Preventive Intervention to Reduce Sexually Transmitted Infections

A Field Trial in the Royal Thai Army

David D. Celentano, ScD, MHS; Katherine C. Bond, ScD; Cynthia M. Lyles, PhD; Sakol Eiumtrakul, MD; Vivian F.-L. Go, MPH; Chris Beyrer, MD, MPH; Chainarong na Chiangmai, MA; Kenrad E. Nelson, MD; Chirasak Khamboonruang, MD, PhD; Chayan Vaddhanaphuti, PhD

Background: During 1991 through 1993, sexually transmitted infections among conscripts in the Royal Thai Army in the upper-northern provinces were common: human immunodeficiency virus (HIV) prevalence at induction was 12%, HIV incidence was 2.4% per year, and incidence of sexually transmitted diseases was 17% per year. We evaluated a behavioral intervention to reduce incident sexually transmitted infections among conscripts inducted into the Thai Army in 1993.

Methods: We developed a preventive intervention that addressed consistent condom use, reducing alcohol consumption and brothel patronage, and improving sexual negotiation and condom skills. Companies were assigned to 1 of 3 groups matched on military mission: 450 men were in the intervention group, 681 were in barracks at the same base but did not receive the intervention (diffusion group), and 414 were in distant camps (controls). Baseline HIV serological testing and behavioral interviews were conducted during basic training in 1993. The intervention was applied for 15 months, and men were followed up at 6-month intervals (with repeated HIV serological testing, sexually transmitted disease assessments, and behavioral interviews) through May 1995.

Results: Incident sexually transmitted diseases were 7 times less frequent among men assigned to the intervention than the combined controls (relative risk, 0.15; 95% confidence interval, 0.04-0.55), after adjusting for baseline risk factors (P < .005). There was no diffusion of the intervention to adjacent barracks. The intervention decreased incident HIV by 50% in the intervention group.

Conclusion: Intensive interventions in structured institutions can successfully reduce risk in settings confronting expanding heterosexual HIV epidemics.

Arch Intern Med. 2000;160:535-540

AN EPIDEMIC of human immunodeficiency virus (HIV) infection in heterosexuals has been under way in Thailand since 1991, and some 800,000 to 1 million persons nationwide are estimated to be infected with HIV. The upper-northern provinces bordering Laos and Burma comprise 12% of the Thai population but account for nearly half the cases of acquired immunodeficiency syndrome (AIDS) reported to the Royal Thai Ministry of Public Health. Sentinel surveillance showed an HIV prevalence greater than 40% among northern female commercial sex workers (CSWs) in 1989 and an epidemic incidence rate. Within 2 years, the HIV prevalence among men attending sexually transmitted disease (STD) clinics approached 20% in several provinces. Serosurveys of military conscripts have been conducted by the Royal Thai Army (RTA) since 1989, and a heavy burden of HIV infection has been shown among inductees from the upper north. The HIV prevalence among conscripts from the upper north was 12% during 1991 through 1993, and the incidence was 2.4 per 100 person-years during that interval. The STD incidence among this cohort was 17.0 per 100 person-years.

The military offers a strategic point for mounting preventive HIV interventions for several reasons. It is a tightly organized institution with a captive population and a command structure that offers the potential for wide coverage and sustainability. Historically, military personnel have been at significant risk for STDs. An epidemiological study conducted in the RTA disclosed the following behavioral risk factors for STD infection: frequency of CSW visits (relative risk [RR], 4.14), alcohol consumption before last CSW visit (RR, 2.24), self-reported STD history (RR, 2.62), and sex with girlfriends (RR, 2.0). Didactic health education sessions conducted in previous years had done little to reduce STD and HIV infection rates; thus, the military was motivated to use its command
METHODS

STUDY POPULATION

Military conscription in Thailand is by lottery; conscripts are representative of the lower four fifths of the Thai socioeconomic strata. Mean age at time of conscription is 21 years, and conscription is conducted annually (in April), with induction taking place semiannually (in May and November). Conscripts from the upper north spend 2 months in basic training, followed by posting at RTA camps in this region. Routine health screening includes HIV testing at the time of induction, and conscripts are retained regardless of HIV status, sexual orientation, or drug use. Exemptions are granted for those with advanced education, selected medical disabilities, and some skilled occupations.

