Original Article

Effect of Unobserved Contextual Factors on the Prevalence of New Psychoactive Substance Use in Thailand

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Objective: To explore the associations of characteristics of the cluster environment with new psychoactive substances (NPS) use in Thailand.

Materials and Methods: A cross-sectional study was done on 30,411 Thai people, stratified in multi-stage cluster sampling. Trained interviewers conducted a semi-structured interview in 2016. A multilevel binary logistic regression model was employed to estimate the effects of the cluster environment on the NPS use.

Results: NPS was widely used. The past month prevalence was 13.6%, and habitual use was 4.4%. Clustering significantly affects the spread of NPS use. Controlling for cluster effects, a likelihood of current NPS use was associated with elementary education, occupation, and reported health problems. While a higher likelihood of habitual NPS use was associated with elementary education, employed, and perceived mental health problem.

Conclusion: NPS use was influenced by characteristics of the cluster environment. Therefore, demand reduction strategies should be designed based on a consideration of the impact of cluster context on NPS use behaviors.

Keywords: Cluster effect, New psychoactive substance, NPS, Thailand

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Substance abuse has been recognized as social and health problems. The United Nations Office on Drugs and Crime (UNODC) estimated that 5.6% of the world population used drugs in 2016. Over 10% of those drug users suffered from drug use disorders[1]. According to the UNODC annual report, the frequency use of drugs has stabilized during the past few years, even though harm from substance use have been recognized[2]. Emerging new psychoactive substances (NPS) have been documented[3]. Although the demand for NPS have been increasing, harm from NPS use had been concentrated in several countries[4]. Recently, there have been reported dead from using NPS[5].

NPS are designed drugs to replicate the effects of illegal substances. The NPS are not being used in any medical and scientific reason, and they are not recognized by both the United Nations Single Convention on Narcotic Drug 1961 and the United Nations Convention on Psychotropic Drug 1971. In addition, NPS are not being regulated among any country by any rule or regulation or convention[6]. NPS are harmful and can be addictive, and they can affect the mental and physical health. For instance, NPS might impair the driving skill, and the user can become aggressive[7]. The number of NPS has increased between 2012 and 2016, from 269 to 479 substances [1]. Each country had defined and recognized NPS differently, which UNODC had categorized them into seven categories, such as Synthetic cannabinoids, Synthetic cathinones, Ketamine, Phenethylamines, Piperazines, Plant-based Substances such as kratom and khat, and Miscellaneous Substances[3].

Among many substances used in Thailand, Opium had been accepted and used for more than 600 years[8]. There are reports of using plant-based such as cannabis and Mitragyna speciose Korth (kratom). Recent report found the use of synthetic drugs[9]. The latest national household survey estimated 1.5 million Thai people, aged between 12 and 65 years old, used drugs. Of these, 4.38 in 1,000 population corresponding to 223,126 people had used kratom

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on a daily base. In addition, 22,218 people had used ketamine, and 53,576 people had used ecstasy[10]. Government statistics reported that only 13% of these drug users were estimated to access all treatment systems in 2016[11].

Although the National Household survey in different periods (2002, 2005, 2008, 2009, 2012, 2016) studied the use of drugs, the group of ecstasy, ketamine, and kratom are included in these studies. For the past ten years, kratom users increased 20 times, from 0.81 in 1,000 population in 2007 to 16.56 in 2016, and ecstasy users increased ten times from 0.03 in 1,000 population in 2007 to 0.31 in 2016[10].

Pieces of evidence have emerged that NPS, the designer drugs, have spread throughout ASEAN and in Thailand[12,13]. NPS use behavior associated with various variables, and are recognized[13]. Although, substance use was influenced by characteristics of neighborhood reported elsewhere[14], the association of NPS use and cluster level effect is unclear. The objective of the present study was to investigate the association between cluster-level factors and NPS use among the Thai population using model simulation following the method described by Bronfenbrenner[15].

Materials and Methods

The present study was a descriptive study using a national cross-sectional household survey.

Population and samples

In 2016, 48,541,501 Thai people aged 15 to 64 years old were registered, with a gender ratio of about 1:1[16]. New households that settled in the last six months were excluded. Only family members in the household aged 15 to 64 years old who stayed longer than three months in the past year were eligible.

In Thailand, there was no NPS survey done before the present survey. Thus, the parameters used were the prevalence of any substances used from previous national households' survey in 2011, which varied across the country between 49.04 and 91.81 in 1,000 population[17]. The sample size was calculated to estimate the proportion of NPS with the precision of the estimate at ±1%, a confidence interval level of 95%, and a design effect of 7.9827. The sample size was 32,410.

