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Predictors of incident and recurrent participation in the sale or delivery of drugs for profit among young methamphetamine users in Chiang Mai Province Thailand, 2005-2006

Amanda D. Latimore¹, Abby Rudolph¹, Danielle German¹, Susan G. Sherman¹, Bangorn Srirojn², Apinun Aramrattana², and David D. Celentano¹

¹Johns Hopkins University Bloomberg School of Public Health, Baltimore, MD, USA ²Research Institute for Health Sciences, Chiang Mai University, Chiang Mai, Thailand

Abstract

Background—Despite Thailand’s war on drugs, methamphetamine (“yaba” in Thai) use and the drug economy both thrive. This analysis identifies predictors of incident and recurrent involvement in the sale or delivery of drugs for profit among young Thai yaba users.

Methods—Between April 2005 and June 2006, 983 yaba users, ages 18-25, were enrolled in a randomized behavioral intervention in Chiang Mai Province (415 index and 568 of their drug network members). Questionnaires administered at baseline, 3-, 6-, 9-, and 12-month follow-up visits assessed socio-demographic factors, current and prior drug use, social network characteristics, sexual risk behaviors and drug use norms. Exposures were lagged by three months (prior visit). Outcomes included incident and recurrent drug economy involvement. Generalized linear mixed models were fit using GLIMMIX (SAS v9.1).

Results—Incident drug economy involvement was predicted by yaba use frequency (Adjusted Odds Ratio [AOR]:1.05; 95% Confidence Interval [CI]: 1.01, 1.10), recent incarceration (AOR: 2.37; 95%CI: 1.07, 5.25) and the proportion of yaba-using networks who quit recently (AOR: .34; 95%CI: .15, .78). Recurrent drug economy involvement was predicted by age (AOR: 0.81; 95% CI: .68, .96), frequency of yaba use (AOR: 1.06; 95%CI: 1.02, 1.09), drug economy involvement at the previous visit (AOR: 2.61; CI: 1.59, 4.28), incarceration in the prior three months (AOR: 2.29; 95%CI: 1.07, 4.86), and the proportion of yaba-users in his/her network who quit recently (AOR: .38; 95%CI: .20, .71).

Conclusion—Individual drug use, drug use in social networks and recent incarceration were predictors of incident and recurrent involvement in the drug economy. These results suggest that interrupting drug use and/or minimizing the influence of drug-using networks may help prevent further involvement in the drug economy. The emergence of recent incarceration as a predictor for both models highlights the need for more appropriate drug rehabilitation programs and demonstrates that continued criminalization of drug users may fuel Thailand’s yaba epidemic.

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Corresponding author: Amanda D. Latimore Department of Epidemiology Johns Hopkins Bloomberg School of Public Health 615 N. Wolfe Street, Suite W6604, Baltimore, MD 21205 USA. alatimor@jhsph.edu.

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Keywords

drug economy involvement; incarceration of drug users; Thailand; war on drugs; adolescents; methamphetamine use; drug network; social network

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Introduction

Methamphetamine (yaba) use in Thailand

Thailand has had a long history of drug abuse, which stems in part from its close proximity to the Golden Triangle. In the last two decades, methamphetamine use has become widely popular and affordable for people from all social classes. In response to methamphetamine's rising popularity, Thailand criminalized its use in 1996 and made the punishment for trafficking, possessing, and using methamphetamines equivalent to that of heroin (Kuratanavej, 2001). Despite these laws, the methamphetamine economy continues to thrive. In the midst of the methamphetamine epidemic (mid-1997), Thailand suffered a major economic crisis and nearly two million people lost their jobs. At a time when legitimate opportunities to make money became constrained, some took drugs to cope and many others became involved in the lucrative business of selling drugs (Phongpaichit, 2003). As the government struggled to combat rising drug use and sales, Thailand's prison system quickly became overcrowded with drug offenders. Between 1996 and 2002, Thailand's prison population increased by 250 percent (Phongpaichit, Priryangsan, & Treerat, 1998) and about 53% of the country's prisoners were incarcerated for drug-related offenses (Phongpaichit, 2003). Rising social concern surrounding the overcrowded prison system, among other factors, contributed to the government's decision to pursue more stringent approaches for reducing the demand for methamphetamine. Political campaigns referred to the drug as "yaba" (translated as "crazy drug") and the penalty for dealing or using yaba was increased to death (Phongpaichit, 2003). Despite these efforts, its popularity continued to increase.

