A survey of sexual risk behavior for HIV infection in Nakhonsawan, Thailand, 2001

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Objective: To determine the prevalence of sexual risk behaviors for HIV in the general population aged 15–44 years in Nakhonsawan province, Thailand.

Design: Cross-sectional survey.

Methods: A two-stage cluster sampling technique was used to select 630 participants aged 15–44 years from the general population. Tape-recorders with earphones provided questions to the respondents, who used self-administered answer sheets to record their responses.

Results: Most participants were rural, married and educated at the primary school level. The mean age was 31.5 years. Seventy-eight percent of all participants had ever had sexual intercourse. The prevalence of premarital sex among married participants was 41%. In the previous year, 20% of the participants had had sex with commercial or non-regular partners. Sex with non-regular partners occurred more frequently than sex with commercial partners. Sixty-one percent had used condoms the last time they had sex with a commercial partner and 46% had used condoms the last time they had sex with non-regular partners. Consistent condom use with non-regular partners was lower than with commercial partners. Voluntary HIV testing during the previous year was reported by 24% of the participants who had had sex with commercial or non-regular partners.

Conclusions: The results suggest that Nakhonsawan needs to strengthen implementation of the 100% condom programme, address condom use with non-commercial partners, promote awareness of personal risk rather than identification of risk groups and increase voluntary HIV testing among people who engage in risky behaviors.

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Introduction

The HIV/AIDS epidemic spread very rapidly throughout Thailand during the late 1980s and the early 1990s. From 1984 to January 2001, there have been 162 813 reported cases of AIDS, 83% contracted through sexual intercourse [1]. Serosurveillance of the epidemic has used sentinel data from high-risk populations (e.g., sex workers, injection drug users) and from groups indicative of general population (e.g., antenatal clinic clients, newly inducted military conscripts). In the early 1990s, these data indicated spread beyond high-risk groups and this led to implementation of the 100% condom campaign, which was designed to reduce spread from sex workers and their clients to the general population [2–3].

Thailand's serosurveillance system became supplemented by a sentinel behavioral surveillance system in 1995 to provide a fuller assessment of current trends in the

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epidemic. The sentinel sites were set up in 20 of Thailand's 76 provinces. The sentinel behavioral populations included army conscripts, male and female factory workers aged 15–29 years, male and female grade 11 students from secondary schools and pregnant women attending public antenatal clinics. The system annually collects data from 350 persons per sentinel population per province using non-probability sampling (quota samples collected through non-systematic selection of venues) and collection of data through self-administered questionnaires [4–5]. In practice, some sentinel sites do not use the assigned sampling methods and do not obtain sufficient sample sizes of some subpopulations [6]. Because of biases in the selection process and inadequate sample sizes, these surveillance results may deviate significantly from true prevalence and cannot accurately describe the magnitude of risk and trends in this risk over time. These limitations have been present in multiple target populations at both the provincial and national levels.

Most of the previous sexual behavior surveys in Thailand have studied subpopulations such as male conscripts, adolescents, commercial sex workers, students and factory workers [7–15]. Only two studies have provided national data on risk behavior in the general population: a Thai Red Cross Society survey in 1990 [16] and a Mahidol University survey in 1993 [17]. Both studies interviewed persons aged 15–49 years who were selected through multistage sampling. The use of face-to-face interviews in these surveys made them very expensive, time consuming and not feasible for surveillance purposes. Furthermore, there is evidence that face-to-face interviews may underestimate the occurrence of some relatively stigmatized sexual behaviors, such as premarital sex among women and same-sex sexual behavior among men [18–19].

The study described here was designed to pilot test promising methods of collecting more valid behavioral surveillance data in the general population in Thailand. Specifically, an inexpensive, relatively private method of questionnaire self-administration was initiated and two-stage sampling was used to obtain representative populations. The survey was conducted in Nakhonsawan province, which is located in the lower north of Thailand. Nakhonsawan is not a province characterized by high HIV prevalence [1]. However, its predominantly rural population reflects the distribution of population outside of Thailand's major urban areas while its provincial capital reflects the kinds of activity common to upcountry cities in Thailand, serving as a center for education, local labor migration and entertainment, including venues such as massage parlors and Karaoke bars. This study helps to provide guidance for HIV prevention and control and provides data about sexual risk behaviors of people outside the upper north epicenter.