A stratified five stages cluster sampling was employed. Thailand was stratified into ten zones, Bangkok metropolitan, and nine regional areas. Seventeen districts in Bangkok and 26 provinces were selected systematically proportional to size. Each province, sub-districts were selected systematically proportional to size, 490 sub-districts altogether. Each sub-district, communities were chosen systematically proportional to size, 673 communities altogether. Each community, 10 to 45 households were selected systematically proportional to size from the revised community map for the present survey, 16,205 households altogether. Each household, male and female lists were generated in age order, but included only the people aged 15 to 64 years old. A sample from each list was selected using simple random sampling with a table. Only 30,411 individuals agreed to participate, thus 93.8% of the sample calculated.

Measures and instrument

The interview questionnaire was composed of four parts, corresponding to individual-level, community-level, and cluster-level variables, as well as NPS use.

Covariates

The individual-level variables included age, gender, education, occupational status, monthly income, perceived health problem or illness, perceived work problem or physical status interrupted working activities, perceived mental problem such as mental status that disturbed daily live, and perceived social problem such as a problem of social interaction with friend and others. All variables were categorized as dichotomous variables. The community-level variable was assessed by urban-rural settlement officially. In the present study, cluster-level designated as provincial data based on the past year statistics of ISAN Substance Abuse Academic Network. Two cluster-level variables were identified, treatment rate in 100,000 population, and drug use estimate in 100,000 population.

Outcome of interest

Outcomes of the study were identified as NPS prevalence. NPS current use was defined as a person who uses NPS within the past month. NPS habitual use was defined as a person who uses NPS for 20 days and over during the past month.

The interview questionnaire was developed by 12 experts from the Office of the Narcotic Control Board and Administrative Committee on Substance Abuse Network. The four-week test-retest reliability of the instrument was 0.92. Content validity index (CVI) was 0.96.

Data gathering

Research assistants were initially trained. They

were asked to do fieldwork, which included update community map, making household sampling frame, and select samples, ask permission for informed consent, and interview sample. They could gather the field data only if they passed the performance test. Research assistants would ask intended samples for consent to the study, left it for a few days, and came back later to collect data. Data were collected through a face-to-face interview in a particular household with a privacy atmosphere (1 to 1:30 hours each sample).

Statistical analysis

Data double entry were employed. Descriptive statistics were used to analyze all socio-ecological factors. Multilevel binary logistic regression analysis via generalized linear mixed models was used to analyze the associations among cluster-level variables, each covariate, and substance use. The level 2 comprised of individuals at level 1 (individual-level variables and community-level variables) nested within clusters at level 2 (consisting of 2 variables). The model building process started with a null model consisting of no predictors, and a series of 2-level models were developed. First, in model 1, it was fitted only individual-level variables into the model. Then, in model 2, the community-level variable was entered into model 1. Finally, in model 3, all cluster-level variables were entered into model 2. The median odds ratio (mOR) and interval odds ratio (IOR) were applied to measure the variation of substance use in different clusters and effects of cluster-level variables, respectively. The level of statistical significance was set as a p-value less than 0.05.

Ethics statement

The present study was conducted by research teams. At the stage of data gathering, written consents were required. Personal identifications (names, full addresses) were stripped from the dataset. The present research project was approved by the Human Research Ethical Committee Khon Kaen University (approval number HE581329) based on the principles of the Declaration of Helsinki and ICH GCP standards. Written consents were acquired from the participants and the parents/guardians of minors.

Results

The distribution of characteristics and socio-ecological variables according to their substance used are provided in Table 1. The gender ratio was almost 1:1, while the median age was 44 years. There was 13.6% aged up to 24 years, and 40.0% had obtained elementary education and lower. A quarter was unemployed, and 39.1% earned below US$ 300 per month corresponding to 9,500 baht. In this group, 29.4% was currently smoked, while 19.1% smoked habitually or over 20 days in the past month. One-third reported health problems while perceived working productivity below expectations. Of the perceived problems, 29.1% perceived their mental health problems, while 19.8% perceived their social problems. One-third lived in the urban area. The median of current users' estimation was 1,252 in 100,000 population, while the median of treatment accessibility was 282. In terms of substance used, 15% of the samples were currently substance users, which used within the past month, 12.8% used only NPS, 1.4% used the only illicit drugs (ID), and 0.8% used both no prescription drugs (NPD) and ID. The most frequently NPS used was kratom. While the top frequently ID used was methamphetamine, the rest were cannabis, volatile, and others. ID users tended to be male and living in a rural area compared with non-substances users. Interestingly, NPS users tended to be lower educated, employed, and lower income than non-users. NPS prevalence in the past month was 13.6%, while NPS habitual use, which used NPS over 20 days within the past month, was 4.4%.

