

# Depression and Severity of Substance Dependence Among Heroin Dependent Patients With ADHD Symptoms

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**Background and Objectives:** Comorbid attention deficit hyperactivity disorder (ADHD) symptoms are highly prevalent among heroin-dependent patients. We aim to investigate differences in dependence severity, depression, and quality of life between heroin-dependent patients with and without ADHD-screened positive.

**Methods:** Heroin-dependent participants ( $n = 447$ ) entering methadone maintenance treatment were divided into ADHD-screened positive (ADHD-P) and ADHD-screened negative (ADHD-N) groups according to scores of Adult ADHD Self-Report Scale (ASRS). Mini-International Neuropsychiatric Interview was used to identify current and lifetime depressive episodes and suicidality. Substance use disorder, depression, family support, and quality of life in two groups were also assessed.

**Results:** About 7.8% ( $n = 35$ ) scored 24 or higher of ASRS indicating highly likely Adult ADHD. More heroin-dependent patients of ADHD-P had a current depressive episode ( $p = .02$ ). They had higher Center for Epidemiological Studies Depression (CESD) scores ( $p = .003$ ), and more severe heroin dependence ( $p = .006$ ). Poorer family support and quality of life in physical, and psychological domains were found in patients of ADHD-P compared to ADHD-N.

**Discussion and Conclusions:** Heroin-dependent patients of ADHD-P represent a vulnerable minority. They were comorbid with regard to depression, greater substance dependence severity, and poorer quality of life.

**Scientific Significance:** Assessment for ADHD symptoms in heroin-dependent patients may be indicated for the effective management of the complex problems of these patients. (*Am J Addict* 2017;26:26–33)

## INTRODUCTION

Attention Deficit Hyperactivity Disorder (ADHD) is a complicated neurodevelopmental disorder and the etiology involves genetic predisposition, neurochemical, neuroanatomical anomalies, and environmental factors.<sup>1</sup> It is a common disorder and has a variable prevalence from 5.9% to 7.1% as defined by the Diagnostic and Statistical Manual of Mental Disorders, fourth edition in a review and a meta-analysis.<sup>2,3</sup> ADHD was believed to be a childhood disorder but it has been found that 40–60% of childhood ADHD persists into adulthood.<sup>4,5</sup> The prevalence of ADHD in the adult population ranges from 2.5% to 5%.<sup>6</sup> A nationwide population-based study in Taiwan revealed the prevalence of treated ADHD in adults was from 5% to 10%.<sup>7</sup> The behavioral and cognitive symptoms remain significant into adulthood for patients and cause functional impairment.

ADHD is frequently comorbid with substance use disorders (SUD).<sup>8,9</sup> The National Comorbidity Survey Replication showed odds ratio of 1.5–7.9 for SUD among adults with ADHD compared to those without. ADHD is also often diagnosed in SUD patients. In a large cross-sectional international study, the prevalence of adult ADHD in this SUD population was 13.9%.<sup>10</sup> A recent meta-analysis revealed higher ADHD prevalence in SUD adults (23.1%, CI: 19.4–27.2%).<sup>11</sup> Children with ADHD have a higher risk of drug use problems than those without ADHD. The onset age is earlier and there is a higher chance of drug abuse and dependence. SUD patients with ADHD have poor treatment outcomes for both SUD and ADHD.<sup>12</sup> SUD patients with ADHD tend to have more severe substance dependence and less favorable prognosis.<sup>13,14</sup> If we focused on opioid abuse, patients with adult ADHD have significantly higher

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opioid dependence severity and less abstinence.<sup>15,16</sup> The prevalence of heroin use disorder in Taiwan was .05% in 2014, accounting for 50.3% of total SUD. There was no study regarding prevalence of ADHD symptoms in patients with SUD and only one study focusing on higher risk of substance use disorder in patients with persistent ADHD in Taiwan.<sup>17</sup> Few studies reported the effect of ADHD on patients receiving methadone maintenance treatment (MMT) in western countries<sup>15,16</sup> and there is no report in Asia. An important limitation of the currently available research is that little or no emphasis is given to differences in comorbidity patterns among SUD patients with ADHD.

To our knowledge, few studies have specifically investigated the association of ADHD, opioid dependence, and comorbidities in MMT patients. This paper investigates comorbidity patterns in adult treatment-seeking heroin-dependent patients with and without ADHD. The study also explores possible differences of social support and quality of life in heroin-dependent patients with and without comorbid ADHD.