Thailand's war on drugs

In March 2001, the Prime Minister declared drug trafficking and yaba use to be national priorities and on February 1, 2003, launched a national war on drugs. Thailand's war on drugs aimed to reduce yaba use (demand) and its availability (supply) within three months by disrupting the drug markets which forced drug users to spend more time searching for drugs and by raising drug prices to make it more difficult to afford a drug habit (Roberts, Trace, & Klein, 2004; Sherman, Aramrattana, & Celentano, 2006; Vongchak et al., 2005). Additionally, several thousand low-level dealers and users were extrajudicially assassinated, which incited fear among the people and consequently drove up the market price for a tablet of yaba from under 100 baht at the end of 2002, to approximately 400 baht in 2003 (Chouvy & Meissonnier, 2004).

Despite the Thai government's effort to thwart yaba production in Myanmar (Burma), trafficking of yaba remained a problem throughout Thailand (Vongchak et al., 2005). While the price of drugs is generally elastic, demand is essentially inelastic, particularly for those who are physiologically dependent (Reuter & Kleiman, 1986). Therefore, in the presence of law enforcement practices that reduced the supply of drugs, drug prices rose. Paradoxically, rather than causing a decline in drug use, it forced the drug economy underground (Human Rights Watch, 2004) and yaba users spent more money to support their yaba habits. Consequently, the revenues from drug sales also increased, making drug dealing a more profitable and attractive market, consistent with the findings from many international studies which showed that drug enforcement policies typically failed to alter the price of drugs, their

availability, or the frequency of use (Best, Strang, Beswick, & Gossop, 2001; Wood, Kerr, Small et al., 2003; Wood, Kerr et al., 2004; Wood, Kerr, Spittal et al., 2003; Wood, Spittal et al., 2004; Wood, Tyndall et al., 2003).

Despite the government's efforts to deter drug use and drug sales, there remains a large market for yaba in Thailand. To effectively reduce yaba sales and use, data are needed to identify factors associated with initiating involvement in the drug economy so that interventions can be designed to prevent entry among those at the greatest risk and to assist those trafficking drugs to find alternative sources of income.

Factors associated with involvement in the drug economy

Policies on incarceration of drug users are predicated on the belief that they deter drug use and curb the drug economy. Evidence suggests that these policies have little impact on influencing the drug economy (Sweet, 2009) or individual drug use (Sherman et al., 2010). Incarceration of non-violent offenders in overcrowded prisons can lead to increased drug dependency and crime (Roberts et al., 2004). Upon release from prison, those who have initiated drug use while in prison may be at higher risk for selling and delivering drugs as a result of social connections established during their period of incarceration (Thaisri et al., 2003). In addition, consequences of incarceration prevent individuals from successfully reintegrating into society by affecting future employment, education, housing, public privileges, and public benefits (Collateral Consequences of Criminal Convictions: Barriers to Reentry for the Formerly Incarcerated, 2010). These barriers to economic opportunities may also increase the risk of entry into the drug economy (Cheng et al., 2006; Gwadz et al., 2009). Given the increased penalties for drug sales after Thailand mounted its war on drugs, fear of incarceration might have an inhibiting effect on the participation in the drug economy; yet, the current literature points to the contrary.

Ethnographic data suggest that gender differences exist in involvement in the drug economy. While selling and distributing drugs is a male-dominated field, women have direct (Dunlap, 1994) and indirect roles in the drug economy. In the context of Thailand's socially mandated gender roles, the motivation for involvement in the drug economy and the mechanisms by which involvement occurs likely varies by gender.

While limited data exist on the participation of Thai women in the drug economy, the existence of gender differences is seen in the United States. An ethnographic study of female crack dealers in New York City identified roles within low-level crack sales and distribution networks created as a result of the need of females to finance their crack consumption (Dunlap, 1997).

Qualitative and quantitative findings from homeless street youth suggest social control is a primary factor driving involvement in the street economy (e.g., selling drugs, prostitution) (Gwadz et al., 2009). A deep familiarity with the street economy and the perception of involvement as normative is common among those involved. Street capital, or the knowledge of and connections to others involved in the street economy, was identified as a prominent predictor of involvement in the street economy.

