

## Development and Validation of a New Substance Use Disorder Screening Test Based on the Diagnostic and Statistical Manual of Mental Disorders (DSM–5)

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### Abstract:

**Objective:** The lack of a screening tool for substance use disorders is a significant problem for health care workers for patient care and referral. This study aimed to develop a Substance Use Disorder Screening Test (SUDST) to enable accurate classification of the severity of substance use disorders based on the Fifth Edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM–5), that can be used by health professionals in all settings for basic screening for individuals at risk of substance use disorder.

**Material and Methods:** Following close study of the DSM–5, 11 questions were developed, which were then tested on 207 participants who were receiving treatment for the use of methamphetamines. The participants were interviewed with the SUDST, the Ministry of Public Health Version 2 (normally ‘V.2’) screening test for risk of substance use, and were clinically diagnosed by their attending psychiatrist.

**Results:** The Cronbach’s alpha coefficient for SUDST was 0.79. The scores obtained from the SUDST were in high agreement with the V.2 and clinical diagnosis ( $p$ -value $<0.001$ ). Factor analysis showed three components of substance use disorder: 1) preoccupation and loss of control, 2) risky/harmful use, and 3) biopsychosocial aspects. Of the total possible score of 11, the cut-off points for identifying severe, moderate, and mild levels of risk were  $\geq 7$ , 5–6, and 3–4, respectively, with sensitivity=72.7%–96.5% and specificity=61.9%–88.7%.

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**Conclusion:** The SUDST had high reliability and validity and could be used to detect patients at risk of substance use disorders.

**Keywords:** addiction, diagnosis, DSM, psychostimulants, scale development

## Introduction

Substance use is a major cause of many problems on all continents around the world, affecting individuals, families, communities, and societies. In South East Asian countries, the most common illicit substances used are cannabis, kratom, and methamphetamine<sup>1-3</sup>, of which the latter (commonly known as speed pill (yaba in Thai) and crystal meth (ice)) cause the most problems in the region. The Princess Mother National Institute for Drug Abuse Treatment (PMNIDAT), the first and largest treatment center for substance use disorders in central Thailand and South East Asia with 600 inpatient beds, reported that almost half of their patients had methamphetamine use disorder<sup>4</sup>, which increased each year from 40.3% in 2016, to 46.4% in 2017, and to 54.4% in 2018. Most of the patients with methamphetamine use disorder in this treatment center had a history of psychiatric symptoms that included anxiety or suspiciousness (91.2%), depression (86.8%) and hallucination (85.7%)<sup>5</sup>.

The lack of an effective and user-friendly assessment tool for substance use disorders is a significant problem for health care workers for patient care and referral to the appropriate setting for management. Currently facilities in Thailand use the Ministry of Public Health Screening Test Version 2 (V.2) for substance use disorders, which was adapted from the World Health Organization (WHO) Alcohol, Smoking, and Substance Involvement Screening Test (ASSIST)<sup>6,7</sup>. The V.2 is currently used to assess the level of risk of substance use to allocate people who use substances to the appropriate level of formal treatment in Thailand. People who have a low risk assessed by the

screening test are generally referred for outpatient treatment in a general, provincial, or district hospital with services for people who are addicted to substances, while those assessed to have a moderate risk are usually referred to a treatment program at a designated government location in each province which are operated in collaboration between the Ministry of Public Health, Ministry of Defense, Ministry of Justice and Ministry of the Interior<sup>8</sup>. And people assessed to have a high risk of methamphetamine use disorder as screened by the V.2 are usually sent for inpatient treatment at one of the special facilities for treating people with serious drug abuse problems in the 4 regions of Thailand.

In 2013, the American Psychiatric Association issued the Fifth Edition of the Diagnostic and Statistical Manual for Mental Disorders (DSM-5)<sup>9</sup> which views substance use problems as a continuum of disorders from mild or moderate to severe substance use disorder. As such, the diagnoses of the DSM-5 for substance use disorders, especially methamphetamine, the most problematic illegal substance in the region, has never been tested or compared to Thai V.2. In the study, we compared the V.2, which is the main screening tool for allocating persons with illegal drug use problems in Thailand to receive treatment, to the Substance Use Disorder Screening Test (SUDST), based on the DSM-5 criteria. The SUDST was then compared with actual clinical diagnoses of substance use disorder by clinicians. The study aimed to establish cut-off points to classify the severity of substance use disorder by the SUDST and to investigate the reliability and validity of this new screening tool for clinical substance use disorder. The new instrument can be used with other personal and

societal factors to allocate persons who have substance use problems to appropriate treatment facilities for substance use according to their needs.

