



Published in final edited form as:

J Adolesc Health. 2009 February ; 44(2): 169–175. doi:10.1016/j.jadohealth.2008.06.021.

Patterns of risky behaviors associated with methamphetamine use among young Thai adults: A latent class analysis

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Abstract

Purpose—Methamphetamine is the leading illicit drug in Thailand among youth and young adults. Sexual risk behaviors are associated with methamphetamine use, but little data exist on the daily context of use. We developed an inductive behavioral typology that young Thais engage in while using methamphetamine.

Methods—We conducted a cross-sectional study in Chiang Mai, Thailand in 2005–2006 among 1,189 18–25 year old street-recruited methamphetamine smokers. Data collected included socio-demographic characteristics, sexual behaviors, and drug use patterns. Latent class analysis was used to describe patterns of activities in which participants reported engaging directly after using MA. Logistic regression was used to examine univariate correlates of class membership, separately by gender.

Results—Participants were 75% male with a median age of 19 years. Over half of participants reported frequent alcohol use (4+ days/week) and half of the sample reported smoking MA ≥ 2 days/week. Three classes of activities emerged for male participants (n=863): “work” (job related); “high-risk behaviors” (motor cycle riding, fighting, sex); and “combined” (all activities). Two classes emerged for the women (n=299): “work” (housework) and “high-risk behaviors.” “High-risk behaviors” and “combined” (men only) classes were associated with more frequent alcohol and methamphetamine use compared to the “work” class.

Conclusions—Our study found a distinct typology of behaviors associated with substance abuse among young adults in Thailand. Behavioral typologies allow for a better understanding of the nuances of “risky” behaviors and might prove useful in targeting interventions.

Introduction

Methamphetamine (MA) has become the leading recreational illicit drug in Thailand, largely driven by high rates of abuse among adolescents and young adults [1–4]. Several large school- and community-based samples of 13 to 20 year olds have found high rates of lifetime MA use,

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ranging from 29% to 37% [1,5]. MA use among youth reached such alarming rates that it was the primary target of the Thai Government's 2003 infamous crackdown or "war on drugs," that resulted in arrests and mandatory treatment of thousands of drug users [6,7].

MA is a synthetic central nervous system stimulant which releases high levels of dopamine, thereby enhancing mood [8,9]. Its favorable effects include euphoria, increased sexual arousal, appetite suppression, heightened energy, and prolonged sexual performance [10–12]. 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 [8,13,14]. MA 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) [15–20]. An established body of research has documented that use of MA and amphetamine type stimulants is associated with violence, aggression, injury, and driving impairment [21–27].

With the extent of MA use among youth in Thailand, we were interested in exploring behavioral typologies associated with MA. Specifically, we hypothesized that distinct patterns of behavior would exist: one comprised of utilitarian behaviors such as employment, schoolwork and housework (for the girls); and a second comprised of such high-risk behaviors as sexual risk, violence, and poly-drug use. The current study uses latent class analysis to develop an inductive typology of behaviors in which young Thai adults engage while using MA.

Methods

Study Participants

This cross-sectional study was conducted within a two-arm randomized peer outreach network trial conducted in Chiang Mai city in northern Thailand that is detailed elsewhere [28]. The 12 month trial was designed to compare the efficacy of a peer educator network-oriented intervention with a best practice standard life skills curriculum that is used to prevent and reduce the harms associated with MA use among young adults. Between April 2005 and June 2006, 1,189 18–25 year olds were screened for eligibility in the study. Participants were primarily recruited by outreach workers in Chiang Mai city at locations where MA users congregated, including community centers, healthcare services, and clubs. Once the study was underway, a number of youth were referred by study participants. The target population's age and recruitment sites were greatly informed by 18-months of extensive formative research that was comprised of in-depth interviews, participant observations, and focus groups with the target population as well as service providers [29].

Index participants were eligible for study participation if they could bring at least one member of their drug or sex networks for enrollment into the trial, were between the ages of 18 and 25, had used MA at least three times in the past three months, and had had sexual intercourse at least three times in the last three months. Network members were eligible for enrollment if they met the same age criteria, and had used drugs or had reported having sex with the index at least three times in the last three months. Participants were compensated (equivalent of approximately \$8.00) for their participation in the study. This analysis includes all index and network participants (N= 1,162) who reported methamphetamine use in the three months prior to the baseline interview.