## METHODS

### Study Design and Participants

We conducted a cross-sectional study to investigate the differences in comorbidity patterns in heroin-dependent with ADHD-screened positive (ADHD-P) and ADHD screened negative (ADHD-N). All adult participants were recruited from a methadone maintenance treatment (MMT) program at Tsaotun psychiatric center in Nantou County in middle Taiwan. The patients received interviews from senior attending psychiatrists and were defined as heroin dependent by the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Text Revision (DSM-IV-TR). Participants entered the MMT program between 2006 and 2011 at Tsaotun Psychiatric Center. The participant eligibility criteria were: heroin use for more than 1 year, diagnosis of heroin dependence according to the DSM-IV-TR criteria, aged of 18 or more years, and no past history of severe physical illness. Exclusion criteria included illiteracy, severe cognitive impairment, and diagnosis of mental retardation by a psychiatrist. A total of 447 heroin-dependent participants were recruited. All participants completed a set of self-reported questionnaires administered by a trained psychiatric nurse. Suicidality, alcohol, and illicit drug use history, HIV-related risky behaviors, criminal behaviors, and several self-administered questionnaires (Family APGAR scale, Barratt Impulsiveness Scale, Severity of Dependence Scale, and The World Health Organization Quality of Life-Short Form) were also evaluated. Interviews were also conducted according to Mini-International Neuropsychiatric Interview (MINI) to detect the current depressive episode. Informed consents were obtained following illustration of the study procedure. The institutional review board at Tsaotun Psychiatric Center granted approval for this study.

## Measures

The assessment included demographic data, heroin, and other substances use history, criminal history, history of suicide attempts, and psychiatric comorbidity before MMT. The amount of heroin is measured by the traditional unit (Qian) in Taiwan. Half a Qian equals 1.875 g in the International System of Units. Participants were asked the average amount of heroin (in Qians) per day and number of heroin-using days in the last 30 days. Estimated heroin amount of use was presented as days to use up half Qian of heroin. Suicide history included lifetime suicide attempts and suicide attempts in the past 1-month. The questions were "Had you attempted suicide in the past one-month? Did you ever make a suicide attempt?" These questions were derived from the Mini-International Neuropsychiatric Interview (MINI). MINI questions were also used to identify current and past depressive episodes. MINI has been validated in Taiwan and used for MMT participants in previous studies.<sup>18</sup>

### Adult ADHD Self-Report Scale Chinese Version

The World Health Organization developed Adult ADHD Self-Report Scale (ASRS) with the revision of WHO Composite International Diagnostic Interview (CIDI). The ASRS comprised 18 questions reflecting the DSM-IV criteria A symptoms of ADHD. The wording of questions provided a context which is more suitable for adults. The 18 items were split into two parts which part A is for inattentive type ADHD whereas part B for hyperactive/impulsive type. The scale for each question ranged from 0 to 4 (from never to very often). In the Chinese version, the score of 17 or higher in either part A or B means the patient is likely to have ADHD, and 24 or higher means highly likely having ADHD.<sup>19</sup> ASRS has been used in epidemiology studies and showed good validity among SUD patients.<sup>20,21</sup> The psychometric properties of the Chinese version of the ASRS had been found to be valid in Taiwan with good concordance and internal consistency.<sup>19</sup>

### The Center for Epidemiological Studies Depression Scale

The Center for Epidemiologic Studies Depression Scale (CESD) is a 20-item self-administered scale assessing the frequency of depressive symptoms in the preceding week.<sup>22</sup> For each item associated with depressive symptoms, a Likert-type scale ranging from 0 (experienced rarely or none of the time) to 3 (experienced most or all of the time) was provided. The standard cut-off score for clinically significant depression is 16, and higher scores correlate with a higher level of depressive symptoms.<sup>23</sup> The validity, reliability, internal consistency, and test-retest reliability has been verified (Cronbach's alpha = .90, intra-class correlation reliability = .93).<sup>24</sup> The CESD has also been translated into Chinese, and has been applied in numerous epidemiology studies of depression in the general population. The sensitivity and specificity of a Chinese version of CESD in screening for depressive illness in community sample was 92% and 91%, respectively.<sup>25</sup>

### **The CAGE Chinese Version**

The CAGE<sup>26</sup> is a four-item screening questionnaire designed to identify problem drinking. Each letter reflects the core concept of the following items: Cut down, Annoyed, Guilty, Eye-opener. Subjects were classified into alcoholics and non-alcoholics. The reliability and validity with minimum number of questions for dividing the responders into two groups were ascertained.<sup>26</sup> Kuo et al.<sup>27</sup> have validated the cross-cultural translation of the CAGE questionnaire in Taiwan.