Gwadz and colleagues (2009) identified perceived financial and emotional benefits of the street economy, severe economic need, and active recruitment into the street economy by others as strong predictors of initiation into the street economy (Gwadz et al., 2009). Barriers to involvement in the street economy included homelessness, educational deficits, mental health problems, perceived stigma associated with homelessness, minority race/ethnicity, and/or sexual identity, substance use problems, and prior incarceration. Those who were younger were also less likely to become involved in the street economy because

employers were less likely to hire those with less experience (Gwadz et al., 2009). A qualitative examination of the New Orleans drug market found that macro-level social forces such as poverty, lack of societal opportunity, lack of social capital, distressed families, and closed neighborhoods were associated with initiation into the drug economy, interceding on the impact of individual-level characteristics (Dunlap, Johnson, Kotarba, & Fackler, 2010). In Baltimore, Maryland, those involved in the drug economy had higher percentages of daily drug use and had drug users commonly in their social network (Sherman et al., 2010).

This analysis identifies predictors of first-time and recurrent participation in the sale or delivery of drugs for profit among a sample of yaba users enrolled in a behavioral intervention study who had no prior experience selling yaba or delivering drugs at enrollment.

Methods

Recruitment

Between April 2005 and June 2006, 1263 18-25 year old yaba users were screened to participate in a two-arm randomized behavior change intervention trial in Chiang Mai Province, Thailand. A total of 983 individuals (415 index and 568 of their network members) completed baseline interviews. Eligible index participants were males and females between 18 and 25 years of age who 1) reported using yaba at least three times in the past three months, 2) reported having sex at least three times in the past three months and 3) could list and enroll eligible members of their sexual and/or drug networks in the study within 45 days of screening. Eligible network members reported either yaba use at least three times in the past three months or reported sex with the index at least three times in the last three months. Participants were excluded if they refused to have blood drawn or provide a urine sample, if they were enrolled in other prevention studies, or if they refused to provide locator information.

Data and sample

A 50-minute survey was administered by trained interviewers at baseline to assess socio-demographic characteristics, drug and alcohol use history, sexual behavior history, social network characteristics and sexual and drug use norms. Collection of demographic and behavioral data also occurred at the 3-, 6-, 9-, and 12-month follow-up visits. The network survey was only administered at baseline and included a series of questions about the number and characteristics of the individuals listed in each participant's social, sexual, and drug networks as well as their levels of interaction and connectedness.

The complete data set included 4514 observations of 983 individuals at five time points. As this analysis aimed to examine predictors of future involvement in the drug economy, five hundred and fifty-four participants who had *ever* experienced the outcome of interest, selling yaba or running (delivering) drugs at baseline were removed from the analysis, leaving 429 individuals whom did not report drug economy involvement. An additional twenty-seven participants (with 126 observations) were deleted due to their status as non-drug using sex network participants. These individuals were thought to be involved in the drug economy via a separate mechanism than drug-using network members. Finally, an additional 34 participants were dropped due to loss-to-follow-up or non-consecutive visit times that prevented the assignment of lagged exposures. The working analytic sample consists of 415 index participants and their 482 drug, 38 sex, and 48 drug and sex network members. Nearly four-fifths (78.9%) of the participants had data for all five visits and over 90% of the sample returned for at least four of the five visits. The final sample then consists of 369 yaba-using

participants and drug-using sexual and drug network members who were naïve to drug economy involvement.

Measures

Drug economy involvement (selling yaba and/or “running” drugs)—The binary outcome, drug economy involvement, was a yes/no response to at least one of two survey questions: “Have you ever sold yaba?” and “Have you ever been paid (in money/drugs) for delivering drugs?” At each follow-up visit, respondents were asked if they had sold yaba or been paid for delivering drugs in the past three months (or since the previous visit). Individuals could experience the outcome multiple times over the 12 months of follow-up. Before combining these two questions, chi-square and t-test statistics were used to verify that each variable was similarly associated with characteristics identified *a priori* to be important predictors of drug economy involvement (e.g., age, gender, income, education, frequency and duration of yaba use and other drug use, prior incarceration, and yaba use among network members).