Our study population was 1669 men conscripted in April 1993. Baseline HIV screening and risk factor surveys were completed at induction (in May and November 1993), and conscripts were followed up semiannually through May 1995. On the basis of our epidemiological studies of HIV and STD incidence in earlier cohorts of Thai conscripts, we expected that the annual HIV incidence rate would be between 2.0 and 2.5 per 100 person-years, and that the annual STD incidence rate would be approximately 5% to 8%. Because of the size of the annual conscription pool, we had too small a sample to have adequate power to demonstrate intervention efficacy based on HIV incidence (more than 3200 subjects would be required to show a 50% intervention efficacy with 80% power and 2 controls per intervention subject). Therefore, we designed our study to have power to detect a 40% decrease in incident STDs (with nearly 90% power).

PROCEDURES

Soon after induction, the men donated a serum specimen for HIV antibody testing by enzyme-linked immunosorbent assay with standard methods and licensed commercial reagents (Behring, Somerville, NJ, or Organon Teknika, Durham, NC). Reactive specimens were retested in duplicate, with confirmation by Western blot using licensed commercial reagents (Biotech-DuPont, Wilmington, Del). All diagnosed STDs were presumptively treated. Every 6 months, participants received HIV testing and risk reduction counseling. The incidence of STDs (gonorrhea, syphilis, chancroid, and nongonococcal urethritis) was based on clinical diagnosis or symptom reports. Diagnoses of genital herpes and warts were excluded, as they may have been recurrent or untreated prior infections. We were unable to confirm all incident STDs with standard laboratory tests for logistical reasons (remote camps lacked adequate laboratories and men were often on maneuvers), because of high rates of antibiotic self-treatment, and because syndromic treatment guidelines were in force. However, we have shown that self-reported STD symptoms are strongly associated with laboratory findings in this setting.

Each conscript was interviewed by a trained male civilian interviewer separate from the intervention team. The interview assessed sociodemographic factors, previous medical incidents, and conditions associated with HIV risk, including STD history, sexual history with females and males, and substance use. All interviews were conducted in a private setting, and the questionnaires were removed from the bases daily. The research protocols were reviewed and approved by the institutional review boards of Chiang Mai University, Chiang Mai, Thailand, the Royal Thai Army, Chiang Mai, and The Johns Hopkins University, Baltimore, Md.

INTERVENTION

The intervention was implemented in 3 phases. First, at each camp we conducted formative research, including discussion groups and in-depth and structured interviews with conscripts to identify contexts of sexual risk taking, and with officers to determine roles and duties in the study. We identified several common risks for STDs among the conscripts: misperceptions of HIV and AIDS transmission; personal experience with AIDS; disinhibition associated with alcohol consumption; sexual partner selection, including commercial partners; perceptions of partner risk; condom use practices with different types of sex partners; and STD treatment-seeking practices. These issues were incorporated into the intervention.

Second, we selected team members, provided training, and conducted participatory planning by the intervention teams in each camp to develop the intervention manual. Each intervention company had an intervention team composed of squad leaders, paramedics, chaplains, the RTA’s education instructors, and selected conscript leaders. Team members were selected on the basis of voluntary participation and exhibition of leadership skills. Intervention teams participated in 2 training exercises, each lasting 3 days, with ongoing (at least monthly) assistance by the researchers. Exercises included lectures on the epidemiology of HIV and AIDS in the region, data on risk practices, group goal setting within camps and among commanders, and introductions to community resources for people with HIV and AIDS.
Finally, we implemented HIV prevention activities during 15 months, from November 1993 through January 1995. Some of the prevention activities were integrated into the curriculum of the continuing education sessions that are mandatory for all conscripts. Conscripts completed assignments on the collection and presentation of home village data regarding HIV infection (with assistance from the local public health unit charged with AIDS prevention), including AIDS illness and death, stigma, and coping with HIV by families; and a diary tracking daily activities and risk avoidance behaviors during home leave.

In addition, paramedics held weekly health education sessions, modified the previously punitive system of STD detection, and expanded the condom distribution system. Chaplains conducted weekly sessions on Buddhist meditation and ethics related to HIV and AIDS, social and sexual responsibility, and compassion for people living with AIDS. Contests were held among the intervention squads to develop media (eg, comics, posters, songs, and exhibits) to reinforce HIV prevention norms. Finally, trained squad leaders conducted problem-solving exercises, such as analyzing friendship and sexual networks, and discussions such as “How to tell your girlfriend you are infected with HIV.” Small-group educational activities conducted at the squad level included condom skills training, building communication skills through role playing and sexual negotiation, and increasing awareness of behavioral triggers to unsafe behavior.

Trainers made contact at least monthly with each intervention team to elicit qualitative assessments of program implementation and to provide suggestions for intervention activities.