### **The Severity of Dependence Scale, Chinese Version**

The Severity of Dependence Scale, Chinese version (SDS-Ch) is a cross-cultural and international five-item scale that measures severity of drug dependence over the preceding 12 months by users of different types of substances.<sup>22</sup> Each item is scored from 0 to 3 on a 4-point scale, and the total scores ranged from 0 to 15. Higher scores indicate greater severity of dependence. The SDS-Ch has good psychometric properties. The reliability, validity, and internal consistency of assessing drug dependence on cocaine, heroin, and amphetamine have been tested and verified in the literature. A positive correlation has been shown between SDS-Ch scores and DSM-IV criteria for heroin dependence among Taiwanese heroin users.<sup>22</sup> The intra-class correlation coefficient for the total SDS-Ch score was .88 for test-retest reliability. Cronbach's alpha was .75 for internal consistency. The SDS-Ch scores were significantly correlated with the DSM-IV total score for heroin dependence ( $r = .54, p < .001$ ).

### **The Family APGAR Scale**

Developed by Smilkstein,<sup>28</sup> Family APGAR (adaptation, partnership, growth, affection, resolve) is a reliable, validated, and utilitarian instrument for evaluating subject satisfaction with five components of family function. Higher scores summed from the 5-point response scales indicate poorer family support in this study. The internal consistency, construct validity, and differential validity are moderate. The Family APGAR scale was translated into Chinese by Chau et al. The Chinese version of the scale has been validated in Taiwan.<sup>29</sup> We also modified the Family APGAR scale by replacing the words regarding "family" with "friends" to assess the level of friends' support.

### **World Health Organization Quality of Life-Short Form**

The World Health Organization Quality of Life (WHOQOL) is a cross-cultural comparable assessment instrument for QoL that measures four broad domains: physical health, psychological health, social relationships, and environment. The short form, WHOQOL-BREF, includes 28 items on a 5-point scale (1–5). The questionnaire comprised two items for general assessment, seven items for physical health, six items for psychological domain, four items for social domain, and nine items for environment domain, and has been used as an outcome-measurement tool in patients receiving MMT.

Recent studies have used WHOQOL-BREF as a predictor of sustained remission from illicit drug misuse.<sup>30</sup> The WHOQOL-BREF has also been adapted to Taiwan Chinese and Taiwanese versions. Three of the four domain scores demonstrated internal consistency (Cronbach's alpha) coefficients ranging from .70 to .77 and content validity coefficients of .53–.78 for item-domain correlations.<sup>31</sup> This QoL global measurement has been applied in widespread studies in various research fields in Taiwan.

### **Statistical Analysis**

A descriptive analysis was performed for socio-demographic characteristics, heroin use, related risky behaviors, depression, self-harm, social support, and WHOQOL-BREF. Statistical analysis of proportions, means, and standard deviations were used as necessary. *T* test and chi-square test were applied to determining the difference of demographic data, drug use related factors, psychiatric comorbidity, and quality of life variables between ADHD-P and ADHD-N groups. Differences were considered significant if  $p < .05$ . All statistical analyses were carried using Statistical Package for the Social Sciences 17.0.1 (SPSS Inc., Chicago, IL.).

## **RESULTS**

A total 447 MMT patients were recruited during the study period. The characteristics of the sample are shown in Table 1. The mean age of the participants was 35.9 years ( $SD = 7.56$ ) and 90.4% were men. They were mostly polysubstance users (79%) and reported shared use of injecting equipment (84.9%). The average score of CESD was 22.9 ( $SD = 9.75$ ), which was higher than the cut-off point of 16 and indicated depressive symptoms. Eighty out of 307 participants (26.1%) who completed the M.I.N.I. were in a depressive episode currently. The mean scores of quality of life for different dimensions were 12.27 ( $SD = 2.14$ ) for physical domain, 12.02 ( $SD = 2.41$ ) for psychological domain, 12.12 ( $SD = 2.45$ ) for social domain, and 12.21 ( $SD = 2.20$ ) for environment domain, respectively. Four hundred and twelve of total MMT patients (92.2%) had an ASRS score less than 24. Thirty-five (7.8%) scored 24 or more, which indicated a high likelihood of having ADHD. Following the ASRS Chinese version, we categorized the ASRS score 24 or more as ADHD-P group and less than 24 as ADHD-N group.