Fixed and Lagged Exposures—Prior to deletion of the baseline visit observations, all time-varying exposures (with the exception of time) were lagged by three months (one study visit) to ensure that exposures preceded the outcomes. Socio-demographic variables such as age, gender, highest level of education attained, years of yaba use, years of drug use, age at first sex and total number of lifetime sex partners were measured at baseline and treated as fixed exposures. Exposure variables were selected based on the literature and *a priori* hypotheses (e.g., age, gender, income, education, frequency and duration of yaba use and other drug use, prior incarceration, and yaba use among network members) as well as the results of exploratory analyses (e.g., age of first sex). Age of first sex was included as a proxy for other high-risk behaviors. In order to account for the size of one’s yaba-using network, questions which asked, “How many of your close friends who use yaba have talked to you about _[various topics]_?” were converted to proportions by dividing by the total number of close friends that the participant reported used yaba.

General linear mixed models were used during exploratory data analysis to calculate unadjusted associations while incorporating information from all visits. The data suggested a powerful effect of drug use on involvement in the drug economy. Some variables that were not statistically significant during exploratory analyses were retained in the final models based on *a priori* hypotheses.

Analytic Strategy/Model Selection

Because the longitudinal data did not have a relevant time origin, a generalized linear model using general estimating equation (GEE) methods was initially used to account for the correlation between repeated measurements on the same individual at discrete times. The Hubber-White robust estimation approach was used to correct standard errors for the possible misspecification of the correlation structure.

Given the fairly stable within-participant correlation observed in the working correlation matrix, and the clinical significance of modeling individual rather than population parameters, a generalized linear mixed model was fit using GLIMMIX (SAS version 9.1). To account for correlations between repeated measures for each subject and in the responses from members of the same network, a random intercept was utilized. An exchangeable correlation structure is assumed in a random intercept model and the individual-level estimates (compared to the population average estimates provided in the marginal models) allow for the identification of high-risk individuals in clinical settings. A transition random effects model was considered to account for the association between prior drug economy

participation and continued involvement. The transition variable included in the model controlled for drug economy involvement at the previous visit.

Results

In this sample of young Thai yaba users with no prior experience selling yaba or running drugs, 74% were male, the median age was 18 years, secondary school was the highest level of education attained for 68%, about half (51%) had received the intervention, and 11% had a lifetime history of incarceration. At the first visit, the median number of arrests was 1 and the primary reasons for arrest were fighting (37%), using drugs (15%) and carrying drugs (4%).

At baseline, those not included in the sample were about six months older, had 4 more lifetime partners and had slightly more yaba users in their social network, a higher income and were more likely to have been arrested. The mean age of incarceration, years of education attained, years of yaba use and most other characteristics of the social network members were similar for those included compared to those excluded in the analysis.

As seen in Table 1, the incidence of drug economy involvement decreased over time. Table 2 describes the demographic characteristics of the population at each visit. Overall, the distribution of individuals involved in the drug economy was relatively constant over time for recurrent involvement in the drug economy. Figure 1 displays the percent of participants involved in the drug economy by frequency of yaba use across four follow-up visits; more frequent yaba users are more likely to be involved in the drug economy than those using yaba less frequently or not at all which supports a constant relationship between frequency of yaba use and drug economy involvement over time. Due to the relatively constant relationship between the prediction variables and drug economy involvement by visit, time was not included in the final model for recurrent drug economy involvement.

Results of exploratory data analysis using exposures lagged by three months (Table 3) suggest that drug economy participation was significantly associated with an increased number of yaba using network members, a decreased proportion of yaba using networks who quit yaba use in the past three months, increased frequency of yaba use, involvement in the drug economy at the previous visit, and self-report of talking to yaba using network members about physical and emotional problems related to his/her yaba use. Those reporting involvement in the drug economy were also more likely to be younger, have been arrested in the past three months, and have initiated sex at an earlier age. While intervention assignment, education, and recent incarceration were not statistically significant in the simple generalized linear mixed models, they were included in the final model because of their hypothesized role in predicting participation in the drug economy.