Informed consent was obtained from all participants and the trial was approved by the Institutional Review Board at Johns Hopkins Bloomberg School of Public Health, the Human Experimentation Committee at the Research Institute for Health Sciences, Chiang Mai University, and the Ministry of Public Health in Thailand.

Data Collection

After screening, participants were administered a baseline survey. The baseline survey included questions on the participant's socio-demographic background, drug utilization patterns and drug-related variables (e.g. involvement in the drug economy), and sexual behaviors. Participants were asked during the three month period prior to being interviewed, which of the following activities they most often engaged in directly after taking MA. Potential responses included drinking alcohol, repairing/fixing motorcycles or appliances, driving/racing motorcycles, fighting, having sex, doing regular house work, or doing job-related work. Responses were in a closed-ended format and based on information learned through our extensive formative research in advance of the current study.

Correlates of interest included age (<20 versus ≥ 20 years of age), religion (Buddhist versus other), ethnicity (Thai versus other), marital status (single versus partnered), educational attainment (less than a high school diploma versus high school or more), current employment status (employed versus unemployed), current enrollment in an educational institution (yes versus no), current living situation (living with parents versus other living arrangements), any past or present involvement in the drug economy, defined as selling or delivering drugs or history of arrests (yes versus no), any illicit sources of money (yes versus no), any history of injection drug use (yes versus no), frequency of MA use in the past three months (once a week or less versus ≥ 2 days a week), age of first MA use (<15 versus ≥ 15 years of age), CAGE score as a four-question measure of drinking problems with a cutoff of 2 (<2 versus ≥ 2) [30], frequency of alcohol consumption in the past three months (<4 days per week versus ≥ 4 days per week), frequency of drunkenness in the past 30 days (<12 versus 12–21 versus ≥ 21 days), number of heterosexual partners in the past 12 months (<3 versus ≥ 3) and measures of condom use, including condom use at last sex (yes versus no) and always used condoms during vaginal sex in the last 30 days (yes versus no). Variables were categorized based on their observed distributions and median values. Only variables that were significantly ($p < 0.05$) correlated with at least one class for either men or women are shown in the results section.

Statistical Analysis

Descriptive statistics were used to describe the demographic characteristics of the study population. Proportions are reported for categorical variables and differences by gender were tested using χ^2 tests. Medians and interquartile (IQR) ranges are reported for continuous variables and differences by gender were tested using the Wilcoxon Rank Sum Test. Descriptive statistics were generated using SAS for Windows, version 9.1 (SAS Institute Inc., Cary, NC) [31].

Latent class analysis (LCA) was used to describe patterns of activities following MA use. LCA is similar to traditional cluster analysis and can be used to identify subgroups (classes) within the data based on similarities in responses to a set of categorical variables. Observations are classified according to model-based posterior probabilities of class membership. LCA has been used in many fields; in the substance use literature examples of LCA include characterization of drug users according to the types/number of substances used [32–35], examination of the association between patterns of criminal activities during adolescence and subsequent cocaine use [36], and examination of patterns of alcohol and drug use trajectories following drug treatment [37]. In this analysis participants were grouped based on their reported participation in activities following MA use. All activities were measured as 0 ('no') or 1 ('yes') in the previous three months. The analysis was conducted for a range of latent classes, beginning with the most parsimonious (one class) and then increasing sequentially up to four latent classes. The optimal number of latent classes was evaluated statistically and practically. Statistically, we compared model fit for different numbers of classes using several goodness-of-fit tests, including Akaike Information Criterion (AIC), Bayesian Information Criterion

(BIC), and the Lo-Mendell-Rubin likelihood ratio test of model fit [38]. The classes were also evaluated in terms of their face validity based on the literature and a priori hypotheses. Once the optimal number of classes was determined, participants were assigned to different classes based on their posterior probability of class membership. The quality of class assignment and the unconditional probability of each latent class were assessed. Additionally, the conditional probabilities of each activity within each latent class were evaluated in order to characterize the predominant activities performed by each class. Latent class analysis was performed using Mplus, Version 4.2 [38].