Methods

Study population and sampling methods

The cross-sectional survey was conducted using two-stage cluster sampling (Fig. 1). In the first stage of sampling, C-survey software (University of Indonesia, Jarkarta, Indonesia and UCLA, Los Angeles, California, USA) was used to select 30 clusters from a list of all 1304 villages and communes in the province, using probability proportional to size [20]. In the second stage, 21 households per selected cluster were randomly selected using a random number table created by the software. One eligible person in each selected household, whose age was between 15 and 44 years, was selected for participation by using the random number table. If the person was illiterate or deaf, they were excluded. If the eligible persons were not at home, the team revisited their homes until the team could meet with them. If the selected household had no eligible persons, those persons were not at home during the 1-month data collection period or they refused to participate, a new household was randomly selected. This process continued until the number of participants required for each cluster was reached. No incentive was provided for participation.

The sample size was calculated based on the prevalence of having sex with any partners other than spouse or regular partners in the previous year among all male participants aged 15–49 years from the Thai Red Cross Society survey, which was 28% [16]. Because no previous data for design effect value were available, the researchers estimated the design effect to be equal to two. The calculated sample size was 630, based on these estimates, with a 95% confidence interval (CI) of $\pm 5\%$ error.

The project was reviewed and approved by the Ethical Review Committee for Research in Human Subjects, Ministry of Public Health, Thailand. Each potential participant was given an information sheet that described the objectives, methodology and advantages of the study to read before deciding whether to participate. Written informed consent was obtained from all participants.

Data collection

Data were collected during October 2001 by 10 field teams. Each team consisted of two trained public health officers, who worked at the district health office or health center in the selected areas. Training for team members included the methods for selecting participants, introducing themselves to participants, obtaining informed consent and data collection.

Questionnaires were self-administered and the content was provided to respondents via audiotape. Tape recorders with earphones and answer sheets were provided to each respondent. Separate tapes were used for male and female participants because the questionnaire content was worded to be semantically appro-

priate by gender. The answer sheet contained only the question number and the cluster number. The data were collected anonymously. No names or other identifying information were collected.

The field teams collected the data at participants' homes. The participants were left alone to complete the answer sheet but staff were available, nearby, to answer questions. The answer sheets were put in a box by the participants themselves after completing the questionnaire. The box was opened by the field supervisor after the data collection in each cluster was finished. The data were recorded in Epi Info, Version 6.04d software (Centers for Disease Control and Prevention, Atlanta, Georgia, USA).

The questionnaire consisted of two parts. The first part collected information on sociodemographic characteristics and history of voluntary HIV testing. The second part consisted of 15 questions regarding sexual experiences [e.g., their age at first sex, sex with non-regular partners or commercial partners, condom use and history of sexually transmitted diseases (STD)]. Sexual intercourse was defined, for all items, and for the male and female versions of the survey, as vaginal or anal intercourse. A commercial partner was defined as a partner to whom money or goods has been paid in exchange for sex. Non-regular partners were defined as sexual partners, including casual partners and friends, who were not spousal, cohabiting or commercial partners. Most of the questions were multiple choice and a few were short answer, such as questions about age, occupation and education. Every question included a 'do not want to answer' option.

Field testing of all questions, survey instruments and procedures was conducted among 30 Nakhonsawan residents who had been selected through convenience sampling and varied in age and gender. Some adjustments of the questionnaire, such as wording, question structure and question order were made after the field test. Most items had been previously tested and used in the sentinel surveillance or in other research projects in Thailand.

Data analysis

STATA software, Version 6 (Stata Corporation, College Station, Texas, USA) was used to obtain the proportion of sexual risk behavior of participants and its 95% CI value. All analysis was done using 'svy' command to take cluster sampling into account in making variance estimates.

Results

Description of the sample

From 638 households visited, there were 638 eligible participants. There were no deaf or illiterate persons among selected sample. Eight (1.3%) of the 638 eligible participants refused to participate, which yielded a final sample of 630; this met the enrollment target that had been obtained in the power analysis (see Methods). The refusal rates for individual questions were less than 6%. These rates were similar for males and females. The demographic distributions in terms of age group, gender and the urban–rural ratio of the selected participants and those of the total population aged 15–44 years in Nakhonsawan were similar.

Of the 630 participants, 291 (46%) were men and 339 (54%) were women; the mean age was 31.5 (SD, 10.5) years. The majority were married or living with regular partners (62%), lived outside of urban areas (90%) and had completed a primary school education (typically 6 years; 57%). The most common occupations were agriculture and wage labor (Table 1).