The Chi-square test and *t*-test were conducted to investigate the comorbidity pattern differences between ADHD-P and ADHD-N groups. The two groups were similar in age, sex, education years, marital status, and employment status. The ADHD-P group reported a higher daily expenditure on heroin ( $p = .004$ ) and tended to have heavier daily usage of heroin, which is indicated by less days to consume half Qian of heroin ( $p = .013$ ). Heroin-dependent patients with ADHD symptoms had a poorer psychiatric illness profile, including more currently in a depressive episode ( $p = .02$ ), greater severity of depression/higher CESD score ( $p = .003$ ), and higher SDS

**TABLE 1.** Sample characteristics at the time of beginning MMT

Variable	Total participants ( <i>n</i> = 447)	
	Mean (SD)	
Age (year)	35.93 (7.56)	
Education (year)	9.86 (1.94)	
Onset age of (year)		
Illicit drug use	23.40 (7.05)	
Heroin use	26.25 (14.73)	
Days to use up half qian <sup>a</sup> of heroin	6.14 (6.25)	
Number of heroin abstinence >2 weeks	3.23 (2.66)	
Criminal records of illicit drug use	2.37 (1.59)	
Criminal records other than illicit drug use	1.35 (1.43)	
Severity of substance dependence (SDS score)	7.10 (2.66)	
Family support (APGAR-Ch)	5.62 (4.28)	
Depressive symptoms (CESD <sup>b</sup> )	22.96 (9.75)	
WHOQOL-BREF		
Physical domain	12.27 (2.14)	
Psychological domain	12.02 (2.41)	
Social domain	12.12 (2.45)	
Environment domain	12.21 (2.20)	
	N	%
Gender		
Male	404	90.4
Female	43	9.6
Marital status		
Single	218	48.8
Married	101	22.6
Divorced	128	28.6
Employment		
Employed	241	53.9
Unemployed	206	46.1
Self-harm ideas in the previous year		
No	353	82.1
Yes	77	17.9
Major depressive episode, current		
No	227	73.9
Yes	80	26.1
ASRS <sup>c</sup>		
<24	412	92.2
≥24	35	7.8
Sharing equipment		
No	67	15.1
Yes	378	84.9
Polysubstance use		
No	94	21.0
Yes	353	79.0

<sup>a</sup>One Qian equals to 3.73 gm.; <sup>b</sup>The Center for Epidemiologic Studies Depression Scale.; <sup>c</sup>Adult ADHD Self-Report Scale.

scores ( $p = .006$ ) indicating more severe drug dependence. Significantly poorer family support was found in this group as was poorer support from friends. Poorer quality of life in the physical, and psychological domains were found among ADHD-P. The scores of social relationships, and environment domains of WHOQOL-BREF were similar between two groups (Table 2).

## DISCUSSION

The prevalence of symptoms which are closely related to ADHD among heroin dependent patients in our study was 7.8%. These patients were more likely to have a current depressive episode. They had more severe depressive symptoms and substance dependence, and poorer physical and psychological quality of life. To our knowledge, the present study is the first to investigate different psychiatric comorbid patterns among Chinese heroin dependent patients with ADHD-screened positive and negative.

There is a broad range of ADHD prevalence among SUD patients in previous studies, from 5% to 85%, and some studies reported 40% of SUD patients screening positive for ADHD using ASRS as screening tool.<sup>10,32,33</sup> A recent meta-analysis revealed an ADHD prevalence rate of 10–54% in SUD patients.<sup>11</sup> The variation in findings could be explained by the different diagnostic instruments used to identify ADHD, criteria in questionnaires required for diagnosing ADHD, source of information, and the different kinds of substance of abuse.<sup>34</sup> Geographic origin may also account for variations.<sup>33</sup> The prevalence of adult ADHD among MMT patients was reported to be near 25% according to two studies in European countries using screening questionnaires for ADHD.<sup>35</sup> Adopting ASRS Chinese Version with a higher ASRS cutoff score of 24 for ADHD may explain the lower prevalence of ADHD in our study.

More severe drug dependence among MMT patients with ADHD symptoms in this study was also in line with previous studies. Carpentier et al. reported the ADHD contribution to addictive pathology, psychopathology, and poor overall quality of life. Inattention was associated with severe cannabis use, craving, problem use-related outcomes whereas hyperactivity-impulsivity correlated with earlier initiation of cannabis.<sup>36</sup> Severity of dependence was associated with IV heroin use, frequency of heroin injection, more money spent on heroin, earlier onset age, and more drug related criminal convictions.<sup>22,37</sup> ADHD symptoms might contribute to these problematic behaviors in heroin abusers through increased severity of dependence. In this sense, identifying ADHD symptoms by either self-report questionnaires or clinical interview might be important in order to provide a more comprehensive care for patients with heroin use disorders.

