Published in final edited form as:

Soc Sci Med. 2009 January ; 68(1): 69–79. doi:10.1016/j.socscimed.2008.09.061.

“Evaluation of a peer network intervention trial among young methamphetamine users in Chiang Mai, Thailand”

Catherine Sutcliffe, MPH

Johns Hopkins Bloomberg School of Public Health, csutclif@jhsph.edu

Bangorn Srirojn, MA

Chiang Mai University, rhobsrj@chiangmai.ac.th

Carl A Latkin, PhD

Johns Hopkins Bloomberg School of Public Health, clatkin@jhsph.edu

Ajpinun Aramratanna, MD, PhD

Chiang Mai University, apinun@mail.med.cmu.ac.th

Susan G Sherman, PhD, MPH

Johns Hopkins Bloomberg School of Public Health, ssherman@jhsph.edu

Abstract

Since the 1990s, there has been a proliferation of methamphetamine use in Thailand, particularly among young people. Simultaneously, risky sexual behaviors among this population have increased. This study examined the effects of a peer network intervention and a life skills intervention on methamphetamine and HIV risk behaviors among 18–25 year olds in Chiang Mai, Thailand. Between April 2005 and June 2007, we conducted a randomized behavioral trial to compare the efficacy of a peer educator, network-oriented intervention with a best practice, life-skills curriculum on methamphetamine use, sexual behaviors, and incident sexually transmitted infections (STIs). Follow-up occurred at three, six, nine, and twelve months. Both conditions consisted of seven, two hour, small group sessions. Longitudinal analyses of the three outcomes were conducted by fitting repeated measures logistic regression models using generalized estimating equations. Participants (N=983) attended a median of six sessions, with no differences between arms. At each follow-up visit, retention was greater than 85%. Participants were 75% male and were a median of 19 years old. Over time, participants in both conditions showed a significant and dramatic decline in self-reported methamphetamine use (99% at baseline versus 53% at 12-months, $p<0.0001$) and significant increase in consistent condom use (32% baseline versus 44% at 12 months, $p<0.0001$). Incident STIs were common, with no differences between arms. Chlamydia had the highest incidence rate, 9.85/100 person-years and HIV had a low incidence rate of 0.71/100 person-years. Among young Thais, we found that a peer educator, network-oriented intervention was associated with reductions in methamphetamine use, increases in condom use, and reductions in incident STIs over 12 months. We also found parallel reductions with the life skills condition. To our knowledge, this is the first such trial targeting this population. Small group interventions are an effective means of reducing methamphetamine use and sexual risk among Thai youth.

© 2009 Elsevier Ltd. All rights reserved

Corresponding Author: Dr. Susan G Sherman Johns Hopkins Bloomberg School of Public Health Baltimore, MD UNITED STATES [Proxy] ssherman@jhsph.edu.

Publisher's Disclaimer: This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final citable form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

Keywords

methamphetamine; randomized behavioral trial; Thailand; young people; intervention; sexually transmitted infections (STIs)

INTRODUCTION

Over the past two decades, there has been a proliferation of methamphetamine (MA) use in Thailand, as evidenced by epidemic growth in rates of methamphetamine seizures and reports of methamphetamine consumption (Celentano, Jittiwutikarn, Hodge, Beyrer, & Nelson, 1998; Thaikla, 2006; UNAIDS, 2003). There were an estimated 2.5 millions methamphetamine users in Thailand in 2002, representing a three fold increase since 1999 (Office of the Narcotics Control Board of, 2002). methamphetamine use in Thailand is now considered an epidemic requiring extensive intervention (Farrell, Marsden, Ali, & Ling, 2002; Office of the Narcotics Control Board of, 2002; Razak, Jittiwutikarn, Suriyanon, Vongchak, Srirak, Beyrer *et al.*, 2003; Verachai, Dechongkit, Patarakorn, & Lukanapichonchut, 2001).

MA is a synthetic central nervous system stimulant which releases high levels of the neurotransmitter dopamine, thereby enhancing mood (Freese, Miotto, & Reback, 2002). Its favorable effects include euphoria, increased sexual arousal, appetite suppression, heightened energy, and improved sexual performance (Kall & Nilsson, 1995; Klee, 1993; Logan, Cole, & Leukefeld, 2002). Long-term use can result in dopamine depletion, which can result in severe mood disorders as well as paranoia, violent behavior, depression, psychosis, and cardiopulmonary damage (Anglin, Burke, Perrochet, Stamper, & Dawud-Noursi, 2000; McKetin, McLaren, Lubman, & Hides, 2006; Sokolov, Schindler, & Cadet, 2004). methamphetamine use has been found, among men who have sex with men, to be associated with prolonged intercourse and decreased condom use, thereby exacerbating the risk of acquiring HIV and sexually transmitted infections (STIs) (Bluthenthal, Kral, Gee, Lorrwick, Moore, Seal *et al.*, 2001; Drumright, Patterson, & Strathdee, 2006; Edlin, Irwin, Faruque, McCoy, Word, Serrano *et al.*, 1994; Hando & Hall, 1994; Molitor, Ruiz, Flynn, Mikanda, Sun, & Anderson, 1999; Semple, Patterson, & Grant, 2002). The extent to which methamphetamine influences sexual risks among Thai youth is largely unknown.

Studies of sexual behavior in young Thais suggest that premarital sexual activity is prevalent, condom use is rare outside of commercial sex, and HIV risk perception is low (Manopaiboon, Kilmarx, van Griensven, Chaikummao, Jeeyapant, Limpakarnjanarat *et al.*, 2003; Verachai, Dechongkit, Patarakorn *et al.*, 2001). Historically, HIV and STI rates have been low among Thai young adults outside of high risk populations such as female sex workers and their clients and injection drug users. But currently, the fastest growing segment of AIDS in northern Thailand is aged 25–29 years old, indicating transmission is occurring during adolescence and early adulthood (Kilmarx, Supawitkul, Wankraioj, Uthavivoravit, Limpakarnjanarat, Saisorn *et al.*, 2000).

In baseline analyses of the current study sample, we reported alarmingly high STI rates among our sample of 18–25 year old Thai methamphetamine users, with 24% of participants testing positive for Chlamydia and 6% testing positive for gonorrhea (Celentano, Siroj, Sutcliffe, Quan, Thomson, Keawvichit *et al.*, 2008). This is a marked increase from a 2001 study of similarly aged, sexually active youth (n=1,069) in Northern Thailand in which 3% tested positive for Chlamydia and 6% tested positive for gonorrhea (van Griensven, Supawitkul, Kilmarx, Limpakarnjanarat, Young, Manopaiboon *et al.*, 2001).