Sexual behavior history

Seventy-eight percent of all participants reported that they ever had sexual intercourse. The mean age at first sex of sexual-experienced participants was 19.6 (SD, 3.3) years: 19.1 years (SD, 3.1) for males and 20.0 years (SD, 3.5) for females (Table 2). Of all participants who reported having had sex, 1.8% first had sex before age 15 years and 52.9% first had sex at age 15–19 years. Among the single participants, 31.6% had ever had sexual intercourse. The proportion of married or partnered participants who reported having had sex with non-regular partners before their current marriage or current regular partners was 40.8% (95% CI, 34.4–47.2); the proportion among males (65.5%; 95% CI, 58.1–72.9) was higher than that among females (18.6%; 95% CI, 12.9–24.3).

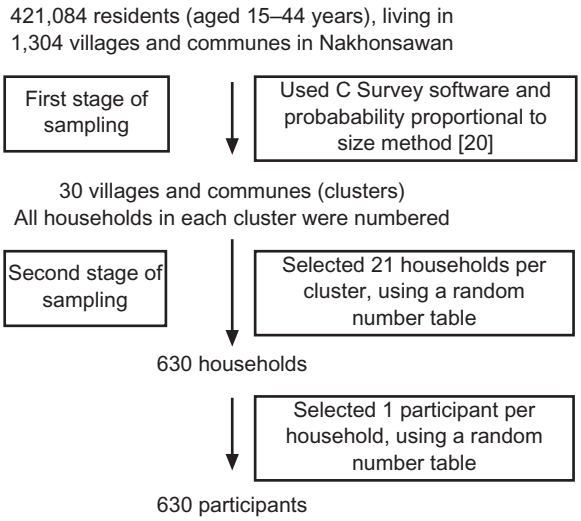

Fig. 1. Flow chart of the sample selection.

Table 1. Demographic characteristics of participants by gender.

	Male (%)	Female (%)	Total (%)
No.	291	339	630
Age (years)			
15–19	11.7	14.2	13.0
20–24	10.7	13.3	12.1
25–29	15.4	13.9	14.6
30–34	18.2	14.7	16.3
35–39	21.0	20.6	20.8
40–44	23.0	23.3	23.2
Mean age [years (SD)]	31.7 (8.9)	31.3 (9.4)	31.5 (10.5)
Marital status			
Single	34.6	29.5	31.9
Married with a marriage license	32.5	40.6	36.9
Regular partner, no marriage license	28.7	22.1	25.1
Divorced/separated	4.2	4.8	4.5
Widowed	0.0	3.0	1.6
Occupation			
Agriculture	39.1	33.8	36.3
Wage-labor	31.3	29.3	30.2
Merchant/work-owner	9.9	10.9	10.4
Student	9.9	10.6	10.2
Housewife/unemployed	1.4	8.8	5.4
Government servant	4.2	4.8	4.6
Others	4.2	1.8	2.9
Highest grade of education completed			
Primary (6 years)	55.1	58.0	56.7
Secondary 1–3	19.6	17.0	18.2
Secondary 4–6	12.6	8.9	10.6
Vocational/diploma	6.0	8.0	6.3
Bachelor's degree	6.3	6.3	7.1
Higher than bachelor's degree	0.0	0.0	0.0
Never in school	0.4	1.8	1.1

Sexual behavior during previous year

In the previous year, 86.6% of all participants reported that they had had sexual intercourse and 19.6% had had sex with commercial partners or non-regular partners. The proportion of males who had had sex with commercial partners or non-regular partners was higher than the proportion of females (26.1% and 13.9%, respectively) (Table 2). The prevalences of sex with commercial partners or non-regular partners in the previous year were similar for single participants (17.8%; 95% CI, 11.3–24.2) and for married or partnered participants (19.4%; 95% CI, 13.8–25.0).

Non-regular partnerships

During the previous year, 15.9% of all participants had had sex with non-regular partners. Among those who had had sex with a non-regular partner, 53.4% reported more than one partner (Table 2); 25.2% reported consistent condom use and 46% said they used a condom at last sex with these partners. The proportion reporting consistent condom use with non-regular partners was similar for single (33.3%; 95% CI, 7.5–59.2) and married/partnered participants (25.8%; 95% CI, 15.7–35.9). A smaller proportion of females than males reported that they had used condoms with non-regular partners (Table 3).