**INTERVENTION ASSIGNMENT**

Assignment of units to treatment conditions was a 2-step process. Because of logistics, we could not randomly assign men to treatment conditions. Companies with the same military mission (in the same battalion) within camps were identified, and matched companies were assigned to intervention, diffusion, or control groups. For example, in Chiang Mai, infantry companies were assigned to intervention and diffusion conditions; similarly, medic units were assigned to these 2 conditions. We attempted to balance assignments to meet the desired sample sizes (ie, a 2:1 ratio of comparison to intervention) and to maintain equal distance between companies assigned to intervention and diffusion on the same base. The diffusion condition was selected to detect whether there was contamination of the intervention to men residing in barracks in the same camp who did not participate in the intervention. In essence, these men had the same jobs as those in the intervention, and similar exposure to HIV and STD risks when off base. Three control units were identified, of which 2 were distant (separated by a mountain range) and 1 was located at a vast military reservation isolated from other units. The matched missions included medical and veterinary units, Special Forces, infantry, and artillery. A total of 450 men were in intervention units, 681 participants were posted to diffusion units, and 414 men were assigned to control units. All men received a 3-hour group HIV and AIDS health education session during basic training.

**DATA ANALYSIS**

Data on STD and HIV incidence among men in the intervention group were compared with those in the diffusion and control groups to evaluate the efficacy of the intervention. Rates of STD incidence were calculated per 1000 person-years of observation, with time calculated as the interval between study visits. Rates of HIV incidence were calculated per 1000 person-years of observation, with infections assumed to occur at the midpoint of the interval between study visits. Data analysis was performed with χ², Mantel-Haenszel χ², and RR ratios for unadjusted relationships between risk factors and STD infections. The generalized estimating equations method allows time-dependent measures from longitudinal studies to be incorporated into the estimation procedure and is an efficient method for autocorrelated data (ie, data from the same person will by nature be correlated, and the analysis removes this component in calculating risk estimates). To be included in the analysis, participants had to have completed a baseline assessment and at least 1 follow-up visit. The calculations for incident STDs included 450 conscripts in the intervention group followed up for 631 person-years and 1095 men followed up for 1552.2 person-years in the combined comparison conditions (92.6% of those eligible). For HIV analyses, a total of 1368 HIV-seronegative conscripts (92.8% of all inductees, and 94.1% of HIV-seronegative conscripts) were followed up for 4306 follow-up visits; these conscripts included 396 persons followed up for 369.6 total person-years in the intervention group and 972 persons followed up for 1431.9 total person-years in the combined comparison conditions. We analyzed the diffusion and control conditions separately and combined them when they had equal risk.
Table 1. Selected Baseline Characteristics of Royal Thai Army Conscripts by Intervention Assignment, 1993

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Experimental (n = 450)</th>
<th>Diffusion (n = 681)</th>
<th>Control (n = 414)</th>
<th>P*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Married</td>
<td>25.3</td>
<td>23.8</td>
<td>21.5</td>
<td>.41</td>
</tr>
<tr>
<td>Education =≤6 y</td>
<td>67.3</td>
<td>58.4</td>
<td>66.0</td>
<td>.004</td>
</tr>
<tr>
<td>Cigarette use</td>
<td>73.1</td>
<td>72.7</td>
<td>73.4</td>
<td>.96</td>
</tr>
<tr>
<td>Alcohol use</td>
<td>94.4</td>
<td>90.7</td>
<td>91.8</td>
<td>.08</td>
</tr>
<tr>
<td>Other drug use</td>
<td>9.6</td>
<td>7.5</td>
<td>11.4</td>
<td>.09</td>
</tr>
<tr>
<td>Sex worker visit (past 6 mo)</td>
<td>56.0</td>
<td>64.0</td>
<td>60.0</td>
<td>.03</td>
</tr>
<tr>
<td>Girlfriend sex (past 6 mo)</td>
<td>25.3</td>
<td>29.8</td>
<td>26.6</td>
<td>.22</td>
</tr>
<tr>
<td>Lifetime history of sex with male</td>
<td>7.1</td>
<td>5.3</td>
<td>5.3</td>
<td>.39</td>
</tr>
</tbody>
</table>

*Based on χ² test with 2 df.