A recent meta-analysis of behavioral interventions focused on cocaine and amphetamine cessation found that the majority of the 27 randomized trials reviewed were cognitive behavioral interventions (Knapp, Soares, Farrel, & Lima, 2007). All but one study, which was conducted in Australia, were carried out in the United States and cognitive behavioral interventions outperformed simple clinical management and referrals. Only one study targeted adult amphetamine users (Baker, Boggs, & Lewin, 2001), with the remaining studies conducted among adult cocaine users. There is a scarcity of tested interventions that specifically target young methamphetamine users. We found only one study that targeted 14–19 year old methamphetamine users (N=48) (Srisurapanont, Sombatmai, & Boripuntakul 2007). The study took place in Chiang Mai, Thailand and compared a 15 minute psycho-education session to two 20-minute counseling sessions over eight weeks, finding modest reductions in methamphetamine use. The study was limited by the small sample size and duration of follow-up.

Another body of relevant intervention research is among peer network interventions to reduce HIV related risk among injection drug users. Such interventions have produced reductions in both sexual and parenteral risk behaviors in the United States (Garfein, Golub, Greenberg, Hagan, Hanson, Hudson *et al.*, 2007; Latkin, Sherman, & Knowlton, 2003; Purcell, Latka, Metsch, Latkin, Gomez, Mizuno *et al.*, 2007) but not in Thailand (Latkin, Donnell, Metzger, Sherman, Aramratanna, Davis-Vogel *et al.*, 2008). The current study evaluates a randomized peer education, social network intervention among young Thais in Chiang Mai, Thailand.

METHODS

Study Design

The 12 month trial was designed to compare the efficacy of a peer educator, network-oriented intervention (“peer education” condition) with a best practice standard life skills curriculum (“life- skills” condition) on methamphetamine use, sexual risks, and incident STIs among young adults in northern Thailand. Both conditions were comprised of seven two-hour sessions in a small group format. Sessions were comprised of educational discussions, engaging activities, and homework.

Recruitment and Eligibility

Between April 2005 and June 2006, 1,263 18–25 year olds were screened for eligibility in the study (see Figure 1). The target population's age and recruitment sites were greatly informed by an extensive 18-month formative, ethnographic research stage prior to the development and implementation of the trial (German, Sherman, Sirirojn, Thomson, Aramrattana, & Celentano, 2006; Sherman, Gann, German, Sirirojn, Thomson, Aramrattana *et al.*, 2008; Sherman, German, Sirirojn, Thompson, Aramrattana, & Celentano, 2008). Index participants were eligible for the trial if they were between the ages of 18 and 25 at screening, used methamphetamine at least three times *and* had sex at least three times in the past three months, *and* were able to enroll at least one of their sex or drug network members in the study within 45 days of screening. Network members were eligible for enrollment if they were also between the ages of 18 and 25 at screening and had used methamphetamine at least three times *or* had sex with the index participant at least three times in the last three months. Participants were excluded if they refused to have blood drawn or provide urine, if they were enrolled in another prevention study, or if they refused to provide locator information. The trial was approved by the Institutional Review Board (IRB) at Johns Hopkins Bloomberg School of Public Health, the Human Experimentation Committee at the Research Institute for Health Sciences, Chiang Mai University, and the IRB of the Ministry of Public Health in Thailand.

Baseline and Randomization

Baseline assessments were conducted the day that individuals were screened eligible. During this appointment, participants provided informed consent, provided biological specimens, including urine and one tube of blood, to be tested for HIV, STIs, and drug use, and underwent interview-administered individual and network surveys. The individual survey included questions on the participant's socio-demographic background, substance use history, and sexual history. The network survey included a series of questions about the number and types of members involved in each participant's social, sexual, and drug networks as well as their level of interaction and connectedness. Participants providing biological specimens received pre-test counseling and were scheduled a two week follow-up visit for STI test results, post-test counseling, and referral for medical treatment as necessary. The baseline visit lasted approximately one and a half hours.

Randomization of index members occurred at the end of the baseline visit. Indexes were randomized to either the peer education or the life skills condition within 45 days of their baseline visit. Randomization occurred in blocks (cohorts) once a minimum of 16 and a maximum of 24 index participants had been enrolled, and randomization sequences for each cohort were generated by a computer program. Scheduling for the first session occurred within two weeks of randomization. In total, 21 cohorts were randomized over a period of 15 months. As this was a peer network intervention and we were interested in examining the effects of index participants on their network members' risk behaviors, network members were not randomized to attend the peer education or life skills sessions. Their involvement was limited to the baseline and four follow-up visit assessments.

Follow-up and Reimbursement

Follow-up visits occurred at three-, six, nine- and twelve-months following randomization. At each follow-up visit, participants were administered the individual survey by study interviewers. At the twelve-month study visit, participants provided biological specimens for STI testing received pre-test counseling and were scheduled a two-week follow-up visit for test results, post-test counseling and referral for medical treatment as necessary. Interviewers were blind to the participant's group allocation. Follow-up visits needed to occur within 30 days of the scheduled visit or it was considered a "missed" visit, unless participants were in the hospital or incarcerated. Visits occurred on average within two weeks of their scheduled follow-up visit. Participants were compensated 200 Baht (\$5 USD) for each of the five study assessments and each of the seven intervention and control sessions, resulting in the opportunity to earn a total of \$55 USD.

Peer Education and Life Skills Conditions

Each study condition consisted of seven two-hour sessions that met twice weekly over the course of a month. Cohorts were comprised of eight to twelve participants. Each study condition had two facilitators with one back up (totaling six facilitators) who were in their early 20s and had been a part of the ethnography team in the study's first phase. Facilitators were trained by the study's first and third authors in an intensive week long training. A detailed description of both arms is located in Table 1. Participants in the peer education condition also attended two booster sessions that occurred three- and six-months after study entry. Participants were not paid for booster session attendance. The peer education condition was based on theory, informed by an extensive 18-month formative research phase, and built upon our previous intervention experience in Thailand (Latkin, Donnell, Metzger *et al.*, 2008) and in the United States (Latkin, Sherman, & Knowlton, 2003). Persuasion and behavior change theories shaped the intervention, including diffusion of innovation (Rogers, 1995), social learning theory (Bandura & Prentice, 1977), and social identity theory (Turner, 1978). Based on our formative research we deemed these theories culturally appropriate and salient to youth in terms of their

methamphetamine use trajectories. Overall, these theories shaped the intervention by training individuals in methamphetamine-related risk reduction behaviors that they then communicated to members of their social network. The underlying assumption was that individuals are more likely to view health education information as more credible if the information is received from peers. Our 18-month formative phase was comprised of 48 in-depth interviews with current and former methamphetamine users (German, Sherman, Sirirojn *et al.*, 2006; Sherman, Gann, German *et al.*, 2008; Sherman, German, Sirirojn *et al.*, 2008), extensive participant observations, and key informant interviews with the target population as well as individuals who worked with youth in such arenas as criminal justice, youth focused organizations, and drug treatment programs. Draft sessions were piloted with the target population and focus groups were conducted to garner feedback. The sessions were developed in English and then translated into Thai. Two U.S. team members who led the intervention development attended pilot sessions and focus groups and reworked sessions with the Thai team.