## Material and Methods

Two hundred and seven male and female patients aged 13 years and older who received either voluntary or compulsory outpatient service for the use of methamphetamine by PMNIDAT or its satellite hospitals in the four regions of Thailand, central (PMNIDAT or Thanyarak Pathumthani), north (Thanyarak Chiang Mai), northeast (Thanyarak Khon Kaen), and south (Thanyarak Songkla) were interviewed between August 2017 and December 2018 by the attending psychiatrist (one psychiatrist from each hospital) and diagnosed with substance use disorder based on the DSM-5 criteria, all of whom had at least 3 years of experience in addiction treatment. The attending psychiatrists were blinded to the diagnoses made by the questionnaires used in the study. Risk of methamphetamine use disorder for each patient were assessed using the SUDST and the V.2 by research nurses (one nurse with at least 5 years of experience in addiction treatment from each hospital). All interviewers attended a one-day training class on the use of the SUDST and V.2 at the PMNIDAT. Participants with cognitive impairment or psychosis (e.g., a history of being diagnosed with dementia or a psychotic disorder) were excluded from recruitment in the study. Parental consent to the study was obtained for participants under the age of 18. The sample size in the study exceeded the minimum requirement of the 1/10 rule of thumb for scale development (11 items resulting in 110 samples). All eligible participants during the duration of the study were recruited by purposive sampling. The study was approved by the PMNIDAT Ethics Committee with study number 59023.

The SUDST was developed by the authors based on the DSM-5 criteria for substance use disorders<sup>9</sup>. The resulting test had 11 yes-no questions for the respondent to answer which assessed the participants' substance use experiences during the previous 12 months. The content validity of the test was assessed by five experts in the fields of addiction, behavioral science, and psychometric tests. The index of Item-Objective Congruence was 0.7. The screening tool was then adjusted following the recommendation by the reviewers and tested in 30 subjects<sup>10</sup> with a current diagnosis of substance use. The language was then further adjusted on the basis of the findings of this initial field testing. The language-adjusted screening test was then tested for inter-rater reliability by two independent interviewers with a time interval not more than one week apart. The content of the screening test included four aspects of addiction, including impaired control of substance use, social impairment from substance use, risky use of a substance, and the pharmacological aspects of addiction.

The V.2 is the most common screening tool for referred persons with substance use problems in Thailand. It was developed by the Ministry of Public Health (MOPH) and is known as 'Screening Form – MOPH: Version 2' or V.2 in brief. The test was adapted from the World Health Organization (WHO) Alcohol, Smoking, and Substance Involvement Screening Test (ASSIST), and consists of 6 questions related to substance use behaviors, the impact of substance use, and other factors related to substance use about substance use in the previous 3 months. Each item has 5 answer options from never, only 1–2 times total, about 1–3 times per month, 1–4 days per week, and 5–7 days per week (almost every day). The total score is then categorized into three levels (mild, moderate, and severe) of risk for substance dependence.

Relationships in the family was an item asking the participant to report their relationships with others in the

family, i.e. were they harmonious, distant, did they fight with others sometimes or almost always? Another question was about ever being charged with a drug offence. The completeness of the data of all questionnaires was verified by a researcher. If there were any incorrect or missing data, the interviewers would be informed to correct them with the participants. The total duration of data collection was 16 months. First, we tested the reliability of the SUDST by using Cronbach's alpha coefficient for internal consistency. The concurrent validity of the questionnaire for the diagnosis of substance use disorder was tested using the contingency coefficient with the clinical diagnosis. In addition, construct validity was tested by using factor analysis that included Principal Component Analysis as the extraction method with orthogonal rotation (Varimax). Finally, the SUDST was tested to determine the cut-off point of developing substance use disorder according to the judgment of the clinicians. The cutoff points for differentiating the levels of substance use disorders were analyzed using the area under the receiver operating characteristic (ROC) curve to determine the sensitivity and specificity values of the SUDST.

## Results

Table 1 shows the demographics of the study participants. Of the 207 participants, the majority were men (88.4%), single (60.9%) and high school graduates (57.0%). The mean age was 29 years (S.D.=8.3, minimum (Min)=14, maximum (Max)=53). Twenty-seven percent of the participants were unemployed and 67.1% had been charged with drug-related offences in the past. Table 2 shows the data on substance use. Most of the participants used methamphetamine and other illegal substances, including cannabis and kratom (67.6%). Of note, cannabis and kratom was still restricted drugs at the time of the study. About one-third (29.0%) used speed pills (yaba) only without any

other illegal substance. The average daily amount of speed pills (yaba) consumed was 4 pills and the average duration of illegal substance use was 7 years. Most of the people who used crystal meth (ice) did not know the daily amount in grams.