Multivariable analysis

As presented in Table 2, multivariable analyses were used to estimate adjusted odds ratios and 95% confidence intervals of variables using binary logistic regression. It was found that gender, age, education, occupation, income, work problem, and social problem were statistically associated with NPS used. At the provincial cluster level, the treatment rate was significantly associated with current used. Both drugs used estimate and treatment rate were significantly associated with habitual use of NPS, even though the effect was small. The respondents who were male, younger, had lower education, were employed, had low income, had perceived of their working problem, and had social problem were more likely to use NPS currently. In addition to these characters, living in an urban area were also likely to use NPS habitually.

Multilevel models

The mOR in all models were greater than 1, indicating that the between-cluster variation in substance use was greater than the within cluster-level variation, all the IOR-80% intervals contained 1, further confirming this finding (Table 3).

In the present study, the past month prevalence

Table 1. Distribution of current users (individual, community, and provincial-level) by substance abuse

	Total (n=30,411); n (%)	None (n=25,862); n (%)	NPS only (n=3896); n (%)	ID only (n=420); n (%)	NPS + ID (n=233); n (%)
Sex					
Male	15,117 (49.7)	12,796 (49.5)	1,829 (46.9)	321 (76.4)	171 (73.4)
Female	15,294 (50.3)	13,066 (50.5)	2,067 (53.1)	99 (23.6)	62 (26.6)
Age					
24 and lower	4,132 (13.6)	3,617 (14.0)	420 (10.8)	61 (14.5)	34 (14.6)
25 and upper	26,279 (86.4)	22,245 (86.0)	3,476 (89.2)	359 (85.5)	199 (85.4)
Education					
Elementary and lower	12,170 (40.0)	9,870 (38.2)	1,934 (49.6)	218 (51.9)	148 (63.5)
Secondary and upper	18,241 (60.0)	15,992 (61.8)	1,962 (50.4)	202 (48.1)	85 (36.5)
Occupation					
Unemployed	7,429 (24.4)	6,658 (25.7)	625 (16.0)	99 (23.6)	47 (20.2)
Employed	22,982 (75.6)	19,204 (74.3)	3,271 (84.0)	321 (76.4)	186 (79.8)
Monthly income					
Up to US$ 300	11,904 (39.1)	9,522 (36.8)	1,980 (50.8)	238 (56.7)	164 (70.4)
US$ 301 and over	18,507 (60.9)	16,340 (63.2)	1,916 (49.2)	182 (43.3)	69 (29.6)
Health problems					
Yes	10,442 (34.3)	8,801 (34.0)	1,460 (37.5)	98 (23.3)	83 (35.6)
No	19,969 (65.7)	17,061 (66.0)	2,436 (62.5)	322 (76.7)	150 (64.4)
Work problems					
Yes	10,037 (33.0)	8,188 (31.7)	1,656 (42.5)	108 (25.7)	85 (36.5)
No	20,374 (67.0)	17,674 (68.3)	2,240 (57.5)	312 (74.3)	148 (63.5)
Mental problems					
Yes	8842 (29.1)	7,241 (28.0)	1,380 (35.4)	132 (31.4)	89 (38.2)
No	21,569 (70.9)	18,621 (72.0)	2,516 (64.6)	288 (68.6)	144 (61.8)
Social problems					
Yes	6,016 (19.8)	4,721 (18.3)	1,140 (29.3)	94 (22.4)	61 (26.2)
No	24,395 (80.2)	21,141 (81.7)	2,756 (70.7)	326 (77.6)	172 (73.8)
Community					
Urban	10,749 (35.4)	9,225 (35.7)	1,379 (35.4)	78 (18.6)	67 (28.8)
Rural	19,662 (64.6)	16,637 (64.3)	2,517 (64.6)	342 (81.4)	166 (71.2)
Treatment rate (in 100,000 population)†	308.10±81.339	304.38±76.279	324.04±99.815	351.91±112.626	376.06±120.509
Drug use estimate (in 100,000 population)†	2,863.23±4,226.823	3,092.14±4,334.009	1,469.58±3,262.616	2,513.19±3,416.951	1,388.97±2,714.491

ID=illicit drugs; SD=standard deviation

† Mean±SD

(currently NPS use) was 13.6%. In model 1, the analysis of the association of the individual-level variables with NPS use showed that a higher likelihood of currently NPS use was associated with elementary education, occupation, low income, reported health problem, perceived of mental health problem, and social problem. In model 2, low income was not associated. In the final model (model 3), two cluster-level variables were added into the model. Drug use estimation was significantly associated with current NPS use.