The peer education condition aimed to teach participants to think critically about and reduce their methamphetamine use and sexual risk behaviors. Participants were taught communication skills that they practiced in role plays during the sessions and used to convey methamphetamine and risk reduction messages to specific social network members that were identified through a social network inventory administered at baseline. The first session aimed to build group cohesion and identity, through having the group establish its own “group rules” to follow during the ensuing sessions. During this session, participants delineated how methamphetamine affected themselves, their social network, and their family. The second session focused on social influences in initiating methamphetamine use and taught participants a set of communication tools that were reinforced and used throughout the subsequent sessions in designated role plays and videos. The third and fourth sessions focused on sexual risk reduction, sexually transmitted infections (STIs), and communication skills in sexual situations. The fifth session focused on stigma and examined methamphetamine's effects on participants' families and the broader community. Because of the intervention's focus on creating a positive and constructive role for participants, the sixth session was dedicated to participants being involved in a community service project, which was chosen by each group. These projects lasted two to four hours and included painting or cleaning temples, garbage clean-up in villages, renovating a village play ground, and weeding a community garden. During the seventh and final session, participants reviewed the content from the previous sessions and graduated from the project. Sessions were comprised of interactive teaching modules, instructive games, and problem-solving activities. Sessions ended with assigning peer education homework in which participants would discuss a specific issue with specific peers (MA-using and/or sexual partners), which were reviewed at the beginning of the next session.

The life skills condition was a best practice intervention based on a skills building approach. It was largely derived from cognitive behavioral psychology, which is widely used with youth in drug treatment and juvenile justice settings in Thailand. Juvenile justice staff were consulted throughout the development of the life skills condition. The sessions focused on the causes and consequences of methamphetamine use at the individual level, with specific attention to stress in the role of drug use. One session focused on sexually transmitted infections and sex risk behaviors. The sessions placed no emphasis on communicating the session content to social network members. The first session focused on examining the role of methamphetamine in participants' life. The second session reviewed problem solving tools and friendships. The third session focused on the physiological effects of methamphetamine use. The fourth session addressed STIs and safer sex practices. The fifth session considered stress and coping. The sixth session focused on managing emotions and self worth. The last session reviewed the intervention and participants graduated. Copies of the manuals for the peer education and life skills conditions are available in Thai and English from the study authors.

Study Endpoints

The study's endpoints, including two behavioral and one biological outcome, were used to determine the efficacy of the intervention in reducing methamphetamine use and associated sexual risks. Methods to enhance the reliability of self-reported behaviors included: 1) using unique study ID's to maintain confidentiality during data collection; and 2) using a brief recall period (three months and 30 days). In addition, STI testing at the 12 month visit provided a biological outcome measure.

The first behavioral endpoint was frequency of methamphetamine use in the three months prior to each interview. To this end, participants were asked at each visit whether they had used methamphetamine in the three months prior to the interview (yes or no). For those who reported that they had used methamphetamine, they were further asked their method of administration of methamphetamine use and the frequency of use. The second behavioral endpoint was 100% condom use with either vaginal or anal sex in the 30 days prior to each interview. Participants were asked at each visit to report the number of times they had engaged in vaginal and anal sex (separately) in the past 30 days prior to the interview. They were then asked to report the number of times they had engaged in vaginal and anal sex (separately) without a condom. The outcome variable was dichotomized to 100% condom use during either vaginal or anal sex and less than 100% condom use. Participants who reported using a condom during all sexual activities (vaginal and/or anal) were assigned to 100% condom use. In addition, participants reporting no sexual activity in the past 30 days or three months (approximately 25%) at a given follow-up visit were assigned to the 100% condom use category.

The third endpoint was the presence of a laboratory-confirmed sexually transmitted infection. To determine the incidence of HIV and STIs during the trial, participants were tested for the following STIs at the baseline and 12 month follow-up visits: indexes and their network (drug and/or sex) members were tested for Chlamydia and gonorrhea; indexes and their sexual network members were tested for HSV-2; and indexes were tested for HCV. This protocol was adopted due to financial constraints which prohibited testing all study participants; therefore priority was given to indexes and their sexual network members. Participants were offered HIV testing on a voluntary basis, according to instructions from the Thai IRBs. Participants who tested positive for HCV or HSV-2 at baseline were not re-tested at the 12 month follow-up visit. Participants testing positive for gonorrhea or Chlamydia at baseline were initially referred for medical treatment, scheduled for post-treatment testing one month after baseline, and were eligible for incidence testing at the 12 month follow-up visit.

Incident gonorrhea and Chlamydia were defined as a positive laboratory test result for gonorrhea or Chlamydia in first-void urine (Amplicor CT/NG PCR; Roche Molecular System, Inc., Branchburg, New Jersey). Incident HCV was defined as a positive laboratory test result for HCV antibodies (IMx Anti HCV test; Abbott Diagnostics, Germany). Incident HSV-2 was defined as a positive laboratory test result for IgG antibodies (HerpeSelect 2 ELISA Ig G; Focus Diagnostics, Cypress, California). Incident HIV was defined as a positive laboratory test result for HIV antibodies (IMx HIV-1/HIV-2 III Plus tests; ABBOTT Diagnostics, Germany), with positive samples confirmed with Western blot (Genelabs Diagnostics HIV Blot 2.2; Genelabs Technologies, Inc., Singapore).

Statistical Analysis

This study randomized networks of drug users and collected risk behavior information at three month intervals. Data were analyzed on an intent-to-treat basis. Differences between the peer education and life skills conditions at baseline were assessed using chi-square tests for nominal variables.

Longitudinal analyses were conducted by fitting repeated measures logistic regression models using generalized estimating equations for both of the behavioral outcomes. For all models, basic effects included intervention assignment, follow-up visits and the baseline value of the behavior if a difference was found between the intervention and control conditions at the baseline visit. Time by intervention interactions were added to the basic model. Covariates found to differ between intervention and control conditions were added as time-varying covariates. Overall intervention effects, intervention effects at each follow-up visit and time by intervention interactions were assessed from the models by computing Wald tests. Separate models were fit for the total sample and for indexes only. All analyses were conducted in STATA version 9.2 (StataCorp, 1997). Correlations between responses by indexes and members of their sexual or drug networks were explored. As the correlation was minimal (data not shown), multi-level modeling accounting for the correlation within networks in addition to the repeated measures for each participant was not conducted.