Correlates of latent class membership were evaluated with latent class regression using a multinomial logistic regression model for males and an ordinary logistic regression model for females. Latent class regression was also conducted using Mplus such that classification and prediction of class membership could be conducted simultaneously. As the data were clustered by index participants and their network members, generalized estimating equations (GEE) were used to take into account correlations between responses within clusters [39]. Unadjusted odds ratios (UORs) and 95% confidence intervals (CIs) were calculated. As the prevalence of each activity differed between males and females, the analysis was performed separately by gender.

Results

The sample (N=1,162) 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. Overall participants' education level was low, with only 39% reporting being currently in school and a median nine (IQR:9–11) years of schooling. Close to half of the sample was employed and about one-third reported receiving income from illicit sources. Over half of participants reported drinking alcohol four or more days per week and close to two-thirds scored two or more on the CAGE. Half of the sample reported using MA two or more days per week and a minority, 5%, reported ever having injected drugs. Over 95% of participants smoked MA (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. A number of differences by gender were observed. Compared to women, men were significantly more likely to be older, live with their parents, be less educated, be employed, use alcohol more frequently, be involved in the drug economy, be single, and report a greater number of sexual partners in the past year.

Table 1 displays the overall prevalence of activities in which participants reported engaging directly after smoking MA, the proportion of the population in each latent class, and the proportion of participants assigned to that class who reported engaging in each activity. The following were the most common activities (not mutually exclusive) that participants reported engaging in after smoking MA: drinking alcohol (67%); having sex (54%); housework such as cleaning (52%); job-related work (41%); fighting (38%); repairing motorcycles/appliances (37%); and driving/racing (30%). There were significant differences by gender for the prevalence of all activities except for "having sex." Three classes or groups of activities emerged for male participants (n=863). Class I consisted of 40% of the male participants and was primarily comprised of job-related activities. Class II accounted for 31% of the men and consisted predominantly of high-risk behaviors such as drinking alcohol, driving/racing, fighting, and having sex. Class III represented 28% of the males and encompassed all listed activities. Two classes emerged for female participants (n=299). Class I contained 39% of females and was comprised predominantly of house-work related activities, while Class II was represented by 61% of the females and largely included high-risk behaviors. Sex and drinking featured prominently in all classes. Table 2 assesses the quality of class assignment. For both males and females, the high and low posterior probabilities of being in the assigned and other classes, respectively, indicate that the chosen models provided clear classification.

A number of demographic variables as well as drug and sexual risk behaviors were correlated with class membership as determined through univariate logistic regression (Table 3). Among males, compared to membership in class I (work-related activities), membership in class II (high-risk behaviors) was significantly associated with: being unemployed, currently being a student; having a CAGE score of two or more; drinking alcohol four or more days per week; and reporting three or more sexual partners in the past year. Among males, compared to membership in class I (work-related activities), membership in class III (all activities) was associated with: being older; being unemployed; not living with their parents; being involved in the drug economy; ever having injected drugs; using MA two or more days per week; initiating MA younger than age 15; having a CAGE score of two or above; drinking alcohol four or more days per week; and reporting three or more sex partners in the past year.

Among females, compared to membership in class I (work-related activities), membership in class II (high-risk behaviors) was associated with being older; being unemployed; being a student; using MA two or more days per week; having a CAGE score of two or higher; and drinking alcohol four or more days per week.

Discussion

The current study inductively identified distinct behavioral patterns associated with MA use among a large sample of young Thai adults. We identified three patterns associated with MA use: the “high-risk class,” who use MA in association with high risk behaviors; the “work class,” who use MA in association with functional activities such as work; and the “combination class,” who use MA in association with most of the possible activities including functional and high risk. The groups can be characterized by differing levels of “risk” behaviors, reinforcing the notion of a heterogeneous group of MA users with varying intervention needs.

Latent class analysis provided us with the tools to understand how MA-related behaviors cluster together, thus illuminating the context of and possible motivations for MA use. Associations between the latent classes and such variables as MA and alcohol frequency and other related (e.g. drug economy) measures were significant and in the anticipated directions, providing external validation of the typology and further pointing to varying risk among groups. Among males, members of the “combined” classes used MA with the greatest frequency, which could indicate a heavier degree of MA addiction. This is concerning because it indicates that members of this class not only used MA frequently but also that they reported engaging more frequently in harmful behaviors.