Habitual use was likely to harm users higher and close to addiction. It was found that 4.4% of the people used NPS habitually, over 20 days a month. In model 1, the analysis of the association of the individual-level variables with NPS use showed that a higher likelihood of habitual NPS use was associated with elementary education, occupation, and perceived mental health problem. In model 2, living in an urban community was significantly associated. In the final

Table 2. Adjusted ORs and 95% CIs from the multilevel binary logistic regression for NPS users and habitual use of NPS

	Multivariables; aOR (95% CI)	
	NPS	HNPS
Sex: male (ref.: female)	1.15 (1.08 to 1.23)***	1.38 (1.24 to 1.54)***
Age <24 (ref.: >25)	1.21 (1.08 to 1.35)**	1.34 (1.11 to 1.62)**
Education elementary (ref.: secondary)	1.28 (1.20 to 1.38)***	1.26 (1.11 to 1.42)***
Occupation unemployed (ref.: employed)	0.50 (0.46 to 0.55)***	0.45 (0.38 to 0.53)***
Monthly income <$300 (9,500 Baht) (ref.: >$301)	1.75 (1.63 to 1.87)***	1.75 (1.55 to 1.97)***
Health problem (ref.: none)	0.97 (0.90 to 1.04)	0.86 (0.76 to 0.98)*
Work problem (ref.: none)	1.26 (1.15 to 1.38)***	1.17 1.01 to 1.37)*
Mental problem (ref.: none)	0.97 (0.88 to 1.07)	1.16 (0.98 to 1.38)
Social problem (ref.: none)	1.48 (1.34 to 1.64)***	1.22 1.02 to 1.46)*
Community-level		
Settlement urban (ref.: rural)	0.985 (0.919 to 1.054)	1.249 (1.113 to 1.402)***
Level 2		
Cluster level		
• Treatment rate	0.998 (0.998 to 0.998)***	0.998 (0.998 to 0.999)***
• Drug use estimates	1.000 (1.000 to 1.000)	1.000 (1.000 to 1.000)***

aOR=adjusted OR; CI=confidence interval; ref.=reference group; NPS=new psychoactive substance; HNPS=habitual use of NPS

* p<0.05, ** p<0.01, *** p<0.001

model (model 3), two cluster-level variables were added into the model. Drug used estimation was significantly associated with habitual NPS used.

Discussion

In general, people begin taking drugs for a variety of reasons. Psychostimulants are considered to be able to reduce fatigue and to enhance activities[18]. NPSs, the designer drugs, were alarming in ASEAN and in Thailand[12,13].

With the objective of exploring the proportion of NPS use, the present study found the past month prevalence of 13.6%. This number is much higher than in the past month prevalence of illicit drugs[10]. It emerges that the current situation of NPS use reflected the widespread epidemic, indicating that NPS is legal, easily accessible, and affordable. It better serves the psychological demand of the population than illicit drugs. Thus, the problem of substance use could be more complicated.

The results showed that the cluster effect was associated with substance use, along with the research findings elsewhere[19-22]. A possible explanation for this finding is that neighborhoods or clusters with a high prevalence of substance used reflect substance availability and accessibility, which could be enabling factors for people throughout the community.

Covariates such as education, occupation, and others were related to both current use and habitual use. This finding is consistent with other research findings[23-26].

The present study was designed as a cross-sectional survey. Therefore, it cannot establish a temporal relationship or causality. However, the present study has the strengths of using the treatment rate as cluster-level, an objective assessment, which is more reliable than a subjective assessment elsewhere[14,27]. Moreover, the study has the strengths of controlling for a wide range of covariates, including large sample size, and utilizing a nationally representative sample, enabling the findings to be generalized. The present study provided not only further insights into cluster-level factors regarding substance use among hard-to-reach groups, but also revealed important descriptive findings. To the best of the authors' knowledge, no other study has investigated the effects of the cluster environment among drug users on a national scale. Nonetheless, further studies with a longitudinal design are required.