Differential intervention effects by baseline characteristics of the participant (age, gender, and urban residence) specified *a priori* were assessed by adding the covariate and an intervention by covariate interaction term to the basic model. The effect of session attendance on the efficacy of the intervention was also assessed by adding a binary measure of session attendance (attending at least six of seven sessions) as well as an interaction term to the basic model (indexes only).

For the biological outcome, each STI was assessed separately. Rates per 100 PY were calculated by accumulating person-time from the date of the baseline visit to the date of the 12-month follow-up visit. For gonorrhea and Chlamydia, participants positive at baseline and 12 months were included if they tested negative at a post-treatment visit occurring between the baseline and 3-month follow-up visits. For all participants testing positive at baseline person-time accumulated from the date of their 3-month follow-up visit. Differences in STI rates between the peer education and life skills conditions were assessed by calculating rate ratios and exact confidence intervals. Separate STI rates and rate ratios were calculated for the total sample and for indexes only.

RESULTS

Enrollment, Adherence, and Retention

The CONSORT flow diagram of participation and study visit rates is located in Figure 1. A total of 1,263 were screened and 1,189 (94%) were eligible for randomization. Of the 1,189 eligible participants, 983 (83%) completed their baseline visit - 415 (42%) were indexes and 568 (58%) were network members. Index participants attended a median of six sessions, with no significant differences between those who were in the intervention versus standard arms (6 vs. 6, $p=0.75$). At each of the four follow-up visits, follow-up was greater or equal to 90% (range: 89% – 95%) for index participants and 86% (range: 85% – 91%) for network participants in both arms. Among index and network members in both arms, there was at least an 89% retention rate at the 12-month follow-up. At each of the four study visits, retention was at least 87% for the network participants. The 3-month and 6-month booster sessions were attended by 59% and 58%, respectively, of the peer education condition index participants.

Demographics, sexual risks, and drug use behaviors

Demographic characteristics, drug and alcohol use patterns, and sexual behaviors that were reported at baseline are displayed in Table 2. The sample ($N=983$) was 75% male, with a median age of 19 (IQR: 18–20), primarily Buddhist (97.1%), and ethnically Thai (99.2%). A majority (63.8%) reported living with their parents. Participants' education level was low, with only 39% reporting being currently in school and a median of nine (IQR:9–11) years of schooling.

Participants reported heavy rates of drinking, with over half reporting drinking alcohol four or more days per week, and close to two-thirds scoring two or more on the CAGE (Ewing, 1984), a measure of drinking problems. Half of the sample reported using methamphetamine two or more days per week and a minority, 5%, reported ever having injected drugs. Over 95% of participants smoked methamphetamine [data not shown]. Over two-thirds reported having a current sexual partner and 44% reported having three or more heterosexual partners in the past year. There were few significant differences in demographic or reported drug use patterns between participants randomized to the peer education compared to the life skills condition. A significantly higher percentage of participants in the peer education condition compared to those in the life skills condition reported drinking problems (77% vs. 71%, $p<0.05$), condom use at last vaginal sex act (38% vs. 31%, $p<0.05$) and “always” using condoms in the past 30 days (22% vs. 16%, $p<0.05$).

Effects of the intervention

Table 3 displays the effect of the intervention on the proportion of participants who reported methamphetamine use in the three months prior to each study visit, for the total sample and for indexes alone. Overall, there was no difference between the two conditions and no differences were found at any of the study visits. Indexes and network members in both conditions showed a dramatic decline in self-reported methamphetamine use over time ($p<0.0001$). Among all participants, 97% (standard arm) and 98% (intervention arm) reported methamphetamine use at baseline compared to slightly over half (54% for control and 53% intervention) at twelve months. When considering only the index participants, the same results were found. Trends in methamphetamine use over time are displayed in Figure 2.

Table 4 reflects the effect of the intervention on reported consistent condom use in the three months prior to each study visit. Overall, there was no difference in condom use by study condition for all participants or for indexes only, after adjusting for baseline condom use. Indexes and network members in both conditions showed a dramatic increase in condom use over time ($p<0.0001$). Among all participants, 29% (standard arm) and 34% (intervention arm) reported consistent condom use at baseline compared to 44% (standard arm) and 46% (intervention arm) at twelve months. When considering only the index participants, the same results were found. Trends in consistent condom use over time are displayed in Figure 3.

At baseline, 8.0%, 2.5% and 1.0% of participants providing specimens tested positive for HSV-2, HCV and HIV, respectively, and were thus ineligible for the analysis of STI incidence. Twenty-two percent and 6% of participants tested positive for Chlamydia and gonorrhea at baseline, respectively. Nineteen percent of participants testing positive for either Chlamydia or gonorrhea returned for post-treatment testing one month later; all but one tested negative. Approximately half of the participants (55%) were tested for at least one of the STIs of interest at both the baseline and 12-month visits. Those tested were significantly more likely to be female and to report casual sex at baseline and were significantly less likely to report consistent condom use at baseline. No significant differences were found by intervention condition or substance use. Incident STIs for all of those tested are displayed in Table 5. New cases of STIs were quite common in the entire cohort, with an incident rate of: 9.85 per 100 person years for Chlamydia; 2.57 per 100 person years for gonorrhea; 0.28 per 100 person years for HCV; 3.53 per 100 person years for HSV-2; and 0.71 per person years for HIV. There was a significant difference between incident gonorrhea in the peer education compared to the life skills condition (3.90 per 100 person years vs. 1.14 per 100 person years), with no other significant differences between the two groups regarding incident STIs.

DISCUSSION

The current study found that a randomized peer education, social network intervention was associated with reductions in methamphetamine use and increases in condom use over 12 months among a sample of young Thais. However, we also found parallel and just as significant reductions associated with the life skills training condition. To our knowledge, this is the first such study examining the effects of behavioral interventions among a randomly assigned sample of young methamphetamine users in Thailand. Even though both conditions were based on the philosophy of harm reduction rather than zero tolerance, a large percentage decreased their methamphetamine use throughout the course of the study. Both study arms were well received, as indicated by extremely high retention rates in both arms, being close to 90% throughout the trial duration. The study indicates that small group interventions are highly appropriate in reducing risk among young adult Thais.

Both arms produced a number of important changes in methamphetamine and sexual risk behaviors. At month twelve, only 53% of all study participants reported having smoked methamphetamine in the previous three months. Reductions in reported methamphetamine use were reported at each of the four follow-up study visits. Some evidence of reduction was inevitable based on the inclusion criteria for indexes of being a fairly regular methamphetamine smoker, but the decrease in use continued over time. Condom use was rare in this sample but we found modest increases in the total sample over time. The lack of condom use was supported by extremely high rates of STIs in the sample, reported elsewhere (Celentano, Siroj, Sutcliffe *et al.*, 2008). Over time, there was less of an impact on the sexual compared to drug risk behaviors in both conditions, similar to findings from trials among injection drug users (Garfein, Golub, Greenberg *et al.*, 2007; Latkin, Sherman, & Knowlton, 2003; Purcell, Latka, Metsch *et al.*, 2007). In Thailand where condom use is extremely rare outside of commercial sex, sexual behavior change presents a great challenge and perhaps would have been better addressed in a single sex setting.