Commercial partnerships

Approximately 9% of all participants had had sex with commercial partners during the previous year. The proportion for males was 15.8% and for females was 3.9%. In the previous month, 5.4% of all participants had had sex with commercial partners; of these, 42.4% had sex with commercial partners more than one time (Table 2).

Among the participants having had sex with commercial partners, 48.7% had used condoms consistently during the previous year and 61.2% reported that they used condoms the last time they had sex with commercial partners (Table 3). For the single participants, the proportion of consistent condom use with commercial partners (66.7%; 95% CI, 44.2–89.1) was higher than that of married or partnered participants (41.7%; 95% CI, 25.9–57.4).

Men who had sex with men

Among males, 4.3% (12 participants) had had sex with male partners during the previous year and 42% of these had consistently used condoms with their male partners. However, these men did not have sex exclusively with men: 33% (95% CI, 2.3–64.4) had sex with female commercial sex workers and 46% (95% CI, 8.1–82.8) had sex with female non-regular partners.

Table 2. Prevalence of sexual risk behaviors by gender.

	Male		Female		Total	
	No.	% (95% CI)	No.	% (95% CI)	No.	% (95% CI)
Ever had sexual intercourse (n = 619)						
15–19 years	10	29.4 (14.3–44.5)	9	18.8 (6.3–31.2)	19	23.2 (13.5–32.9)
20–24 years	17	54.8 (33.4–76.2)	24	53.3 (36.5–70.2)	41	54.0 (40.1–67.8)
25–29 years	40	95.2 (88.3–100.0)	40	87.0 (77.4–96.5)	80	91.0 (84.7–97.1)
30–34 years	46	88.5 (80.2–96.7)	43	86.0 (76.9–95.1)	89	87.3 (80.0–94.5)
35–39 years	58	95.1 (89.5–100.0)	63	92.6 (85.5–99.8)	121	93.8 (89.2–98.4)
40–44 years	64	100	69	88.5 (81.8–95.1)	133	93.7 (89.6–97.7)
Total	235	82.7 (77.3–88.2)	248	74.0 (68.2–79.9)	483	78.0 (73.7–82.3)
Mean age [year (SD)] at first sex (n = 456)	19.1 (3.1)	20.0 (3.5)	19.6 (3.3)			
Had sex in the past 1 year						
With commercial or non-regular partners (n = 624)	75	26.1 (19.1–33.1)	47	13.9 (9.3–18.6)	122	19.6 (14.8–24.3)
With commercial partners (n = 615)	45	15.8 (10.3–21.3)	13	3.9 (1.8–6.0)	58	9.4 (6.9–11.9)
With non-regular partners (n = 609)	55	19.9 (13.8–25.9)	42	12.7 (8.0–17.3)	97	15.9 (11.6–20.2)
With men (males only) (n = 280)	12	4.3 (1.8–6.7)				
Frequency of sex with commercial partners in the past month (n = 33)						
1	17	56.7 (36.7–76.6)	2	66.7 (0.0–100.0)	19	57.6 (40.6–74.6)
2	6	20.0 (4.0–36.0)	0	0.0	6	18.2 (4.0–32.4)
3	2	6.7 (0.0–15.6)	1	33.3 (0.0–100.0)	3	9.1 (0.0–18.9)
4	3	10.0 (0.0–21.4)	0	0.0	3	9.1 (0.0–19.6)
> 4	2	6.7 (0.0–16.7)	0	0.0	2	6.1 (0.0–14.9)
Number of non-regular partners in the past 1 year (n = 73)						
1	23	43.4 (28.8–58.0)	11	55.0 (29.2–80.8)	34	46.6 (34.0–59.1)
2	16	30.2 (19.2–41.1)	4	20.0 (0.0–40.5)	20	27.4 (18.3–36.5)
3	7	13.2 (3.7–22.7)	3	15.0 (0.0–30.7)	10	13.7 (4.1–23.3)
4	1	1.9 (0.0–5.8)	2	10.0 (0.0–24.8)	3	4.1 (0.0–8.9)
> 4	6	11.3 (1.2–21.4)	0	0.0	6	8.2 (1.2–15.3)
STD or genital ulcer in the past year (n = 614)	7	2.5 (0.5–4.5)	14	4.2 (1.8–6.6)	21	3.4 (1.6–5.2)

CI, confidence interval.

Table 3. Condom use in the past year by gender.