Conclusion

The present study demonstrated that the cluster-level factor was associated with NPS use in the Thai setting. These results imply that cluster-level and local socioeconomic factors should be considered when developing preventive interventions for substance use

Table 3. Adjusted ORs and 95% CIs from the multilevel binary logistic regression for NPS users and habitual use of NPS (model 1, model 2, and model 3)

	Model 1; aOR (95% CI)		Model 2; aOR (95% CI)		Model 3; aOR (95% CI)	
	NPS	HNPS	NPS	HNPS	NPS	HNPS
Sex male (ref.: female)	1.21 (0.90 to 1.64)	1.43 (0.93 to 2.19)	1.21 (0.90 to 1.64)	1.43 (0.93 to 2.20)	1.21 (0.90 to 1.64)	1.43 (0.93 to 2.20)
Age <24 (ref.: >25)	0.97 (0.75 to 1.26)	1.15 (0.91 to 1.45)	0.97 (0.75 to 1.24)	1.13 (0.91 to 1.41)	0.97 (0.75 to 1.24)	1.13 (0.91 to 1.41)
Education elementary (ref.: secondary)	1.27 (1.14 to 1.41)***	1.32 (1.13 to 1.53)***	1.25 (1.12 to 1.41)***	1.27 (1.10 to 1.47)**	1.25 (1.12 to 1.41)***	1.27 (1.10 to 1.47)**
Occupation unemployed (ref.: employed)	0.81 (0.67 to 0.97)*	0.70 (0.59 to 0.82)***	0.82 (0.69 to 0.97)*	0.72 (0.60 to 0.87)**	0.82 (0.69 to 0.97)*	0.72 (0.60 to 0.87)**
Monthly income <$300 (ref.: >$301)	1.15 (1.02 to 1.29)*	1.16 (0.88 to 1.52)	1.12 (0.98 to 1.28)	1.07 (0.83 to 1.39)	1.12 (0.98 to 1.28)	1.07 (0.83 to 1.39)
Health problem (ref.: none)	1.28 (1.15 to 1.43)***	1.03 (0.89 to 1.18)	1.28 (1.16 to 1.42)***	1.02 (0.89 to 1.17)	1.28 (1.15 to 1.42)***	1.02 (0.89 to 1.17)
Work problem (ref.: none)	1.09 (0.93 to 1.26)	0.99 (0.83 to 1.19)	1.08 (0.93 to 1.26)	0.99 (0.81 to 1.18)	1.08 (0.93 to 1.26)	0.98 (0.81 to 1.18)
Mental problem (ref.: none)	1.24 (1.11 to 1.38)***	1.27 (1.05 to 1.53)*	1.24 (1.12 to 1.39)***	1.28 (1.06 to 1.55)*	1.24 (1.12 to 1.39)***	1.28 (1.06 to 1.55)*
Social problem (ref.: none)	1.16 (1.00 to 1.34)*	1.05 (0.76 to 1.45)	1.15 (1.00 to 1.33)*	1.05 (0.76 to 1.44)	1.16 (1.00 to 1.39)*	1.05 (0.76 to 1.44)
Community-level						
Settlement urban (ref.: rural)			1.158 (0.935 to 1.436)	1.543 (1.237 to 1.925)***	1.158 (0.935 to 1.436)	1.543 (1.237 to 1.924)***
Level 2						
Cluster level						
• Treatment rate					1.007 (0.994 to 1.020)	1.005 (0.993 to 1.016)
• Drug use estimates					1.000 (1.000 to 1.000)**	1.000 (1.000 to 1.000)**
Random effects						
Level 1[a]	1	1	1	1	1	1
Level 2[b]	6.042 (1.817)**	4.831 (1.530)**	6.097 (1.833)**	4.986 (1.578)**	5.908 (1.851)**	4.774 (1.572)**
Median OR	10.430	8.138	10.542	8.415	10.161	8.038
IOR-80% for treatment					0.012, 81.894	0.019, 52.727
IOR-80% for drug use estimates					0.012, 82.469	0.019, 52.464

OR=odds ratio; aOR=adjusted OR; CI=confidence interval; ref.=reference group; IOR=interval OR; NPS=new psychoactive substance; HNPS=habitual use of NPS

[a] Variance at level 1 was constrained to 1, [b] Estimate standard error

* p<0.05, ** p<0.01, *** p<0.001

reduction. The application of these results might be suggested that cluster-level and local socioeconomic factors can be applied by judgment considered while developing interventions for substance use protection measured.

What is already known on this topic?

NPS was spread throughout Thailand. NPS use behavior associated with various variables is recognized elsewhere.

What this study adds?

In Thailand, NPS use was influenced by characteristics of the cluster environment.

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Conflicts of interest

The authors declare no conflict of interest.

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