Although we failed to find anticipated significant differences between study arms in regard to the three study outcomes, the findings were quite robust. No differences were found by gender, age, number of intervention sessions attended, or enrollment status (index vs. network). There are several possible explanations for our failure to detect significantly greater risk reductions in the intervention versus standard arm. First, session attendance and follow-up rates were consistently high in both arms indicating a high level of interest. Second, the life skills arm might have been similar enough that they produced comparable results. The largest difference between the two arms regarding content was the intervention arm's focus on peer education, diffusion of innovation, and social influence. These additions failed to produce a significant difference in the study outcomes between the two arms. This leads us to believe that perhaps the comparison arm was too similar to the intervention with its parallel, albeit not as intense, focus on both the individual motivations for drug use as well as the effects of methamphetamine use on the individual, family, and community as well as sexual risk and STIs. Third, the current study occurred directly in the wake of the Thai Government's "war on drugs" (Sherman, Aramrattana, & Celentano, 2007; Vongchak, Kawichai, Sherman, Celentano, Sirisanthana, & Latkin, 2005), which resulted in the arrest and forced treatment of thousands of drug users, as well as the extrajudicial killings of over 2500 people. In this context, it was difficult not to provide a comparison condition that was meaningful to the study participants and that provided them with important risk reduction information delivered in a humane and respectful manner. Perhaps any risk reduction intervention targeting methamphetamine users in the wake of the "war" would have resulted in methamphetamine use reductions. Additionally, condoms were equally accessible to all study participants who were tested for HIV/STIs in pretest counseling as well as to all who asked for it. We do not believe that merely having condoms available resulted in similar rates of condom use over the course of a year, but could have played a small

role. Lastly, it is highly probable that contamination occurred between the two study arms. Based on our observation at the study house, many participants enrolled in the study with or were referred to the study by their friends who could have been randomized to different study arms.

The study's findings should be viewed in light of several limitations. Firstly, the study utilized nonrandom sampling recruitment methods and had inclusion criteria regarding regular sexual behavior and methamphetamine use, therefore generalizability of the study's results could be limited. There is also some risk of sampling bias due to recruitment time periods and locations, although it is thought that the variety of recruitment sources and the extensive experience of our staff mitigated this concern. Secondly, behavioral data were collected through self-report and it is possible that social desirability influenced participants' responses, particularly in light of the recent "war on drugs." As a result, drug users might have been reluctant to participate in research or share accurate information in such a context. However, the research took place in an unmarked building and the Thai research team worked closely with the police to ensure participant safety. Additionally, our research was guided by an active community advisory board to provide advice to ensure respondent safety and trust. Condoms were available to study participants who were underwent HIV/STI counseling and testing as well as upon request. This could have affected condom use in both arms but we do not know the extent that this effected condom use over time. Lastly, there is the possibility that tight social networks were randomized to both control and intervention arms, leading to a high degree of contamination that resulted in a bias towards the null.

It is important to highlight that the expense of such a randomized trial is prohibitive in terms of exact replication in the field. But many lessons can be learned that do not necessitate an exact replication. Lessons include the effectiveness of small group interventions and specific effective modes of information delivery for the target population.

The study was characterized by a number of strengths. Secondly, the study was extremely popular among participants. This was evident by their level of enthusiasm as well as the length of time that participants spent at the study house surrounding their visits – arriving early and staying after interviews or study sessions. This was the result of extensive formative research, an extremely dedicated staff, and study arms that spoke to the needs and interests of the target population.

Acknowledgments

We would like to acknowledge support from a grant from the National Institutes of Health (1 R01 DA14702) and thank the staff of the Research Institute of Health Sciences, Chiang Mai University for assistance with this project, and the participants who gave their time.

References

- The NIMH Multisite HIV Prevention Trial: reducing HIV sexual risk behavior. The National Institute of Mental Health (NIMH) Multisite HIV Prevention Trial Group. *Science* 1998;280(5371):1889–1894. [PubMed: 9632382]
- Anglin MD, Burke C, Perrochet B, Stamper E, Dawud-Noursi S. History of the methamphetamine problem. *Journal of Psychoactive Drugs* 2000;32(2):137–141. [PubMed: 10908000]
- Baker A, Boggs TG, Lewin TJ. Randomized controlled trial of brief cognitive-behavioural interventions among regular users of amphetamine. *Addiction* 2001;96(9):1279–1287. [PubMed: 11672492]
- Bandura, A.; Prentice, H. *Social Learning Theory*. Englewood Hill, NJ: 1977.
- Bluthenthal RN, Kral AH, Gee L, Lorvick J, Moore L, Seal K, Edlin BR. Trends in HIV seroprevalence and risk among gay and bisexual men who inject drugs in San Francisco, 1988 to 2000. *Journal of Acquired Immune Deficiency Syndrome* 2001;28(3):264–269.