Frequency of condom use in the past 1 year	Male		Female		Total	
	No.	% (95% CI)	No.	% (95% CI)	No.	% (95% CI)
With commercial partners (n = 78)						
Every time	36	55.4 (41.9–68.9)	2	15.4 (0.0–34.9)	38	48.7 (36.1–61.3)
Sometimes	11	16.9 (6.1–27.8)	2	15.4 (0.0–34.9)	13	16.7 (6.8–26.6)
Never	18	27.7 (15.2–40.1)	9	69.2 (37.4–100.0)	27	34.6 (21.9–47.3)
With non-regular partners (n = 103)						
Every time	22	36.1 (23.2–49.0)	4	9.5 (0.7–18.3)	26	25.2 (17.7–32.7)
Sometimes	17	27.9 (15.4–40.4)	14	33.3 (14.8–51.9)	31	30.1 (18.5–41.7)
Never	22	36.0 (22.7–49.5)	24	57.2 (37.6–76.7)	46	44.7 (32.4–56.9)
With men (male respondents) (n = 12)						
Every time	5	41.7 (8.5–74.8)			5	41.7 (8.5–74.8)
Sometimes	3	25.0 (0.0–53.1)			3	25.0 (0.0–53.1)
Never	4	33.3 (6.8–59.8)			4	33.3 (6.8–59.8)
Condom use at the last sexual intercourse with commercial partners (n = 67)						
Used	40	78.4 (64.7–92.2)	1	6.3 (0.0–19.6)	41	61.2 (44.7–77.7)
Not used	11	21.6 (7.8–35.3)	15	93.8 (80.4–100.0)	26	38.8 (22.3–55.3)
Condom use at the last sexual intercourse with non-regular partners (n = 87)						
Used	35	58.3 (42.7–74.0)	5	18.5 (4.2–32.8)	40	46.0 (33.9–58.0)
Not used	25	41.7 (26.0–57.3)	22	81.5 (67.2–95.8)	47	54.0 (42.0–66.1)

CI, confidence interval.

Sexually transmitted diseases or genital ulcers in previous year

STD or genital ulcers were reported by 3.4% of participants during the previous year. Of these, 42.1% (95% CI, 14.7–69.5) had had sex with commercial or non-regular partners while they were having these symptoms: 66.7% (95% CI, 31.0–100.0) of males and 20% (95% CI, 0.0–50.1) of females. Among the

participants who reported having commercial or non-regular partners, 10.9% (95% CI, 4.5–17.4) reported having had STD or genital ulcers during the previous year, whereas these were reported by only 1.6% (95% CI, 0.3–3.0) of the participants who had never had sex with commercial or non-regular partners.

HIV testing during previous year

Voluntary serum-based HIV testing with receipt of the result in the previous year was reported by 19.0% (95% CI, 14.9–23.0), while 5.5% (95% CI, 3.2–7.8) had been tested but did not know the result. Among participants who had had sex with commercial or non-regular partners in the previous year, 24.2% (95% CI, 15.2–33.2) reported having had voluntary HIV testing.

Discussion

The methods piloted in this study appeared successful in accruing a representative sample, with low rates of refusal. Major findings, such as the levels of unprotected sex with non-regular and commercial partners, appeared consistent with patterns that have been seen in a number of recent studies with adolescents and young adults in Thailand [11,21]. These findings are in contrast to those from two national surveys in the general population in 1990 and 1993 [16,17] and other research from the early 1990s [15,22] in Thailand, which found commercial sex to be more common than sex with casual or other non-commercial partners.

The patterns of behavior during the previous year found in our study have important implications for HIV prevention. Condom use was far below levels targeted by the 100% condom programme [2,3] and this was true for commercial partners (the main target of the programme) as well as for the more frequently reported non-regular partners. The low level of consistent condom use with commercial partners is worrisome and is consistent with results of the national behavioral surveillance [6,23] and a recent survey among adolescents and young adults in upper northern Thailand [13,21]. These findings suggest gaps in Thailand's condom campaign and the need to strengthen it.

Our findings suggest that condom use with non-commercial partners needs to be addressed with more intensity. Condom use with casual partners has generally been lower than with commercial partners in Thailand [11,14,15,23] but the increasing prevalence of casual partners makes it the issue that needs serious attention, along with efforts to revitalize the 100% condom programme [2,3] with commercial sex.