**Table 1** Demographic data of the study participants (N=207)

Demographics	Number (N=207)	%
Gender		
Male	183	88.4
Female	24	11.6
Marital status		
Single	126	60.9
Married	65	31.4
Divorced, widowed, separated	13	6.3
Did not answer	3	1.4
Age (years)		
Mean=29, S.D.=8.3, Min=14, Max=53		
≤19	27	13.0
20–29	89	43.0
30–39	66	31.9
40–49	21	10.2
≥50	4	1.9
Level of education		
None	1	0.5
Primary school	45	21.8
High school	118	57.0
Vocational school	28	13.5
Bachelor or graduate degree	15	7.2
Occupation		
Unemployed	56	27.0
Student	11	5.3
Employee	73	35.5
Farming / fishery	16	7.6
Business owner	39	18.8
Government officer	10	4.8
Did not answer	2	1.0
Relationships in the family		
Good	117	56.5
No interactions / distant	21	10.1
Fighting a few times	63	30.5
Fighting almost always	6	2.9
Drug offence(s)		
Ever	139	67.1
Never	68	32.9

S.D.=standard deviation, Min=minimum, Max=maximum

**Table 2** Substance and methamphetamine use data in study participants

Substance use variables	Number (N=207)	%
Substance use		
Speed pills (yaba) only	60	29.0
Crystal meth (ice) only	3	1.5
Speed pills and crystal meth only	4	1.9
Yaba/ice and other substances <sup>a</sup>	140	67.6
Daily amount of yaba use (pills)		
Mean=4, S.D.=5.1, Min=0.5, Max=48		
≤5	143	72.9
6–10	20	10.1
11–15	4	2.0
>15	2	1.0
Did not answer	29	14.0
Duration of yaba use (years)		
Mean=84, S.D.=74.4, Min=12, Max=576		
≤5	104	52.5
6–10	45	22.7
11–15	25	12.6
16–20	15	7.6
>20	4	2.0
Did not answer	5	2.6
Daily amount of ice use (grams)		
<1 gram	17	25.4
1 gram and more	4	5.9
Did not answer	46	68.7
Duration of ice use (years)		
Mean=36, S.D.=49.9, Min=2, Max=240		
≤1	10	14.9
2–5	10	14.9
6 or more	2	2.9
Did not answer	45	67.3

S.D.=standard deviation, Min=minimum, Max=maximum

<sup>a</sup>Cannabis, kratom

Regarding the reliability of the SUDST as examined in the study, the Cronbach's alpha coefficient was 0.8, which indicates good internal consistency of the instrument, but the Cohen's kappa was only 0.5 for inter-rater reliability. The construct validity was tested using factor analysis of the 11 questions used in the questionnaire and the results shown in Table 3. The extraction method was used with Principal Component Analysis by Varimax rotation. Three aspects of substance use disorder were found, including preoccupation / loss of control of use comprising 4 items, risky or harmful use comprising 3 items, and the impact of use comprising 4 items. Most of the factor loading values of the three aspects were at a moderate level (0.5–0.75). Factor 1 accounted for 32.3% of the overall variability, Factor 2 for 10.1%, and Factor 3 for 9.3%. The concurrent validities of the SUDST for substance use disorder with other measures, including clinical diagnosis by a physician and the V.2, were high by using a contingency coefficient (p-value<0.001) (Table 4).

**Table 3** Factor loading of the 11 items of the Substance Use Disorder Screening Test (SUDST)

Factor	Item	Factor loading
Factor 1	1 Used more than intention	0.72
	3 Preoccupation / loss of control of substance use	0.67
	2 Wanted to stop or cut down but failed	0.55
	4 Craving for substance	0.49
Factor 2	9 Used despite the fact that the substance caused problems	0.73
	8 Risky / harmful use	0.69
	10 Used in risky situations	0.54
Factor 3	11 Tolerance	0.72
	6 Impact of use	0.69
	7 Used despite having problems with others	0.66
	5 Reduced healthy recreational activities	0.66
	5 Used until impairment in work, school, or family	0.41