Table 2. Baseline Prevalence and Incidence During Observational Period of HIV Infection and STDs Among Royal Thai Army Conscripts by Intervention Assignment, 1993-1995*

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Group</th>
<th>Prevalence, 1993†</th>
<th>Incidence, 1993-1995§</th>
</tr>
</thead>
<tbody>
<tr>
<td>HIV Infection</td>
<td>Experimental (n = 450)</td>
<td>12.0 (9.0-15.0)</td>
<td>3.5 (0.9-14.0)</td>
</tr>
<tr>
<td></td>
<td>Diffusion (n = 681)</td>
<td>12.3 (9.9-14.8)</td>
<td>6.8 (3.0-15.1)</td>
</tr>
<tr>
<td></td>
<td>Control (n = 414)</td>
<td>9.4 (6.6-12.2)</td>
<td>5.5 (1.8-17.0)</td>
</tr>
<tr>
<td>STDs</td>
<td>Experimental (n = 450)</td>
<td>569.6</td>
<td>280.0</td>
</tr>
<tr>
<td></td>
<td>Diffusion (n = 681)</td>
<td>884.1</td>
<td>260.7</td>
</tr>
<tr>
<td></td>
<td>Control (n = 414)</td>
<td>547.7</td>
<td>315.0</td>
</tr>
</tbody>
</table>

*HIV indicates human immunodeficiency virus; STDs, sexually transmitted diseases.
†Prevalence rate expressed as percentage of men with infections at induction (baseline), with 95% confidence intervals in parentheses.
‡Incidence rate expressed as infections per 1000 person-years of observation during military service, with 95% confidence intervals in parentheses.
§Percentage of men giving a history of an STD at induction (baseline), with 95% confidence interval in parentheses.

RESULTS

Demographic and behavioral risk factors at induction (baseline) were similar in the 3 study groups (Table 1). There was little evidence of bias in treatment assignment by baseline demographic characteristics or behavioral risks for STDs. The 3 groups were equivalent in the proportion married, reported sex with girlfriends and other men, and different psychoactive substances used. Men in the experimental condition were somewhat less likely to report a history of female CSW visits in the 6 months before induction, and men in the diffusion condition reported a lower level of education than in the experimental group. Men inducted in November had somewhat higher histories of CSW visits but less frequent reports of prior STDs. Despite this, baseline HIV prevalence at conscription was equivalent in the 3 groups (12.0%, 12.3%, and 9.4%, respectively; P = .31) (Table 2), and STD histories were similar (P = .34).

Since there was no difference in STD incidence for the diffusion and control groups (P = .24), we combined them. There was a statistically significant difference between the intervention and combined comparison groups in incident STDs in univariate analysis (RR, 0.16; 95% confidence interval, 0.05-0.60; P = .006) (Table 3). In multivariate analysis, after adjusting for types of recent sexual partners and STD history, the experimental group had an 85% lower STD incidence than the comparison group.

The intervention difference in incident STDs did not result from differences in many of the risk behaviors targeted in the intervention (Table 4). This analysis used multivariate logistic regression to compare the intervention group, diffusion subjects, and controls regarding reports of CSW visits, having sex with girlfriends, and having sex with men, after adjusting for baseline levels of risk. The experimental group had a higher rate of brothel visits than the control group. If the intervention had its impact through this behavioral factor, we would have seen fewer CSW visits in the intervention group compared with the diffusion and control groups. No differences by treatment condition were seen for having sex with girlfriends or other males.

Next, we addressed risk behaviors among men who reported a CSW visit by assignment (Table 5), after adjusting for each risk as reported at baseline (ie, self-reported CSW visits, drinking, and condom use before conscription). The intervention appeared to have no impact on reducing alcohol use before CSW visits, an intervention target. Men in the intervention group were significantly less likely to report visiting CSWs alone (more than a 2-fold reduction), another target of the intervention (to maximize peer pressure for maintaining safe

©2000 American Medical Association. All rights reserved.
behavior). No differences were seen by group in improved consistency of condom use with CSWs, which was nearly universally reported (>90%) at all CSW visits, regardless of group assignment. The significant decline in STDs in the experimental group is probably attributable to behaviors not measured in the evaluation.

Seroconversions for HIV were documented for 11 conscripts during the follow-up (an incidence rate of 5.5 per 1000 person-years): 2 HIV seroconversions occurred in the intervention group and 9 in the combined diffusion (n = 5) and control (n = 4) groups. The difference between the latter 2 groups was not statistically significant (P = .36). Since HIV seroconversion was almost 4 times less common than expected, we had inadequate power to detect a significant difference between the intervention and combined comparison groups (P = .90). The intervention effect (RR 0.49; 95% confidence interval, 0.11-2.26), however, was in the hypothesized direction.