Forty percent of males and females belonged to a class that used MA in conjunction with work-related activities: job-related work for males and household work for females. The use of MA to enhance work performance has a long history in Thailand and in numerous other countries [10]. It emerged in the 1930s as a pharmaceutical product, methedrine, that became illegal after widespread abuse among laborers, such as long distance truck drivers, whose jobs demanded endurance [2]. Our study found that it is still used, by both young men and women, to enhance work performance, with over one-third of the sample reporting that it was used prior to job-related activities. This result can be interpreted in several ways. First, work demands are better met when MA is used to increase productivity, energy, or focus. Alternatively, MA is so widely available and normative among peer networks that it is used to enhance performance in a range of activities, including work.

Close to one-third of men and over 60% of women belonged to the “high-risk” class which was characterized by engaging in a variety of risky behaviors - drinking alcohol, driving/racing, fighting, and having sex. Membership to this and the “combined” class among men was associated with a higher CAGE score and frequent MA use compared to membership in the

“work” class. The constellation of high risk behaviors in the context of heavy drug and alcohol use could be indicative of an underlying risk-taking or thrill seeking personality. Alternatively, MA use may not simply amplify but be the cause of such thrill seeking/risk taking behavior because of its production of euphoria and/or aggression [8,10]. Members of the “combined group” used MA in relation to both high risk and work-related activities. Future research would be needed to explore the origins of their MA use – did they use MA to enhance work performance and then it spilled over into other areas of their lives or are they “partiers” who use MA in conjunction with all aspects of their lives - and to disentangle personality traits and states induced by MA use.

Similar to other research in and outside of Thailand [1,15,17–19,40,41], the results underscore the need to target youth in sexual risk reduction interventions, highlighting the effects of MA on sexual behaviors that could result in HIV/STIs. This could include the promotion of “planning ahead” or having condoms and lubricants on hand in the context of MA use. Numerous studies have documented the co-occurrence of drug and alcohol use with violence and risky driving among young adults [22–24,42]. The prevalence of fighting and motorcycle racing is logical as MA use can produce a sense of fearlessness. There is a need to understand the nature of violence and racing among the study population, both in and outside of the context of MA use.

Our results indicated a number of differences and surprising number of similarities between males and females. The majority of significant differences in behaviors that ensued MA use were fairly consistent with common gender stereotypes – drinking alcohol, repairing motorcycles, driving or racing motorcycles, and fighting was more common for males, while housework was more common for females. But sex was not among these differences- over half of males and females reported engaging in sex in the context of MA use. Elsewhere, we have reported high rates of unprotected sex and STIs among men and women in this sample [43]. While such high levels of sexual behavior may be attributed to the effect of MA on impairing judgment and heightening sexual drive, they may also reflect broader shifts in Thailand, as sexual practices among unmarried Thai adolescents and young adults have changed substantially over the past two decades. Recent studies have documented higher levels of sexual experience and an earlier median age of sexual debut among Thai youth than in the pre-AIDS era [44,45].

Results from this study must be viewed with several limitations. All of the data were collected through self-report and it is possible that social desirability influenced participants’ responses. 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. The results could have been biased because sexual network members had sex with index members by design (e.g. inclusion criteria). This could have resulted in the sample being more sexually active than a random sample of MA users. As a result, the importance of sex in the current study could have been artificially inflated. Some of the confidence intervals are large surrounding the unadjusted estimates of correlates of class membership. This is due to small numbers in the cells and would merit a large sample to validate our findings. We did not ascertain the frequency of each behavior while high on MA, however 50% of the sample reported using MA frequently - two or more days per week, so we can deduce that these behaviors were fairly frequent given that they were associated with MA use. The analysis indicated that a three-class model fit best for males while a two-class model fit best for females. This may be interpreted as less of a spectrum of behavioral profiles among female MA users, but more plausible is that our analysis of women was limited by sample size.