Final Model Results

Model I: Recurrent involvement in the drug economy (drug economy naïve sample at baseline.)—As seen in Table 4, the adjusted odds of involvement in the drug economy significantly decreased with increasing age (AOR: .81; 95% CI: .68-.96) and significantly increased with increasing frequency of yaba use (AOR: 1.06; 95% CI: 1.02-1.09). The adjusted odds of drug economy involvement was also higher for those who engaged in selling yaba and running drugs in the previous three months (AOR: 2.61; 95% CI: 1.59-4.28). The proportion of yaba-using friends who recently quit yaba and individual incarceration in the past three months significantly predicted drug economy involvement after controlling for the effects of drug use, intervention group, age and prior drug economy involvement. Specifically, the odds of selling yaba and running drugs decreased by 62% for each additional percent of drug-using network members who quit yaba in the past three

months (AOR:.38; 95% CI:.20-.71). Participants were at significantly greater risk for drug economy involvement if they had been incarcerated in the past three months (AOR: 2.29; 95% CI: 1.07-4.86).

Model II: Incident drug economy involvement—In Model I, drug economy involvement at the previous visit was a very strong and significant predictor of current drug economy involvement (Table 4). In order to identify the mechanism driving initiation of involvement in the drug economy, a sub-analysis was conducted, whereby participants were removed from the dataset after initiating involvement in the drug economy. This effectively eliminated the potential for multicollinearity between previous involvement in the drug economy and other predictors of drug economy involvement so the factors predicting the initiation of drug economy involvement could be isolated.

As seen in Table 4, few differences existed between the two models. Time was an important predictor for incident drug economy involvement but not for recurrent involvement. The odds of incident drug economy involvement was highest at time 1 with a relative decrease in odds of 36%, 64%, and 33% at times 2, 3, and 4, respectively, although only one of the three relative time points was significant. Self-reported age at first intercourse was a statistically significant predictor unique to the model for first occurrence of drug economy involvement, with each year of age leading to a 23% decrease in odds of initiating drug economy involvement (AOR: .77, 95% CI =.62,.85).

Discussion

This study examines predictors of first-time and recurrent involvement in the sale and/or delivery of drugs for profit among a sample of young Thai yaba users. Increased frequency of yaba use was associated with an increased odds of involvement in the drug economy. Having a greater proportion of yaba-using members in one's social network who quit yaba was associated with a decreased odds of drug economy involvement. These results suggest that both individual and network factors influence one's decision to sell and/or run drugs, a finding supported by the literature. Street capital and active recruitment by peers have been identified as factors which predispose homeless youth to participate in the street economy (Gawad, Gostnell et al., 2009). Similarly, using drugs and being surrounded by others who also use drugs may increase one's connections to those already involved in the drug economy. It is also possible that intentions of drug economy involvement motivate one's social network choices. Nevertheless, interrupting individual drug use and/or minimizing the influence of drug-using social contacts may serve, for some, as a point of intervention to prevent initiation of involvement in the drug economy.

The most compelling finding in the current analysis is the effect of prior incarceration. Compared with those who had not been incarcerated in the past three months, those who had been incarcerated were twice as likely to participate in the drug economy. Incarceration may affect involvement in the drug economy by increasing exposure to those who are involved in illegal street markets or by increasing the social and economic barriers to obtaining an income in the formal economy.

These results are consistent with other findings on this relationship. For example, in a cross-sectional study of Thai methamphetamine using these study data, users reported an association between ever selling methamphetamine or being paid to deliver drugs and a history of incarceration after adjusting for age, gender, education, employment status, and drug use and illegal activities (Thomson et al., 2009). The authors suggested that selling and delivering drugs placed youth at higher risk of contact with the judicial system, however the cross-sectional study design prevent the authors from identifying a temporal causal

relationship. A case control study of drug users in Baltimore also linked drug use and having drug users in ones social network with involvement in the drug economy (Sherman & Latkin, 2002). The current study lends support to these findings while establishing temporality for the exposure and outcome relationship.

Some differences existed between the two models. In the recurrent involvement model, the odds of recurrent drug economy involvement increased with self-reported involvement in the drug economy in the past three months and decreased with increasing age. While the effects of prior exposure was unique to the recurrent model by analytic design, age was included in both models but was significant only in the recurrent model. This may be due to varying decisions to engage in the drug economy for the first time and factors associated with continuing engagement after initiation. Social factors may be more important during initiation while economic factors may contribute to persistent involvement. With older age, social pressures may exert forces to a lesser extent on decision-making and the need for economic opportunities may be more pressing.