Major changes have been documented in the risk behaviors of young men in Thailand, a country that has witnessed an expanding HIV epidemic. The HIV prevalence at induction in our study cohort was equivalent to that of conscripted in the military lottery; this study design is slightly biased toward a lower socioeconomic group. Also, the integration of HIV and AIDS prevention into the daily life of the conscripts could only be possible in a vertically integrated institution with commitment to conducting this type of trial. The intervention developed indigenously with the RTA might not be easily replicated at the village or community levels, but could be evaluated in other male institutions (ie, police forces) or vertical institutions (workplace settings). Wider-scale experimental field trials that use the processes of social action and skills acquisition used here are needed in other settings and contexts to establish their generalizability. Laboratory diagnoses of STDs as well as routine ascertainment of possibly asymptomatic infections by noninvasive methods would strengthen the results reported herein and overcome possible biases.

These are the first findings, to the best of our knowledge, from an experimentally controlled investigation in a developing country that evaluated a community-level field trial of a behavioral intervention to reduce HIV risks, using biological outcomes to determine intervention effectiveness. Other studies have used peer leaders, influential spokespersons for HIV risk reduction, or group in-

### Table 4. Adjusted Relative Risks for Behavioral Risks Among Royal Thai Army Conscripts by Intervention Assignment, 1993-1995

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Sex Worker</th>
<th>Girlfriend Sex</th>
<th>Sex With Male</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Experimental group</strong></td>
<td>1.36 (1.09-1.70)</td>
<td>0.88 (0.67-1.17)</td>
<td>0.91 (0.60-1.39)</td>
</tr>
<tr>
<td><strong>Diffusion group</strong></td>
<td>1.10 (0.90-1.35)</td>
<td>1.03 (0.80-1.33)</td>
<td>0.85 (0.58-1.24)</td>
</tr>
<tr>
<td><strong>Baseline risk†</strong></td>
<td>3.74 (3.04-4.59)</td>
<td>4.63 (3.75-5.71)</td>
<td>20.50 (14.00-29.80)</td>
</tr>
</tbody>
</table>

*Adjusted for date of induction and calendar time, as compared with the control group.
†Reporting the sexual risk at baseline.
tervations, or engaged the assistance of mass media in promoting safer sex practices. However, these studies have relied solely on self-reports of risk behaviors, not incident STDs, and have not used longitudinal cohort designs to evaluate efficacy. Three recent studies in the United States have included STDs as outcomes of prevention strategies. In the National Institute of Mental Health Multisite HIV Prevention Trial, men in the intervention had significantly lower rates of incident gonorrhea than controls, and although no difference was found for women. Project RESPECT reported that intervention differences in STD incidence found at 6-month follow-up decayed with further follow-up. The final study reported a reduction in chlamydia and gonorrhea infection rates at 6 and 12 months among Mexican American and African American women who attended small-group sessions compared with a control condition. The Thai study corroborates these findings in the setting of a developing country.

The results of this study demonstrate the utility of conducting interventions at the institutional level. Organization structural features can be used to reinforce messages, to integrate the intervention across activities of daily life, and to take advantage of naturally existing interaction networks. The military’s command structure lends itself well to HIV and STD prevention. Other similar institutions include correctional facilities, schools, and workplaces.

Accepted for publication May 6, 1999.

This work was supported in part by the AIDS Control and Prevention Project of Family Health International, Arlington, Va, with funds from the US Agency for International Development, Washington, DC, although the views expressed in this article do not necessarily reflect those of Family Health International or the US Agency for International Development. Additional support was provided by grant R21-AI33862 from the National Institute of Allergy and Infectious Diseases, Bethesda, Md, and by contract N01-AI35173 with the National Institute of Allergy and Infectious Diseases, National Institutes of Health, Bethesda, Md, through Family Health International, Research Triangle Park, NC.

We thank Chawalit Natpratan, MD, Choti Theetra, MD, Somboon Supraserth, RN, S. Ruchhapont, Som-nakat Chachawan, MS, Prasit Leeprecha, MA, Sukanya Phonsohpakul, Carl Kendall, PhD, Michael Sweat, PhD, and the research teams from the Social Research Institute and the Research Institute for Health Sciences, Chiang Mai University, Chiang Mai, Thailand.

Reprints: David D. Celentano, ScD, MHS, Department of Epidemiology, Johns Hopkins University School of Hygiene and Public Health, 615 N Wolfe St (Suite E-7132), Baltimore, MD 21205 (e-mail: dcelenta@jhsphs.edu).

REFERENCES