Risk of psychiatric comorbidity also increased in MMT patients with ADHD.<sup>15</sup> The severity of depression indicated by CESD scores is also higher in ADHD heroin-dependent patients. Our study showed that the prevalence of current

**TABLE 2.** Comparison of the characteristics between ADHD-N and ADHD-P groups at the time of beginning MMT

	ADHD-N ( <i>n</i> = 412, 92.2%)		ADHD-P ( <i>n</i> = 35, 7.8%)		<i>p</i> -Value ( <i>t</i> test)
	Mean (Sd)		Mean (Sd)		
<b>Demographic data</b>					
Attendance (%)	.58 (.24)		.59 (.25)		.813
Age	35.94 (7.54)		35.80 (7.95)		.918
Education (year)	9.87 (1.93)		9.74 (2.08)		.713
Average income per month (NTD <sup>a</sup> )	21000 (22600.21)		24400 (19727.85)		.391
<b>Drug use related factors</b>					
Onset age of					
cigarette smoking	16.82 (3.08)		16.26 (2.20)		.291
alcohol use	16.59 (11.06)		16.09 (4.62)		.791
illicit drug	23.48 (7.07)		22.46 (6.90)		.409
heroin use	26.36 (15.24)		24.89 (6.16)		.569
Days to use up half Qian <sup>b</sup> of heroin	6.27 (6.44)		4.57 (2.85)		.004*
Heroin abstinence >2 weeks	3.21 (2.67)		3.40 (2.59)		.687
Other substance use in past 6 months	1.90 (1.11)		1.77 (.91)		.496
Criminal records of illicit substance use	2.35 (1.58)		2.51 (1.72)		.568
Criminal records other than illicit substance use	1.34 (1.39)		1.40 (1.90)		.819
<b>Scores in assessment</b>					
Substance dependence (SDS score)	7.00 (2.60)		8.29 (3.12)		.006*
Depressive symptoms (CESD <sup>c</sup> )	21.18 (9.23)		26.34 (9.41)		.003*
Family support	5.44 (4.20)		7.80 (4.64)		.002*
Friend support	7.55 (4.38)		8.34 (3.93)		.298
<b>WHOQOL-BREF</b>					
Physical domain	12.77 (2.14)		11.93 (1.87)		.025*
Psychological domain	12.09 (2.40)		11.24 (2.49)		.046*
Social domain	12.14 (2.41)		11.89 (2.91)		.555
Environment domain	12.10 (2.17)		11.54 (2.48)		.151
	ADHD-N		ADHD-P		<i>p</i> -Value (Chi-square)
	N	%	N	%	
<b>Demographic data</b>					
Gender					
Male	373	90.5	31	88.6	.705
Female	39	9.5	4	11.4	
Marital status					
Single	202	49.0	16	45.7	.889
Married	92	22.3	9	25.7	
Divorced	118	28.6	10	28.6	
Employment					
Employed	222	53.9	19	54.3	.963
Unemployed	190	46.1	16	45.7	
<b>Drug use related factors</b>					
Route of heroin use					
Smoking	102	24.8	8	22.9	.802
Injection	310	75.2	27	77.1	
Sharing equipment					
No	60	14.6	7	20.0	.394
Yes	350	85.4	28	80.0	
Polysubstance use					
No	89	21.6	5	14.3	.308

*(Continued)*

**TABLE 2.** Continued

	ADHD-N		ADHD-P		<i>p</i> -Value (Chi-square)
	N	%	N	%	
Yes	323	78.4	30	85.7	
Psychiatric comorbidity					
Suicide attempt, lifetime					
No	372	90.5	30	85.7	.361
Yes	39	9.5	5	14.3	
Major depressive episode, current					
No	216	75.5	11	52.4	.020*
Yes	70	24.5	10	47.6	
Major depressive episode, past					
No	248	86.7	17	81.0	.458
Yes	38	13.3	4	19.0	

<sup>a</sup>\$1INTD = \$.031 USD in 2006.; <sup>b</sup>One Qian equals to 3.73 gm.; <sup>c</sup>The Center for Epidemiologic Studies Depression Scale.; \**p* < .05.