- Celentano DD, Jittiwutikarn J, Hodge MJ, Beyrer C, Nelson KE. Epidemiology of HIV-1 infection in opiate users in Northern Thailand. *Journal of Acquired Immune Deficiency Syndrome* 1998;17(1): 73–78.
- Celentano DD, Sirirojn B, Sutcliffe CG, Quan VM, Thomson N, Keawvichit R, Wongworapat K, Latkin C, Taechareonkul S, Sherman SG, Aramrattana A. Sexually transmitted infections and sexual and substance use correlates among young adults in Chiang Mai, Thailand. *Sexually Transmitted Diseases* 2008;35(4):400–405. [PubMed: 18362863]
- Drumright LN, Patterson TL, Strathdee SA. Club drugs as causal risk factors for HIV acquisition among men who have sex with men: a review. *Substance Use Misuse* 2006;41(10–12):1551–1601. [PubMed: 17002993]
- Edlin BR, Irwin KL, Faruque S, McCoy CB, Word C, Serrano Y, Inciardi JA, Bowser BP, Schilling RF, Holmberg SD. Intersecting epidemics--crack cocaine use and HIV infection among inner-city young adults. Multicenter Crack Cocaine and HIV Infection Study Team. *New England Journal of Medicine* 1994;331(21):1422–1427. [PubMed: 7969281]
- Ewing JA. Detecting alcoholism. The CAGE questionnaire. *Journal of American Medical Association* 1984;252(14):1905–1907.
- Farrell M, Marsden J, Ali R, Ling W. Methamphetamine: drug use and psychoses becomes a major public health issue in the Asia Pacific region. *Addiction* 2002;97(7):771–772. [PubMed: 12133111]
- Freese TE, Miotto K, Reback CJ. The effects and consequences of selected club drugs. *Journal of Substance Abuse Treatment* 2002;23(2):151–156. [PubMed: 12220613]
- Garfein RS, Golub ET, Greenberg AE, Hagan H, Hanson DL, Hudson SM, Kapadia F, Latka MH, Ouellet LJ, Purcell DW, Strathdee SA, Thiede H. A peer-education intervention to reduce injection risk behaviors for HIV and hepatitis C virus infection in young injection drug users. *AIDS* 2007;21(14): 1923–1932. [PubMed: 17721100]
- German D, Sherman SG, Sirirojn B, Thomson N, Aramrattana A, Celentano DD. Motivations for methamphetamine cessation among young people in northern Thailand. *Addiction* 2006;101(8): 1143–1152. [PubMed: 16869844]
- Hando J, Hall W. HIV risk-taking behaviour among amphetamine users in Sydney, Australia. *Addiction* 1994;89(1):79–85. [PubMed: 8148747]
- Kall K, Nilsson A. Preference for sex on amphetamine: a marker for HIV risk behaviour among male intravenous amphetamine users in Stockholm. *AIDS Care* 1995;7(2):171–188. [PubMed: 7619871]
- Kilmarx PH, Supawitkul S, Wankrairoj M, Uthairoravit W, Limpakarnjanarat K, Saisorn S, Mastro TD. Explosive spread and effective control of human immunodeficiency virus in northernmost Thailand: the epidemic in Chiang Rai province, 1988–99. *AIDS* 2000;14(17):2731–2740. [PubMed: 11125892]
- Klee H. HIV risks for women drug injectors: heroin and amphetamine users compared. *Addiction* 1993;88(8):1055–1062. [PubMed: 8401159]
- Knapp WP, Soares BG, Farrell M, Lima MS. Psychosocial interventions for cocaine and psychostimulant amphetamines related disorders. *Cochrane Database Systematic Review* 2007;(3):CD003023.
- Latkin C, Donnell D, Metzger D, Sherman S, Aramrattana A, Davis-Vogel A, Quan VM, Gandham S, Srirak N, Vongchak T, Perdue T, Hilgenberg D, Wiboonnatakul K, Celentano DD. The efficacy of a network intervention to reduce HIV risk behaviors among drug users and risk partners in Chiang Mai, Thailand and Philadelphia, US. 2008 In Press.
- Latkin CA, Sherman SG, Knowlton A. HIV prevention among drug users: Outcome of a network-oriented peer outreach intervention. *Health Psychology* 2003;22(4):332–339. [PubMed: 12940388]
- Logan TK, Cole J, Leukefeld CG. Women, sex, and HIV: Social and contextual factors, meta-analysis of published interventions, and implications for practice and research. *Psychological Bulletin* 2002;126(6):851–885. [PubMed: 12405135]
- Manopaiboon C, Kilmarx PH, van Griensven F, Chaikummao S, Jeeyapant S, Limpakarnjanarat K, Uthairoravit W. High rates of pregnancy among vocational school students: results of audio computer-assisted self-interview survey in Chiang Rai, Thailand. *Journal of Adolescence* 2003;26(5):517–530. [PubMed: 12972266]
- McKetin R, McLaren J, Lubman DI, Hides L. The prevalence of psychotic symptoms among methamphetamine users. *Addiction* 2006;101(10):1473–1478. [PubMed: 16968349]

- Molitor F, Ruiz JD, Flynn N, Mikanda JN, Sun RK, Anderson R. Methamphetamine use and sexual and injection risk behaviors among out-of-treatment injection drug users. *American Journal of Drug and Alcohol Abuse* 1999;25(3):475–493. [PubMed: 10473010]
- Office of the Narcotics Control Board of Thailand. Thailand Narcotics Annual Report (p. 1). 2002.
- Purcell DW, Latka MH, Metsch LR, Latkin CA, Gomez CA, Mizuno Y, Arnsten JH, Wilkinson JD, Knight KR, Knowlton AR, Santibanez S, Tobin KE, Rose CD, Valverde EE, Gourevitch MN, Eldred L, Borkowf CB. Results from a randomized controlled trial of a peer-mentoring intervention to reduce HIV transmission and increase access to care and adherence to HIV medications among HIV-seropositive injection drug users. *Journal of Acquired Immune Deficiency Syndrome* 2007;46(Suppl 2):S35–47.
- Razak MH, Jittiwutikarn J, Suriyanon V, Vongchak T, Srirak N, Beyrer C, Kawichai S, Tovanabutra S, Rungruengthanakit K, Sawanpanyalert P, Celentano DD. HIV prevalence and risks among injection and noninjection drug users in northern Thailand: need for comprehensive HIV prevention programs. *Journal of Acquired Immune Deficiency Syndrome* 2003;33(2):259–266.
- Rogers, E. Diffusion of innovations. Free Press; New York, NY: 1995.
- Srisurapanont M, Sombatmai S, Boripuntakul T. Brief intervention for students with methamphetamine use disorders: a randomized controlled trial. *American Journal of Addiction* 2007;16(2):111–116.
- Sample SJ, Patterson TL, Grant I. Motivations associated with methamphetamine use among HIV+ men who have sex with men. *Journal of Substance Abuse Treatment* 2002;22(3):149–156. [PubMed: 12039618]
- Sherman SG, Gann D, German D, Sirirojn B, Thomson N, Aramrattana A, Celentano D. A qualitative study of sexual risk behaviors and methamphetamine among young drug users from Chiang Mai, Thailand: A typology of risk. 2008 In Press.
- Sherman, SG.; Aramrattana, A.; Celentano, DD. Public health research in a human rights crisis: The effects of the Thai “war on drugs. In: Beyrer, C.; Pizer, HF., editors. *Public Health and Human Rights: Evidence-Based Approaches*. Johns Hopkins University Press; Baltimore, MD: 2007. p. 222–242.
- Sherman SG, German D, Sirirojn B, Thompson N, Aramrattana A, Celentano DD. Initiation of methamphetamine use among young Thai drug users: a qualitative study. *Journal of Adolescent Health* 2008;42(1):36–42. [PubMed: 18155028]
- Sokolov BP, Schindler CW, Cadet JL. Chronic methamphetamine increases fighting in mice. *Pharmacology, Biochemistry & Behavior* 2004;77(2):319–326.
- StataCorp. Stata Statistical Software. Stata Corporation; College Station. TX: 1997.
- Thaikla, K. Information on club drugs in Thailand; Ecstasy, Ketamine, Cocaine, and ICE. 3rd Thailand Conference on Substance Abuse, 2006; Chiang Mai, Thailand. 2006.
- Turner JC. Social Comparison and Social Identity: Some perspectives for Intergroup Behavior. *European Journal of Social Psychology* 1978;5:5–34.
- UNAIDS. Report on the global HIV/AIDS epidemic, 2002. 2003.
- van Griensven F, Supawitkul S, Kilmarx PH, Limpakarnjanarat K, Young NL, Manopaiboon C, Mock PA, Korattana S, Mastro TD. 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(1):E13. [PubMed: 11433092]
- Verachai V, Dechongkit S, Patarakorn A, Lukanapichonchut L. Drug addicts treatment for ten years in Thanyarak Hospital (1989–1998). *Drug and Alcohol Dependence* 2001;84(1):245–253.
- Vongchak T, Kawichai S, Sherman S, Celentano D, Sirisanthana T, Latkin CA. The Influence of Thailand's 2003 ‘War on Drugs’ Policy on Self-Reported Drug Use Among Injection Drug Users in Chang Mai, Thailand. *International Journal of Drug Policy* 2005;16(2):115–121.