The risks experienced by females appear to need more attention. Although the proportion of women who reported having had sex with commercial or non-regular partners was lower than that of males, the reported level of consistent condom use with these partners was lower than among males. Furthermore, females lacking sexual risk behaviors may contract HIV because of other sexual activities of their male partners, a pattern evident in other research in Thailand [24]. In our investigation, the prevalence of premarital sex with non-current regular partners was over 50% among males, and approximately 19% of the current married or partnered participants (regardless of gender) had had sex with commercial or non-regular partners during the previous year. Significantly, consistent condom use with commercial partners for married or partnered participants was lower than that of singles. The impact of this may be disproportionate for women because non-regular and commercial partnerships are more common among their male partners, and because cultural norms in Thailand make it difficult for women to initiate discussions about sex and condom use with their partners [25]. This may help to explain the increasing proportion of HIV and AIDS cases who are female, as well as increases in the prevalence of HIV-seropositive pregnant women in Nakhonsawan [26–30]. For same-sex behavior among males, the prevalence was similar to findings from previous surveys in young men [11,12,15,23]. At present, the available evidence indicates that heterosexual activity is the dominant mode of HIV transmission in Thailand [1] and that HIV seroprevalence among men who have sex with men is low in comparison with Western countries [19]. Even so, there is some evidence that this group are now at increased risk for HIV infection in Thailand, which was not true earlier in the epidemic [15,22]. Many in this group also report sex with women, which means that they are a potential bridge population.

According to the results of this study, the prevalence of having had STD or genital ulcers was similar to that seen in the previous national survey of the general population in 1990 [16]. This was surprising because other data have suggested declines in STD in Thailand [2,3,15,31]. However, the method for collecting STD data here was more anonymous than that used in the previous national survey [16], which would suggest that the present data may underestimate STD less than previous research using face-to-face interviews.

In the previous year, about 24% of the full sample had received HIV testing. The proportion of those at high risk who had been tested was similar. Relative to 100% condom programme [2,3] or efforts to prevent mother-to-child transmission [32], voluntary counseling and testing (VCT) has received less attention, although these services are currently available at all provincial and community hospitals [31]. There are no other published data about VCT utilization among Thai

adults; therefore, it is difficult to judge how our data relate to overall trends. Barriers and facilitators of testing also have not been investigated and warrant further attention.

The results of this survey appear to provide good estimates of the prevalence of sexual risk behaviors of the population aged 15–44 years in Nakhonsawan. The response rate for this study was very high and the refusal rates for individual questions were low. Importantly, these rates did not differ between males and females, which is significant in a society where disclosure of sexual behavior by women is discouraged [25]. The study was able to provide timely findings at a low cost. Data collection was completed in 1 month at an overall cost of only US$3688.

Nonetheless, this study had several limitations. First, the sample size was designed for surveying the general population. This limited the precision of estimates of risk behavior prevalence among subpopulations, such as men who had sex with men. It also limited comparisons between age groups or other subgroupings in the population. Relatively rare behaviors or subgroup comparisons could be used to drive sample size estimates but this would increase the cost and complexity of the surveillance activity.

Second, there may be 'self-presentation' bias for some findings [18]. The researchers tried to avoid this tendency to present oneself in a socially desirable way by using the anonymous methods and the self-administered questionnaires. We believe that bias should be minimal and, if present, the prevalence of sexual activities reported here would be an underestimate. Third, there was some degree of measurement error influenced by participant factors and the instrument, especially question wording [18]. There were small amounts of inconsistency of responses between items that asked about sex with different partner types and subsequent responses to questions that asked about condom use with these partners. Further testing of wording would seem desirable to ensure better comprehension. Finally, the results may be difficult to generalize to people living in provinces that differ demographically from Nakhonsawan or to the national population.

The study suggests that representative sampling and valid behavioral surveillance among general population can occur in a short period of time and this would appear feasible for general population surveillance in Thailand. However, it may be desirable to include some additional items to evaluate risk related to drug use, as well as common determinants of risk such as alcohol use or history of sexual coercion [13,21]. Our findings, combined with other recent research in Thailand [11,13,17,21] suggest that more attention needs to be given to condom use with non-commercial partners and that efforts are also needed to improve the long-term efficacy of the 100% condom programme with commercial partners. More attention to personal risk, rather than to identification of risk groups, may be helpful. There is also the need to develop HIV education and prevention packages specific for women, that draw on programmes in Thailand that have increased awareness of personal HIV risk, taught assertive behaviors for using condoms or encouraged utilization of VCT [33–35]. In addition, consideration should be given to increased access to and use of VCT, including premarital testing for couples. Further, policy-makers should ensure continuous availability of HIV education and prevention resources in both rural and urban communities.