major depression among heroin users with ADHD is higher than among non-ADHD controls. This finding is in agreement with a recent large multinational study.<sup>10</sup> The rate of major depressive disorder in the entry to MMT was 15.8–42%.<sup>38</sup> The positive association between ADHD symptoms and major depressive disorder has also been reported, and MMT patients with depression have been found to have poorer quality of life.<sup>39,40</sup>

Lower quality of life in ADHD MMT patients was shown in this study. The positive factors contributing to a good quality of life in MMT patients included having social relationships, and being employed.<sup>41</sup> Depression, anxiety, paranoia, and sleep difficulties had a negative impact on quality of life in these patients.<sup>42</sup> Very few studies explored ADHD as an associated factor to poor quality of life. Carpentier et al. reported lower QoL among MMT patients with ADHD.<sup>15</sup> QoL of MMT patients in our study was in line with previous study from Taiwan.<sup>43</sup> We found MMT patients had even lower QoL comparing to patients with schizophrenia and had similar QoL scores to those of depressive outpatients in Taiwan.<sup>44,45</sup> Heroin users who perceived higher family support have been found to have better quality of life in the social relationship and environment domains.<sup>39</sup> The present study found the ADHD heroin-dependent patients has poorer family support. This may indicate a poor prognosis of both treatment outcome and quality of life. Involving family members in recruitment and interventions of the MMT program may achieve higher rates of participation and compliance.

### Strengths and Limitations

This study has several limitations. Firstly, the cross-sectional design does not permit inferences about the causal relationships of ADHD and comorbid psychiatric disorders. Secondly, despite an effort of recording the details of drug use variables using self-reported questionnaires, these data may be subject to problems of accuracy and reliability. The Chinese ASRS provides screening for adult ADHD symptoms rather

than confirming the diagnoses of ADHD. Nevertheless, the validation of ASRS in patients with SUD has been carried out in a study in alcoholics and showed a sensitivity of 79.3% and specificity of 70.3%.<sup>46</sup> The CESD indicates depressive symptoms rather than major depressive disorder meeting DSM-IV-TR criteria. These questionnaires are prone to bias and inaccuracy, such as difficulty in question comprehension, false memories, resistance of disclosure of substance use history, and cognitive deficit. But self-reported questionnaires on substance use met good agreement in one study.<sup>47</sup> Diagnosis of psychiatric comorbidities during the MMT intake is less reliable than that after the stabilization period. The questionnaire is less suitable if we consider the effect of substance intoxication or withdrawal. Abstinence from illicit substances to clarify the substance induced psychiatric symptoms may lead to less overestimation of symptoms. Nevertheless, abstinence for illicit substance prior to entering MMT program is not mandatory in Taiwan. Combination use of heroin and stimulant may cause hyperactivity, distractibility, and impulsivity. These symptoms are sometimes mistaken as manifestations of ADHD by patients. Therefore, we could not exclude the ongoing substance use as the cause of ADHD symptoms and the onset age of ADHD symptoms was not specified in the ASRS Chinese version. Depressive disorder, anxiety disorder, and posttraumatic stress disorder (PTSD) were the most common psychiatric comorbidities in MMT patients and studies indicated an association between higher severity of psychiatric comorbidities and poor QoL.<sup>48,49</sup> We did not include the evaluation of anxiety and PTSD when patients entering MMT and the effects of these comorbidities on QoL were not assessed. We evaluated the psychiatric comorbidities in MMT patients in the past or while abstinence to avoid substance induced psychiatric disorders. However, without concomitant urine drug screens for multiple substances, the effect of substance on the current psychopathology was possible. Also, the recruitment of participants in the MMT programs was conducted in a single medical center

located in a rural area of Taiwan. Our study results may not be generalized to other patient populations because of geographic differences. However, the study also has several strengths. We included a relatively large sample to evaluate the comorbid pattern in heroin-dependent population with ADHD. The validated instruments were applied for better interpretation of psychopathology and diagnosis. In addition to self-reported scale, we carried out structural interview to detect the current and lifetime major depressive episodes.

## CONCLUSION

Our results showed that heroin-dependent patients with more ADHD symptoms suffered from complex comorbidities and impairment in daily life than other heroin-dependent patients. Findings indicate the importance and relevance of assessment and treatment of ADHD and the associated comorbid psychiatric disorders such as depression in heroin-dependent patients. With further longitudinal follow-up and intervention studies, the comprehensive assessment and management of heroin-dependent patients with ADHD symptoms may indicate ways of providing more effective and more holistic interventions.

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## Declaration of Interest

The authors report no conflict of interest. The authors alone are responsible for the content and writing of the paper.

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