Figure 1.
CONSORT Flowchart for Chiang Mai Methamphetamine Intervention Trial

Figure 2. Mean proportion using methamphetamine at baseline and at 3-, 6-, 9- and 12-month follow-ups by intervention assignment.^a

^a Brackets at each time point show 95% confidence intervals for the mean.

Figure 3. Mean proportion always using condoms at baseline and at 3-, 6-, 9- and 12-month follow-ups by intervention assignment.^a

^a Brackets at each time point show 95% confidence intervals for the mean.

Table 1

Comparison of intervention and standard condition session content for methamphetamine trial

Sessi on	Intervention “Peer Education” Condition	Standard “Life Skills” Condition
1	Ya [MA]'s effects on individuals <ul style="list-style-type: none"> • Introduction to peer education (D/GD) • Trust game (GA) • Introduction to harm reduction (D/GD) • Horse game: what leads you to use methamphetamine and its effects on you, your family and the community (GA) <p>Homework: talk to a friend about experience with session</p>	Understanding Life <ul style="list-style-type: none"> • Life graph: Draw history of positive and negative life events, personal role in creating good and bad events highlighted (I/GD) • Video about drug-addicted youth who realizes his drug addiction is harming family, community and self. 1 (V/GD) <p>Homework: Think about who you care about</p>
2	Ya and Social Influences <ul style="list-style-type: none"> • Communication game (GA) • Communication skills for peer mentors (D) • Chocolate game: peer pressure and drugs (GA) • Initiation stories: participants share experiences (GD) • Role play: communication (GA) <p>Homework: practice communication skills with a friend</p>	Decision Making Skills and Old Friends/New Friends <ul style="list-style-type: none"> • Decision making and problem solving skills (I/GD) • Problem solving skills (D) • Problem solving scenarios (GA) • Qualities of good friends (GA) • Maintaining friendships with non-drug users (GD)
3	Ya and Sex <ul style="list-style-type: none"> • Exchange of fluid game (GA) • Peer mentoring and HIV risk video (V/GD) • HIV/STI transmission and prevention (D/GD) • Sex risk ladder – hierarchy of behaviors (D/GD) • HIV myths and facts (GD) • Communication video and role play (V/GD) <p>Homework: talk to friends about HIV/STIs and risk</p>	Danger of Yaba <ul style="list-style-type: none"> • Danger of yaba: (D/GD) • Stop circle of drug use: intentions to stop using drugs, avoiding cues and situations (D) • Aware of stimulants: identifying personal cues to drug use, strategies for quitting (D/GD/IA) • Stopping your thought: techniques to avoid acting on drug cravings (D) • How to deny drug peer pressure (D/RP/GD)
4	Ya and Risk Behaviors <ul style="list-style-type: none"> • Condom use skills building (D/GA/GD) • Effect of ya on risky behaviors (GD) • Reducing harms related to methamphetamine (GD) • Make slogan and brochure for safe sex and safe methamphetamine use (GA) <p>Homework: talk to friends about harm reduction for methamphetamine</p>	Sexually Infectious Diseases <ul style="list-style-type: none"> • Basic STI knowledge (D/GA/GD) • The STI puzzle: game to review STI knowledge (GA) • How to use condom correctly (D/GA/GD)

Sessi on	Intervention “Peer Education” Condition	Standard “Life Skills” Condition
5	Family and Community <ul style="list-style-type: none"> Stigma activity: what it feels like to be stigmatized (GA/GD) Family issues: talk about positive and negative aspects of living in a family (GA/GD) Family and stigma: discuss stigma drug users face from family (GD) Community issues (GD) Discuss community needs and decide on community service project (GD) <p>Homework: recruit friends for community project</p>	How Important is Stress? <ul style="list-style-type: none"> Stress analysis: what is stress, identifying personal sources of stress (D/GD/IA) How important is stress: causes of stress, small group support discussion, stress management techniques, strategies to avoid stress, relaxation exercise (D/GD/GA) Thinking without stress: skills and philosophies for positive thinking (GD/GA/D) <p>Homework: Practice stress reduction</p>
6	Community Project <ul style="list-style-type: none"> 2–4 hour community service project (GA) 	Emotion Management and Life Goal <ul style="list-style-type: none"> Emotion management: consequences, strategies, role of drugs, skills (RP/GD/D) Practice emotion management (GD/RP) Tree drawing: self worth and self esteem activity, self-value through helping others (IA/GD/D) A goal of my life: video and motivational story about popular journalist who overcame childhood jail experience and achieved personal goal, discussion of barriers to achieving personal goals (V/GD) <p>Homework: Do something good for someone else</p>
7	Review and Graduation <ul style="list-style-type: none"> Community activity debrief (GD) Recap lessons learned (D) Future plans (GD) Graduation and certificates 	Envelope of Goodness and Graduation <ul style="list-style-type: none"> Envelopes of good deeds: everyone writes two good qualities about themselves and for each person, members get full list, sing group song, group reflection (GA/ GD) Wrap up and summarize all sessions (GD) Graduation and certificates

D: Didactic; IA: Individual Activity; GA: Group Activity; GD: Group Discussion; RP: Role Play; V: Video

Table 2

Sociodemographic and risk behavior characteristics at baseline of participants randomized in the trial

