useful for ART programs and service providers to prepare sufficient numbers of condoms to support HIV-infected patients.

Surveillance systems for antiretroviral drug resistance and sexual risk behavior among HIV-infected persons should be developed and implemented.

ACKNOWLEDGEMENTS

The authors gratefully appreciate Dr Sombat Thanprasertsuk, Assoc Prof Dr Kanokrat Siripanichgon, Asst Prof Chaweewon Boonshuyar, Nutchanart Kaeodumkoeng, Suwanee Maisuwan, Kruatip Jantarathaneewat, Nopphanath Chumpathat and staff of Mahidol University and Bamrasnaradura Infectious Diseases Institute for their assistance and helpful comments.

REFERENCES

Bureau of AIDS, TB and STIs, Department of Disease Control, Thailand Ministry of Public Health. Operational Guideline of National Access to Antiretroviral Program for PHA. Nonthaburi: Bureau of AIDS, TB and STIs, September 2004.

Catania JA, Gibson DR, Chitwood DD, Coates TJ. Methodological problems in AIDS behavioral research: Influences on measurement error and participation bias in studies of sexual behavior. *Psychol Bull* 1990; 108: 339-62.

Crepaz N, Hart TA, Marks G. Highly Active Antiretroviral Therapy and sexual risk behavior: A meta-analytic review. *JAMA* 2004; 292: 224-36.

Diamond C, Richardson JL, Milam J, *et al*. Use of and adherence to antiretroviral therapy is associated with decreased sexual risk behavior in HIV clinic patients. *J Acquir Immune Defic Syndr* 2005; 39: 211-8.

Dukers NHTM, Goudsmit J, de Wit JBF, Prins M, Weverling GJ, Coutinho RA. Sexual risk behaviour relates to the virological and immunological improvements during highly active antiretroviral therapy in HIV-1 infection. *AIDS* 2001; 15: 369-78.

Jenkins RA, Torugsa K, Mason CJ, *et al*. HIV risk behavior patterns among young Thai men. *AIDS Behav* 1999; 3: 335-46.

Jitsabuy B. Sexual risk behaviors among HIV-infected persons in Lampoon Province. In: Plipat T, Saengwonloey O, Thanaisawanyangkoon S, Rattanasuporn N, Cheumsuk K, eds. AIDS epidemiological surveillance 2002. Nonthaburi: Bureau of Epidemiology, Ministry of Public Health, 2003: 1-15.

Kalichman SC, Rompa D. HIV treatment adherence and unprotected sex practices in people receiving antiretroviral therapy. *Sex Transm Infect* 2003; 79: 59-61.

Kitsiripornchai S, Markowitz LE, Ungchusak K, *et al*. Sexual behavior of young men in Thailand: regional differences and evidence of behavior change. *J Acquir Immune Defic Syndr Hum Retrovirol* 1998; 18: 282-8.

Kravcik S, Victor G, Houston S, *et al*. Effect of antiretroviral therapy and viral load on the perceived risk of HIV transmission and the need for safer sexual practices. *J Acquir Immune Defic Syndr Hum Retrovirol* 1998; 19: 124-9.

Lertpiriyasuwat C, Plipat T, Jenkins RA. A survey of sexual risk behavior for HIV infection in Nakhonsawan, Thailand, 2001. *AIDS* 2003; 17: 1969-76.

Nelson KE, Eiumtrakul S, Celentano DD, Beyrer C, Kuntolbutra S, Khamboonruang C. HIV infection in young men in northern Thailand, 1991-1998: increasing role of injection drug use. *J Acquir Immune Defic Syndr* 2002; 29: 62-8.

Ostrow DE, Fox KJ, Chmiel JS, *et al*. Attitudes towards highly active antiretroviral therapy are associated with sexual risk taking among HIV-

infected and uninfected homosexual men. *AIDS* 2002; 16: 775-80.

Plipat T. HIV sero-surveillance, Thailand 2004. *Thai AIDS J* 2005a; 17: 1-12.

Plipat T. HIV-related behavior among general population, Thailand 2004. *Thai AIDS J* 2005b; 17: 175-83.

Plipat T, Chemnasiri T. Commercial sex visit and condom use among Thai men, 1995-2003. *Thai AIDS J* 2004; 16: 123-31.

Plipat T, Chemnasiri T. Behavioral surveillance system among male conscripts, Thailand 1995-2004. *Thai AIDS J* 2005; 17: 119-27.

Pomerantz R. Primary HIV-1 resistance: a new phase in the epidemic? *JAMA* 1999; 282: 1177-9

Scheer S, Chu PL, Klausner JD, Katz MH, Schwarcz SK. Effect of highly active antiretroviral therapy on diagnoses of sexually transmitted diseases in people with AIDS. *Lancet* 2001; 357: 432-5.

Steven SF. The affordability of antiretroviral therapy in developing countries: what policymakers need to know. [Cited 2005 Sep 5]. Available at: URL: http://www.worldbank.org/aids-econ/arv/background/aidconc.htm

Tun W, Celetano DC, Vlahov D, Strathdee SA. Attitudes toward HIV treatments influence unsafe sexual and injection drug practices among injecting drug users. *AIDS* 2003; 17: 1953-62.

Vernazza PL, Kashuba ADM, Cohen MS. Biological correlates of sexual transmission of HIV: practical consequences and potential targets for public health. *Rev Med Microbiol* 2001; 12: 131-42.

Wainberg M, Friedland G. Public health implications of antiretroviral therapy and HIV drug resistance. *JAMA* 1998; 279: 2000-2.

Wilson TE, Minkoff H. Condom use consistency associated with beliefs regarding HIV disease transmission among women receiving HIV antiretroviral therapy. *J Acquir Immune Defic Syndr* 2001; 27: 289-91.