**Table 4** Concurrent validity of the Substance Use Disorder Screening Test (SUDST) with V.2 and clinical diagnosis

Measures	Coefficient	p-values
V.2	0.6	<0.001
Clinical/physician diagnosis based on DSM-5	0.5	<0.001

V.2=Ministry of Public Health Screening Test, Version 2

DSM-5=Fifth Edition of the Diagnostic and Statistical Manual of Mental Disorders

**Table 5** Cut-off point for the Substance Use Disorder Screening Test (SUDST) compared to clinical judgment based on the DSM-5 criteria for substance use disorders

Level of substance use disorder	Cut-off point	Sensitivity (95% CI)	Specificity (95% CI)	Area under curve (95% CI)
Severe	≥7	77.9% (77.2%–78.6%)	72.7% (72.1%–73.3%)	0.8 (0.8–0.9)
Moderate	5–6	88.7% (88.2%–88.8%)	61.9% (61.4%–62.4%)	0.9 (0.8–0.9)
Mild	3–4	96.5% (95.5%–97.4%)	66.7% (66.2%–67.2%)	0.9 (0.7–1.0)

DSM-5=Fifth Edition of the Diagnostic and Statistical Manual of Mental Disorders

Table 5 shows the SUDST cut-off points decided on to determine the level of substance use disorder and categorize the patients into three groups according to clinical judgement as low, moderate or high risk of substance use disorder according to the physician's judgment. The score of 7 or higher had high sensitivity (77.9%) and specificity (72.7%) to determine the high-risk group. Scores of 5 or 6 were set to define the moderate risk group (sensitivity=88.7%, specificity=61.9%), and scores of 3 or 4 to define the low risk group (sensitivity=96.5%, specificity=66.7%). The Area Under the Curve (AUC) was 0.8–0.9 for all of three aspects.

## Discussion

The SUDST is a screening test developed based on the DSM-5 criteria for substance use disorders comprising 11 questions regarding the experiences of substance use

in a patient over the previous 12 months with simple yes or no answers, giving a total score of 0 to 11. It is suitable for addiction researchers/specialists to help them evaluate people who use illegal substances with respect to a DSM-5 diagnosis of substance use disorder using the DSM-5 diagnostic criteria or to evaluate the risk of future illegal substance use, especially methamphetamines, using the new cut-off point for all of the three levels of substance use disorder for clinical purposes such as allocation of persons to specific treatment settings (i.e. outpatient, inpatient, long-termed rehabilitation)<sup>8</sup>.

The reliability by internal consistency of the Thai SUDST instrument was found to be on a good level as indicated by a Cronbach alpha coefficient=0.8. Construct validity by Principal Component Analysis found that 3 factors covered 51.8% of the variance including 32.3%, 10.1% and 9.3%, for Factor 1 (preoccupation / loss of control), Factor

2 (risky and harmful use), and Factor 3 (impact of use), respectively. The concurrent validity of the instrument was good compared to both the V.2 and clinical diagnosis/judgment (both  $p$ -values < 0.001). In addition to using the DSM-5 diagnostic criteria for substance use disorders, the scores from this new instrument could make cut-off points able to divide subjects into three categories comparable to clinical judgment, including a high risk (score=7 or more with sensitivity=77.9% and specificity=72.7%), moderate risk (score=5-6 with sensitivity=88.7% and specificity=61.9%), and low risk (score=3-4 with sensitivity=96.5% and specificity=66.7%) with AUC at good levels (0.8-0.9).

In the study, all participants had used methamphetamine in the past 12 months and two-thirds of them had used it with other illegal substances. This proportion is consistent with the recent annual report which found that more than half of their patients with methamphetamine use disorders at the treatment center had used other illegal substances in the previous 12 months<sup>4</sup>. Using more than one substance increases both harm and negative outcomes, and might also be related to the level of risk and result in different screening results<sup>10</sup>. We did not exclude participants who used more than one substance in this study. We felt that including people who used substances other than methamphetamine would reflect the real-world situation that would make the SUDST more useful generally.

The factor analysis of the SUDST revealed three components or aspects, 1) preoccupation or loss of control, 2) risky/harmful use, and 3) impact of use. The results were consistent with other instruments related to measuring the severity or risk of substance. For example, the Khon Kaen University-Volatile Use Disorder Identification Test (KKU-VOUDIT)<sup>11</sup>, a ten-question questionnaire, is comprised of three components, intoxication or impact of use, preoccupation or loss of control, and harmful use. However, the DSM-5 diagnostic criteria for substance use disorder suggest four components of the disorder, including impaired control, social impairment, risky use, and the

pharmacological component<sup>9</sup>. In general, preoccupation or loss of control over substance use is usually considered to be the core symptom by the definition of addiction, that is, continuing to use or seek a substance despite knowing that it causes harm to oneself. Four items or questions to assess the component or aspect of impaired control in our study, including 1) use of substance more than intended, 2) unable to stop or reduce substance use, 3) spending a lot of time using/interacting with the substance, and 4) craving the substance.