The current study is novel in its use of latent class analysis to examine the cluster of activities that young Thais engage in after they have smoked MA. These behavioral typologies suggest

distinct risk profiles that have implications for the locations (e.g. workplaces) and population segments that should be targeted for several types of interventions. The study also demonstrates the heterogeneity of MA users and the need to focus on both root causes as well as the consequences of MA use. These findings have implications for targeting youth who use MA in HIV prevention, workplace and injury prevention, and harm reduction interventions.

Acknowledgements

This study was supported by a grant from the National Institutes of Drug Abuse (DA14702). We appreciate Carla Zelaya's advise on the analysis. We thank all of the participants who shared their stories and our staff.

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Table 1
Classes and prevalence of activities after MA use, by gender (N=1,162)

	Males (n=863)				Females (n=299)		
	Overall	Class I	Class II	Class III	Overall	Class I	Class II
Number in Class		349	269	245		116	183
Class Prevalence		0.40	0.31	0.28		0.39	0.61
<i>Activities</i>							
Drinking alcohol*	0.68	0.47	0.88	0.75	0.52	0.18	0.73
Repair motorcycles/appliances*	0.37	0.29	0.11	0.75	0.08	0.04	0.11
Driving/racing*	0.30	0.13	0.35	0.49	0.19	0.11	0.24
Fighting*	0.38	0.13	0.55	0.55	0.30	0.04	0.47
Sex	0.54	0.34	0.60	0.77	0.58	0.45	0.66
House work*	0.52	0.55	0.25	0.78	0.69	0.68	0.70
Job-related work*	0.41	0.36	0.26	0.65	0.26	0.32	0.23

Class I: work-related activities

Class II: high risk social activities

Class III: all activities

* p<0.05 for comparison of prevalence of activities between men and women

Table 2
Mean individual posterior probability of class assignment by class and gender

Class Assignment	Males (n=863)			Females (n=299)		
	Class I	Class II	Class III	Class I	Class II	Class III
Class I	0.80	0.09	0.11	0.88	0.12	
Class II	0.12	0.77	0.11	0.08	0.92	
Class III	0.10	0.12	0.77	---	---	---

Table 3

Univariate Associations between Demographic and Behavioral Characteristics and Class Membership by Gender, Accounting for Clustering by Network (GEE)

Characteristic	Males		Females
	Class II* OR (95% CI) ⁺	Class III* OR (95% CI)	Class II* OR (95% CI)
20 years or older (versus < 20 years)	0.54 (0.17, 1.70)	2.15 (1.03, 4.51)	0.49 (0.23, 1.01)
Employed (versus unemployed)	0.03 (0.01, 0.09)	0.14 (0.03, 0.62)	0.39 (0.19, 0.80)
Currently a student	6.37 (1.35, 29.95)	1.35 (0.25, 7.44)	3.41 (1.84, 6.31)
Living with parents	1.50 (0.57, 3.94)	0.52 (0.27, 0.99)	0.89 (0.46, 1.72)
Involved in the drug economy	0.95 (0.29, 3.14)	3.12 (1.49, 6.54)	1.28 (0.64, 2.55)
Ever injected drugs	2.19 (0.41, 11.73)	6.15 (1.58, 24.03)	2.48 (0.28, 21.71)
Smoked MA 2+ days/week (versus <2)	1.09 (0.58, 2.07)	2.08 (1.18, 3.66)	2.13 (1.02, 4.47)
Initiated MA < 15 years old (versus ≥ 15 years)	0.92 (0.45, 1.85)	2.05 (1.28, 3.29)	1.79 (0.86, 3.73)
CAGE score ≥ 2 (versus <2)	1.80 (1.08, 3.02)	2.75 (1.38, 5.51)	4.25 (2.15, 8.40)
Drink alcohol 4+ days per week (versus < 4 days)	2.88 (1.50, 5.53)	3.66 (1.79, 7.48)	4.84 (2.13, 11.00)
3+ heterosexual sexual partners in last year (versus <3)	6.45 (3.04, 13.69)	4.71 (1.97, 11.25)	2.13 (0.95, 4.74)

* Class I: work-related activities/reference; Class II: high risk social activities; Class III: all activities combined

⁺OR = Odds Ratio; 95%CI = 95% Confidence Intervals