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References

1. AIDS Epidemiology Section, Division of Epidemiology, Ministry of Public Health. *Situation of AIDS Cases and Symptomatic HIV Cases in Thailand.* Bangkok: Division of Epidemiology, Ministry of Public Health, Thailand; 2000.
2. Rojanapithayakorn W, Hanenberg R. **The 100% Condom Program in Thailand.** *AIDS* 1996, **10**:1–7.
3. The Institute for Population and Social Research. *Condom Promotion Programme in Thailand: Survey Results of the Evaluation of the 100% Condom Promotion Programme.* Nakhon Pathom: The Institute for Population and Social Research, Mahidol University at Salaya; 1999.
4. Thonghong O, Saengwonloey O, Juntasiriyarkorn S. **AIDS surveillance.** In *Manual of the Proceeding in Epidemiology.* Edited by Kuharat S. Bangkok: Division of Epidemiology, Ministry of Public Health, Thailand; 1999:129–144.
5. AIDS Epidemiology Section, Division of Epidemiology. *Manual of Behavioral Surveillance for HIV in Thailand.* Bangkok: Division of Epidemiology, Ministry of Public Health, Thailand; 1999.
6. Juntasiriyarkorn S, Saengwonloey O, Thonghong O. *Results of HIV Risk Behavioral Surveillance in Thailand in 1995–1998.* Bangkok: Division of Epidemiology, Ministry of Public Health, Thailand; 1999.
7. Swaddiwudhipong W, Pisuttakoon K, Khumklam P, Koonchote S, Lerdlukanavonge P, Chandeoun C, *et al.* **A survey of knowledge about AIDS, risk factors and prevalence of HIV infection in a hill tribe population in Tak Province.** *Com Dis J* 1994, **20**:79–87.
8. Swaddiwudhipong W, Pisuttakoon K, Lerdlukanavonge P, Koonchote S, Boonmak C, Khumklam P. **A survey of knowledge**