The pharmacological aspect of substance use disorder has not appeared as a main component in the study. Specifically, there were two questions reflecting the pharmacological aspects of substance use disorder (tolerance and withdrawal) included in the risky / harmful use component and in the impact of use component. The items for the components of risky/harmful use were 1) using a substance in a risky situation (i.e., driving, operating machinery), and 2) using a substance despite knowing it can cause physical, psychological, or other problems, and 3) increasing the amount of substance to get the same effect or experiencing a reduced effect while using the same amount of the substance. It is understandable that tolerance of a substance, especially having to increase the amount of the substance in order to get the same effect, may be viewed as risky/harmful use.

Similarly, having withdrawal symptoms from methamphetamine, including fatigue, hypersomnia, or irritable or depressed mood, may be viewed as negative impacts of substance use and are included in the component of impacts of use. The other items in this component include 1) regular use of a substance until you have impaired function for work, study, or family, 2) use of a substance despite it causing an interpersonal relationship problem (i.e., domestic violence, physical or verbal fights), and 3) reduced social or recreational activities due to substance use.

Several limitations of the study should be mentioned. Firstly, recall bias in persons who used drugs and other confounding factors, including the use of other substances than methamphetamine, could have interfered with our results<sup>7</sup>. The study was carried out in addiction treatment settings, so most of the participants had substance use problems and thus the results could not reflect the feelings of those with a milder level of substance use. Further studies should test the instrument in primary health care settings where more people with mild levels or use without any level of substance use disorder would be included. Additionally, a larger sample size would give more power to tests of the instrument. The instrument was tested for methamphetamine (yaba or ice) only, therefore it should be tested for validity, reliability, and cut-off points for other substance use disorders including illegal substances (i.e., cannabis, kratom, opioids) or legal substances (i.e., alcohol, tobacco). However, the tool might be used for these substances, as the DSM-5 diagnostic criteria for substance use disorder are identical for all substances. Another limitation is that neither a clinical diagnosis nor the V.2 are generally considered as gold standard tools. However, the clinical diagnosis of the psychiatrists in the study had a high concurrent validity with the Mini International Neuropsychiatric Inventory (M.I.N.I.) (p-value<0.001, data not shown), which is generally used as a standard diagnostic tool in both clinical and research settings. Lastly, persons of different ages who use drugs might have different cut-off points, which is worth studying further.

Using the SUDST, as well as the risk assessment using V.2, which has already been formally used, the severity of the disorder is divided into three levels of risk, including mild, moderate, and severe. By doing so, substance use disorder is viewed as a spectrum and not a binary of disease (for example, abuse or dependence). This work agrees with the ASSIST<sup>7</sup> and DSM-5 diagnostic criteria<sup>9</sup> (which were the basis of the SUDST). The SUDST

cut-off point for the mild level of risk of substance use disorder had a 96.5% sensitivity, making the instrument a good candidate for screening people with risky substance use behavior to various levels of severity and referral to an appropriate setting in the early stages of the disease. Therefore, the SUDST is an option that can be used in a health care setting to differentiate the severity of substance use. This is the first instrument in Thailand to use DSM-5 for the diagnosis of substance use disorders with different cut-off points from the original DSM-5 to determine the severity. The implication of these results is that this new instrument could help identify drug abuse problems at an earlier stage in the future, allowing for earlier treatment. The tool could be used in the Thai context to allocate people with methamphetamine use disorder to appropriate treatment based on the severity of their use. The results might be further studied in other countries with a similar context as Thailand, where methamphetamine use is one of the most common drug problems.

## Conclusion

The SUDST based on the DSM-5 criteria had high reliability and high sensitivity and specificity to test the severity of methamphetamine use disorder. The SUDST showed three components or aspects of addiction, preoccupation and loss of control, risky or harmful use, and impact on the biopsychosocial outcome. In the future, people with other substance use disorders, including other illegal substances (i.e., cannabis, kratom, opioids) or legal substances (i.e., alcohol, tobacco), should be recruited to test the reliability and validity of the instrument.

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## Conflict of interest

There are no potential conflicts of interest to declare.

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