The model for incident drug economy involvement had two unique predictors; time and age of first intercourse. The importance of time in the incident drug economy model but not the recurrent drug economy involvement model may be an artifact of the how the variables were created; those at highest risk for recurrent involvement in the drug economy at Time 1 were removed from the data because they were not naïve to the drug economy at baseline. Consequently, the remaining participants constitute a group with a substantially lower risk of drug economy participation at later follow-up times. Furthermore, it is not intuitive that age of first intercourse should predict future involvement in the drug economy. However, in this sample the mean age of first intercourse was almost a year younger for those with drug economy involvement ($M=15$, $Sd=1.48$) compared to those without drug economy involvement ($M=15.8$, $Sd=1.47$). Age of first intercourse may be a proxy for other social or psychological factors such as lack of economic opportunity, impulsivity or a need for social or material resources. While some Thai youth may enter the drug economy due to lack of economic opportunity, others may become involved to obtain material needs.

Individual drug use and the drug use of close friends were significant for both recurrent and incident drug economy involvement which reflects the importance of drug networks. Interventions for those naïve to and persistent in selling and distributing drugs should seek to distance participants from drug-using friends and encourage drug cessation. Because incarceration emerged as a significant predictor of both outcomes, interventions should address those leaving the prison system to form positive social networks and provide social and economic support to enter the formal economy.

The two models were deemed to have notable but not robust differences. Those engaging in high-risk behaviors, whether sexual or drug-related, appear to be at higher risk for involvement in the drug economy. The limited social and financial resources present in the current sample may increase the reliance on the emotional and financial benefits of the street economy. Further research could inform an understanding of the relationship between age of first intercourse and drug economy involvement.

The current study has several limitations. First, young Thai yaba users were enrolled in a randomized controlled behavior change intervention trial. Participation in this study required that individuals use yaba regularly and that indexes (but not necessarily networks) be able to identify close network members who also used yaba and recruit them to also participate in the study. Thus, our sample may not represent all young Thai drug users or be generalizable to young Thai yaba users. Second, the data were collected in 2005 and 2006 during a time in which the historical context may have influenced willingness to participate or affected the

validity of self-reported data. However, there were high rates of participation and follow-up and low refusal rates for each of the questions used in this analysis. Changes in drug use trends may also limit the generalizability of the results. Third, limits in power due to sample size may have also prevented the observation of additional significant predictors of incident drug economy involvement; however, the significant associations that were observed should not be affected. Although the two models were not substantively different, our analyses point to the importance in specifying various outcomes, which have different interpretations. Fourth, the ascertainment of exposures (excluding incarceration) was limited to the previous three months. It is possible that the relevant time period for predictors was earlier than the prior three months and that some exposures, such as drug use, may exert cumulative effects. As a result, our definition of relevant exposure may have prevented us from observing statistically significant associations for some long-term predictors. One additional limitation is the inability to distinguish between social causation and social selection of network influences on drug economy involvement in the sample. While having a greater proportion of yaba-using members in one's social network who quit yaba was associated with decreased drug economy involvement, we were not able to differentiate whether this is because yaba using network members encourage involvement in drug economy or because those who opt not to engage in the drug economy also select network members who are less connected to yaba. In either case, these findings demonstrate a social context of drug economy involvement which may have value for intervention efforts. Finally, data were not collected on other forms of participation in the drug economy such as the selling of drugs other than yaba or the production of drugs, limiting the scope generalizability of these findings to other forms of involvement in the drug economy.

Despite these limitations, this analysis has a number of strengths. First, the prospective study design and low rates of attrition allowed for the assessment of a temporal relationship. While first-time and recurrent involvement in the drug economy shared common predictors, unique factors may predict one's decision to participate in the drug economy for the first time. The results of the current study expand the understanding of the precursors of drug economy involvement among yaba users and identify drug and non-drug related opportunities for intervention. The results point to social factors as important predictors of drug economy involvement.

The current study elucidates predictors of drug economy involvement in a population naïve to involvement in the drug market. The emergence of prior incarceration as a predictor of incident and recurrent drug economy involvement underscores the possible need for more appropriate and effective drug treatment options for Thai yaba users. Current yaba use was also a significant predictor of drug economy participation, as was prior incarceration. In addition, the results suggest that drug economy participation is related to yaba use among peers. While the current model is limited in scope, these findings suggest that methods of reducing yaba use outside of the criminal justice system, such as evidence-based drug treatment and harm reduction measures, may be one way to positively impact yaba use in Thailand without also fueling the drug economy.