	Total (n=983)	Standard (n=488)	Intervention (n=495)
Demographic Characteristics			
Male	715 (72.7)	355 (72.8)	360 (72.7)
Age $\geq$ 20 years	320 (32.6)	168 (34.4)	152 (30.7)
Buddhist	950 (96.6)	474 (97.1)	476 (96.2)
Thai	977 (99.4)	486 (99.6)	491 (99.2)
Urban Residence	403 (41.0)	211 (43.2)	192 (38.8)
Single	217 (22.1)	96 (19.7)	121 (24.4)
Completed high school	183 (18.6)	98 (20.1)	85 (17.2)
Main occupation			
Student	379 (38.6)	176 (36.1)	203 (41.0)
Working	369 (37.5)	193 (39.6)	176 (35.6)
Not working/unemployed	235 (23.9)	119 (24.4)	116 (23.4)
Main place of residence			
Parent/relative's house	666 (67.8)	329 (67.4)	337 (68.1)
partner/friend's house	115 (11.7)	62 (12.7)	53 (10.7)
Rented room	139 (14.1)	69 (14.1)	70 (14.1)
Other	63 (6.4)	28 (5.7)	35 (7.1)
Risk Behaviors^b			
Frequency of alcohol use			
$\leq$ 3 days a month	98 (10.0)	50 (10.3)	48 (9.7)
1–3 days a week	387 (39.4)	185 (37.9)	202 (40.8)
$\geq$ 4 days a week	498 (50.7)	253 (51.8)	245 (49.5)
Frequency of drunkenness			
$\leq$ 11 days per month	733 (74.6)	360 (73.8)	373 (75.4)
12–20 days per month	139 (14.1)	76 (15.6)	63 (12.7)
$\geq$ 21 days per month	111 (11.3)	52 (10.7)	59 (11.9)
CAGE score $\geq$ 2	731 (74.4)	348 (71.3)	383 (77.4) ^a
Frequency of methamphetamine use			
$\leq$ 3 days a month	372 (37.8)	182 (37.3)	190 (38.4)
1–3 days a week	459 (46.7)	234 (48.0)	225 (45.5)
$\geq$ 4 days a week	152 (15.5)	72 (14.8)	80 (16.2)
No. of heterosexual partners in past 12 months			
0–1	384 (39.1)	191 (39.1)	193 (39.0)
2–4	372 (37.8)	179 (36.7)	193 (39.0)
$\geq$ 5	227 (23.1)	118 (24.2)	109 (22.0)
Sex with a casual partner in last 12 months	381 (38.8)	196 (40.2)	185 (37.4)
Sex with a sex worker in last 12 months	20 (2.0)	8 (1.6)	12 (2.4)
Condom used at last vaginal sex act (n=929)	320 (34.5)	142 (30.7)	178 (38.1) ^a

	Total (n=983)	Standard (n=488)	Intervention (n=495)
Always used condoms in last 30 days (n=814)	157 (19.3)	66 (16.2)	91 (22.4) ^a
Always used condoms with a casual partner in last 12 months (n=380)	172 (45.3)	85 (43.4)	87 (47.3)
<i>Sexually Transmitted Infections</i>	<i>n=539</i>	<i>n=263</i>	<i>n=276</i>
Prevalent laboratory-confirmed STI	206 (38.2)	96 (36.5)	110 (39.9)

^a Indicates a difference between participants in the intervention condition vs. the standard condition at p<0.05 level with a χ^2 test of association

^b Behaviors in past three months unless indicated

Table 3

Effect of the intervention on methamphetamine (MA) use in the 3 months before baseline and at 3-, 6-, 9-, and 12-months follow-ups by participant type.

	Overall		Indexes Only ^c	
	Standard	Intervention	Standard	Intervention
Baseline	N 474	486	206	209
	% using MA 97.1	98.1	100.0	100.0
3 months ^a	N 446	440	190	194
	% using MA 72.0	73.9	75.3	82.0
	OR (95% CI) 1	1.07 (0.79,1.45)	1	1.37 (0.82,2.29)
6 months ^a	N 440	442	196	189
	% using MA 60.7	61.5	64.8	65.1
	OR (95% CI) 1	1.11 (0.83,1.47)	1	1.08 (0.70,1.38)
9 months ^a	N 437	443	189	186
	% using MA 54.7	54.6	59.8	58.6
	OR (95% CI) 1	1.00 (0.76,1.32)	1	0.92 (0.61,1.41)
12 months ^a	N 440	442	188	187
	% using MA 53.9	53.2	56.4	55.1
	OR (95% CI) 1	0.92 (0.70,1.21)	1	0.88 (0.58,1.35)
Overall intervention effect ^b	1	1.03 (0.83,1.27)	1	1.03 (0.75,1.43)

^a Separate models were fit to the data overall and for indexes only. Models included effects for intervention assignment, time, CAGE score and time by intervention assignment interaction.

^b Longitudinal models were fit as above excluding time by intervention assignment interaction.

^c Longitudinal models omit baseline visit as 100% of participants used MA (eligibility criteria of the study).

Table 4

Effect of the intervention on the proportion always using condoms in the 3 months before baseline and at 3-, 6-, 9-, and 12-months follow-ups among sexually active participants at baseline by participant type.

	Overall		Indexes Only ^c	
	Standard	Intervention	Standard	Intervention
Baseline	N 483	485	206	209
	% always using condoms 28.8	34.2	22..	28.2
3 months ^a	N 442	430	190	194
	% always using condoms 45.3	47.7	41.6	45.4
	OR (95% CI) 1	0.95 (0.69,1.31)	1	0.98 (0.61,1.57)
6 months ^a	N 436	432	196	189
	% always using condoms 40.1	44.9	36.7	42.9
	OR (95% CI) 1	0.92 (0.66,1.28)	1	1.11 (0.68,1.81)
9 months ^a	N 433	433	189	186
	% always using condoms 40.0	44.8	36.0	44.1
	OR (95% CI) 1	1.28 (0.92,1.77)	1	1.24 (0.77,2.00)
12 months ^a	N 436	432	188	187
	% always using condoms 39.5	40.5	37.8	34.8
	OR (95% CI) 1	1.04 (0.74,1.45)	1	0.83 (0.51,1.38)
Overall intervention effect ^b	1	1.09 (0.91,1.31)	1	1.09 (0.83,1.44)

^a Separate models were fit to the data overall and for indexes only. Models included effects for baseline condom use, CAGE score, intervention assignment, time and time by intervention assignment interaction.

^b Longitudinal models were fit as above excluding time by intervention assignment interaction.

Table 5

STI incidence by person-time

	Overall			Control			Intervention		
	Events	PY	Rate (per 100 PY)	Events	PY	Rate (per 100 PY)	Events	PY	Rate (per 100 PY)
Chlamydia	45	456.75	9.85	26	230.35	11.29	19	226.40	8.39
Gonorrhea	12	465.98	2.57	1	231.67	0.43	11	234.31	4.69 ^a
HCV	1	358.69	0.28	1	174.45	0.57	0	184.24	0
HSV-2	15	424.87	3.53	6	204.56	2.93	9	220.31	4.09
HIV	2	399.01	0.50	0	191.47	0	2	207.53	0.96

^a p<0.05 for comparison between enhanced and standard conditions