about AIDS and risk factors for HIV infection in Burmese People Living in Mae Sot, Tak Province. *Com Dis J* 1994, **20**:232–238.
9. Komvisade P, Wannavake J, Subpasri S. **The study of AIDS knowledge, attitude and sexual behavior in males attending the Center of Venereal Disease Control Region 10, Amphur Muang, Changwat Chiang Mai.** *Suanprung J* 1995, **11**:31–34.
10. Ramasoota P. **Relating factors and risk behavior towards occurrence of sexual transmitted diseases and HIV/AIDS among street children and youth in Bangkok**. *J Health Sci* 1996, **5**:362–374.
11. Jenkins RA, Torugsa K, Mason CJ, Jamroenratana V, Lalang C, Nitayaphan S, *et al.* **HIV risk behavior patterns among young Thai men.** *AIDS Behav* 1999, **3**:335–346.
12. Kitsiripornchai S, Markowitz LE, Ungchusak K, Jenkins RA, Leucha W, Limpitaks T, *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**:282–288.
13. Saisorn S, Griensven FV, Kilmarx P. **Prevalence of HIV, STD, drug use, and sexual behavior among adolescents and young adults in northern Thailand: results of an innovative research technology.** *J Health Sci* 2000, 9: 202–213. [in Thai]
14. Mills S, Benjarattanaporn P, Bennett A, Pattalung RN, Sundhagul D, Trongsawad P, *et al.* **HIV risk behavioral surveillance in Bangkok, Thailand: sexual behavior trends among eight population groups.** *AIDS* 1997, **11**(suppl 1):S43–S51.
15. Nelson KE, Eiumtrakul S, Celentano DD, Beyrer C, Galai N, Kawichai S, *et al.* **HIV infection in young men in northern Thailand, 1991–1998: increasing role of injection drug use.** *J AIDS* 2002, **29**:62–68.
16. Sittitrai W, Phanuphak P, Barry J, Brown T. *Thai Sexual Behavior: A Report on the 1990 Survey of Partner Relations and Risk of HIV infection in Thailand*. Bangkok: Thai Red Cross Society Programme on AIDS Research Report; 1992.
17. Thongthai V, Guest P. **Thai sexual attitudes and behaviours: results from a recent national survey.** *Gender and Sexuality in Modern Thailand Conference*. Canberra, July 1995.
18. 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**:339–362.
19. London AS, Vanlandingham MJ, Grandjean N. **Socio-demographic correlates, HIV/AIDS related cofactors, and measures of same-sex sexual behavior among Northern Thai male soldiers.** *Health Transit Rev* 1997, **7**:33–60.
20. Bennett S, Woods T, Liyanage WM, Smith DL. **A Simplified general method for cluster-sample surveys of health in developing countries.** *World Health Stat Q* 1991, **44**:98–106.
21. Griensven FV, Supawitkul S, Kilmarx PH, Limpakarnjanarat K, Young NL, Manopaiboon C, *et al.* **Rapid assessment of sexual behavior, drug use, human immunodeficiency virus, and sexually transmitted diseases in northern Thai youth using audio-computer-assisted self-interviewing and noninvasive specimen collection.** *Pediatrics* 2001, **108**:e13.
22. Nopkesorn T, Mastro TD, Sangkharomya S, Sweat M, Singharaj P, Limpakarnjanarat K, *et al.* **HIV-1 infection in young men in northern Thailand.** *AIDS* 1993, **7**:1233–1239.
23. Juntasiriyarkorn S, Saengwonloey O, Thonghong O, Kumtaload C, Swangsri S. **HIV risk behavior sentinel surveillance in Thailand: the results of the 1995–1999 survey.** *Thai AIDS J* 2000, **12**:64–88.
24. Nagachinta T, Duerr A, Suriyanon V, Nantachit N, Rugpao S, Wanapirak C, *et al.* **Risk factors for HIV-1 transmission from HIV-seropositive male blood donors to their regular female partners in northern Thailand.** *AIDS* 1997, **11**:1765–1772.
25. Podhisita C, Pattaravanich U. *Youth in Contemporary Thailand: Results from the Family and Youth Survey.* Nakorn Phathom, Thailand: Institute for Population and Social Research, Mahidol University; 1995:IPSR Publication No. 197.
26. Division of Epidemiology, Ministry of Public Health, Thailand. **Result from national HIV serosurveillance, Thailand, 1996.** *Wkly Epidemiol Surveil Rep* 1997, **28**:181–200.
27. Division of Epidemiology, Ministry of Public Health, Thailand. **Result from national HIV serosurveillance, Thailand, 1997.** *Wkly Epidemiol Surveil Rep* 1997, **28**:725–748.
28. Division of Epidemiology, Ministry of Public Health, Thailand. **HIV serosurveillance in Thailand: result of the 16th round, June 1998.** *Mthly Epidemiol Surveil Rep* 1999, **30**:1–36.
29. Division of Epidemiology, Ministry of Public Health, Thailand. **HIV Serosurveillance in Thailand: result of the 17th round, June 1999.** *Mthly Epidemiol Surveil Rep* 2000, **31**(Suppl 1):1–16.
30. Division of Epidemiology, Ministry of Public Health, Thailand. **HIV Serosurveillance in Thailand: result of the 18th round, June 2000.** *Mthly Epidemiol Surveil Rep* 2001, **32**(Suppl):1–20.
31. AIDS Division. *Inter-country Consultation for Preparation for ASEAN Summit 26–28 April 2001: Report on HIV/AIDS and STI in Thailand*. (cited 2002 Feb 25). http://www.cdcnet.moph.go.th/cdcdept/Aids/AidUpdate/ASEAN%20Report.html.
32. Amornwichet P, Terraratkul A, Simonds RJ, Naiwatanakul T, Chantharojwong N, Culnane M, *et al.* **Preventing mother-to-child HIV transmission: the first year of Thailand's national program.** *JAMA* 2002, **288**:245–248.
33. Cash K, Sanguansermsri J, Busayawong W, Chuamanochan P. *AIDS Prevention through Peer Education for Northern Thai Single Migratory Factory Workers* (*Women and AIDS Program Research Report in Brief*). Washington, DC: International Center for Research on Women, 1997.
34. Elkins D, Maticka-Tyndale E, Kuyyakanond T, Miller P. **Toward reducing the spread of HIV in northeastern Thai villages: evaluation of a village-based intervention.** *AIDS Educ Prevent* 1997, **9**:49–69.
35. Xu F, Kilmarx PH, Supawitkul S, Manopaiboon C, Yanpaisarn S, Limpakarnjanarat K, *et al.* **Incidence of HIV-1 infection and effects of clinic-based counseling on HIV preventive behaviors among married women in Northern Thailand.** *J AIDS* 2002, **29**:284–288.