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Figure 1.
Probability of engaging in drug economy involvement (incident and recurrent) by frequency of yaba use across visits (N=369)

Table 1

Frequency of events by visit (N=369)

	Total # Prevalent Events	N at Risk for Prevalent Event	% Prevalent Events	# Incident events	N at risk for Incident Event	% Incident Events
Visit 1 (3 months)	47	369	12.7	47	369	12.7
Visit 2 (6 months)	41	369	11.1	18	323	5.57
Visit 3 (9 months)	29	361	8.03	9	298	3.02
Visit 4 (12 months)	45	364	12.4	16	292	5.48
Cumulative events			11.07			7.02

Demographic characteristics by visit (N=369)

Involved in selling yaba or delivering drugs												
	Visit 1 (3 months)			Visit 2 (6 months)			Visit 3 (9 months)			Visit 4 (12 months)		
	Yes	No	p-value	Yes	No	p-value	Yes	No	p-value	Yes	No	
	N (%)	N (%)		N (%)	N (%)		N (%)	N (%)		N (%)	N (%)	N (%)
Baseline age <i>Mean (range)</i>	47 (18-22)	322 (18-25)	<0.0001	41 (18-25)	328 (18-25)	<0.0001	29 (18-23)	332 (18-25)	<0.0001	45 (18-25)	319 (18-25)	<0.0001
Education (at baseline)			0.25			0.50			0.52			0.77
Primary	9 (19.2)	37 (11.5)		5 (12.2)	44 (13.4)		2 (6.9)	47 (14.2)		5 (11.1)	42 (13.2)	
Secondary	32 (68.1)	224 (69.6)		31 (75.6)	221 (67.4)		22 (75.9)	225 (67.8)		33 (73.3)	217 (68.0)	
≥ High school	6 (12.8)	61 (18.9)		5 (12.2)	63 (19.2)		5 (17.2)	60 (18.1)		7 (15.6)	60 (18.8)	
Gender			0.43			0.48			0.57			0.42
Males	37 (78.7)	236 (73.3)		32 (78.1)	239 (72.9)		20 (69.0)	245 (73.8)		35 (77.8)	230 (72.1)	
Females	10 (21.3)	86 (26.7)		9 (22.0)	89 (27.1)		9 (31.0)	87 (26.2)		10 (22.2)	89 (27.9)	
Randomized to intervention group	25 (53.2)	157 (48.8)	0.57	20 (48.8)	165 (50.3)	0.85	16 (55.2)	165 (49.7)	0.57	27 (60.0)	155 (48.6)	0.15
Participant Status			0.03			0.52			0.90			0.47
Index	25 (53.2)	119 (37.0)		18 (43.9)	127 (38.7)		11 (37.9)	130 (39.2)		15 (33.3)	124 (38.9)	
Network members	22 (48.8)	203 (63.0)		23 (56.1)	201 (61.3)		18 (62.1)	202 (60.8)		30 (66.7)	195 (61.1)	
Sale or delivery of drugs at previous visit	n/a	n/a	n/a	23 (56.1)	23 (7.0)	<0.0001	16 (55.3)	24 (7.2)	<0.0001	15 (33.3)	15 (4.7)	<0.0001
Incarceration in the past 3 months (yes vs. no)	7 (14.9)	35 (10.9)	0.42	2 (4.9)	5 (1.5)	0.14	2 (6.9)	5 (1.5)	0.04	3 (6.7)	6 (1.9)	0.05

	Involved in selling yaba or delivering drugs													
	Visit 1 (3 months)			Visit 2 (6 months)			Visit 3 (9 months)			Visit 4 (12 months)				
	Yes	No	p-value	Yes	No	p-value	Yes	No	p-value	Yes	No	p-value		
	N (%)	N (%)		N (%)	N (%)		N (%)	N (%)		N (%)	N (%)		N (%)	N (%)
Days used yaba in last 30 days	5.0 (5.14)	4.55 (5.75)	.609	3.94 (4.21)	2.09 (4.07)	.063	7.22 (9.24)	1.73 (3.92)	.0001	3.19 (1.42)	1.25 (3.68)	.049		
Mean (Std														

Table 3

Unadjusted generalized linear mixed models for drug economy involvement(both incident and recurrent events) by a variety of sociodemographic, network, drug use, and study characteristics (controlling for network and individual clustering with GLIMMIX in SAS version 9.1) (N=369)

	OR	95% CI	
<i>Proportion of yaba using network members who ____</i>			
Total # of yaba-using network members ¹	1.05	1.00	1.11
Quit yaba in the past 3 months ¹	0.36	0.19	0.66
Talked to you about physical problems they had from using yaba ¹	1.88	0.82	4.27
Talked to you about emotional problems they had from using yaba ¹	1.62	0.65	4.04
Talked to you about financial problems they had from using yaba ¹	1.30	0.60	2.84
Talked about wanting to quit yaba ¹	1.40	0.58	3.36
Talked about the effect yaba use has had on their relationships with friends, family, or sex partners ¹	0.75	0.27	2.04
Talked about the governments war on drugs ¹	1.72	0.69	4.30
<i>Current drug use and history of drug use</i>			
Duration of yaba use in years ²	1.10	0.87	1.38
Duration of any drug use in years ²	1.00	0.82	1.21
Frequency of yaba use in the past 3 months (number of days in the last 3 months) ¹	1.07	1.04	1.10
Drug economy involvement at the last study visit (yes vs. no) ¹	2.71	1.68	4.37
<i>Talked to friends about ____ in the past 3 months</i>			
Physical problems you have had from using yaba ¹	1.76	1.17	2.65
Emotional problems you have had from using yaba ¹	1.85	1.24	2.77
Financial problems you have had from using yaba ¹	1.29	0.86	1.94
Wanting to quit yaba ¹	1.14	0.76	1.70
The effect yaba use has had on your relationships with your friends, families, or sex partners ¹	1.06	0.70	1.60
<i>Demographics</i>			
Sex (Male vs. Female) ²	1.26	0.72	2.22
Age (centered at 18 years of age) ²	0.82	0.68	0.99
Highest level of education (primary, secondary and ≤ high school) ²	0.86	0.55	1.34
Age at first intercourse ²	0.72	0.61	0.85
Total number of sex partners ²	1.01	0.99	1.03
Incarceration in the past 3 months (yes vs. no) ¹	2.01	0.94	4.30
Prior arrest (ever vs. never in the past 3 months) ¹	1.84	1.10	3.08
<i>Study characteristics</i>			

	OR	95% CI	
Randomized to intervention group (yes vs. no) ²	1.31	0.80	2.13

¹Variables lagged one visit forward

²Variables collected at baseline

Table 4

Final model for the predictors of drug economy participation (N=369)

	Recurrent Model			Incident Model		
	AOR	95% CI	AOR	95% CI	AOR	95% CI
<i>Covariates</i>						
Intercept	0.08	.03 .21	13.9	.95	203.1	
Intervention (yes vs. no)	1.28	0.82 2.00	1.62	0.99 2.62		
Education (Less than high school, High school or more)	1.16	0.65 2.05	0.98	0.62 1.54		
Age (centered at 18 years of age)	0.81	0.68 0.96	0.84	0.68 1.02		
Frequency of yaba use (times per month)	1.06	1.02 1.09	1.05	1.01 1.10		
Proportion of yaba using networks who quit yaba in the past 3 months	0.38	0.20 0.71	0.34	0.15 0.78		
Incarcerated in the past 3 months (yes vs. no)	2.29	1.07 4.86	2.37	1.07 5.25		
Prior drug economy participation (yes vs. no)	2.61	1.59 4.28	-	-	-	-
Age at first intercourse	-	-	0.73	0.62 0.85		
Time 2 (6mos vs 3mos)	-	-	0.64	0.35 1.17		
Time 3 (9 mos vs 3 mos)	-	-	0.36	0.17 0.77		
Time 4 (12 mos vs 3 mos)	-	-	0.67	0.35 1.26		
Index ID random-effect variance (SE)	1.02 (1.65)		1.09 (1.57)			
Degree of Heterogeneity (ν^2)	1.04		1.19			
Subject ID random-effect variance (SE)*	3.36 (1.78)		1.49 (1.92)			
Degree of Heterogeneity (ν^2)	11.29		2.22			