Comparisons of psychological distress and self-stigma among three types of substance use disorders receiving treatment-as-usual approaches: real-world data from a 9-month longitudinal study

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Abstract
Background: Substance use is an important issue worldwide and people with substance use disorders (SUDs) have been reported to have high levels of psychological distress and self-stigma. Therefore, psychological distress and self-stigma in people with SUDs are considerable.

Objective: The present study used a longitudinal design to examine whether treatment-as-usual approaches in Taiwan improve psychological distress and self-stigma among people with three types of SUDs (heroin, amphetamine, and alcohol use disorders).

Design: A 9-month longitudinal design involving four assessments spaced 3 months apart.

Methods: Convenience sampling was used to recruit people with heroin (n = 112), amphetamine (n = 151), and alcohol (n = 56) use disorders from outpatient psychiatric center in Southern Taiwan. Psychological distress was assessed using the Depression, Anxiety, Stress Scale (DASS-21), and self-stigma was assessed using the Self-Stigma Scale–Short (SSS-S). Generalized estimating equation (GEE) models were constructed to understand between-group differences in psychological distress and self-stigma over time.

Results: Patients with heroin and amphetamine use disorders had lower levels of psychological distress as compared with those with alcohol use disorder. Levels of psychological distress were lower at Time 2 to Time 4 as compared with Time 1. Patients with heroin and amphetamine use disorders had higher levels of self-stigma as compared with those with alcohol use disorder. Self-stigma levels remained stable over time. The dropout rate of receiving treatment-as-usual approach in the 9-month study was 60%.

Conclusion: Treatment as usual for SUDs among outpatients in Taiwan may decrease psychological distress but not self-stigma. However, such effects need to be further examined given the high drop-out rates and absence of a control condition. The findings suggest that self-stigma may warrant additional treatment for patients with SUDs.

Keywords: addictive behaviors, alcohol, amphetamine, heroin, psychological distress, self-stigma, substance-related disorders

Received: 13 April 2022; revised manuscript accepted: 3 November 2022.
(ATS), opioids/opiates, and cannabis are the most widely used illicit substances worldwide, the substance use situation in Asian countries is somewhat different, with cannabis use not particularly common among Asian groups currently, including Taiwanese. Nevertheless, a small proportion of individuals in Taiwan face significant concerns regarding use of opioids (e.g. heroin), amphetamines, and alcohol. Specifically, a 2014 national survey estimated that the prevalence of heroin use in Taiwan was 0.71%, that of amphetamine use was 0.78%, that of binge drinking (with the definition of consuming five or more drinks on an occasion for men or four or more drinks on an occasion for women) was 3.93%, and that of harmful alcohol use (with the definition of scoring 8 or above in the Alcohol Use Disorders Identification Test) was 6.90%.

Psychological distress and impaired quality of life have been reported for people with substance use disorders (SUDs) and those with behavioral addictions, and these phenomena (i.e. high psychological distress and low quality of life) have been associated with more severe substance use. Psychological distress is associated with impaired health and greater healthcare expenditures. Psychological distress may lead to serious health problems for people with SUDs. For example, psychological distress has been associated with increased mortality. Therefore, it is important to investigate whether treatments provided by mental health professionals may reduce psychological distress for people with SUDs.

Self-stigma is another concern among people with SUDs as these individuals may be viewed as criminals or people with weak personalities, and they may internalize such beliefs. Because Chinese people value ‘face’, the impression of being a criminal or having a weak personality among people with SUDs may lead them to be stigmatized. When encountering stigmatizing views, people with SUDs may develop self-stigma, which may promote poor psychological adjustment, including poor self-esteem and depression. Therefore, it is important for mental health professionals to understand, identify, and address self-stigma among people with SUDs.

In Taiwan, people with different SUDs who receive psychiatric treatments may have different levels of psychological distress and self-stigma given different features linked to specific SUDs. People who use heroin or amphetamines may be viewed as criminals because heroin and amphetamines are illegal drugs (heroin is a first-level controlled drug and amphetamines are second-level controlled drugs) in Taiwan. Moreover, people who use heroin or amphetamines may get prison sentences. In contrast, alcohol consumption is legal in Taiwan. However, the behavior of driving under the influence of alcohol is illegal and highly stigmatized. Thus, people who use heroin or amphetamines may be more likely to have higher levels of self-stigma than do people with alcohol use disorders because of social factors like legality. Moreover, with different features relating to these SUDs, motivations for receiving psychiatric treatments may also differ. For people who use heroin and amphetamine, a primary purpose of receiving psychiatric treatment may be related to criminal prosecution. That is, if these individuals agree to receive psychiatric treatment, their prosecution and sentencing may be deferred. Individuals with alcohol use disorder who seek psychiatric treatments may have other considerations. A main reason may involve awareness of poor health related to heavy alcohol consumption. Nonetheless, individuals with alcohol use disorder who seek psychiatric treatment may focus on their psychological distress instead of addressing their drinking problems. However, studies have not directly examined possible differences across these SUDs with respect to self-stigma, psychological distress, and treatment.

Different modalities of treatments have been developed and used to treat people with different types of SUDs in Taiwan. Specifically, people who use heroin and have opioid use disorders have typically received methadone maintenance treatment (MMT). People with amphetamine use disorder have typically received psychological treatments, and people with alcohol use disorder have typically received medications (e.g. naltrexone and acamprosate) combined with psychological treatments. These different treatments often focus on reducing cravings for the substances. Little information has been reported for treatment effects on psychological distress or self-stigma reduction in Asian groups (e.g. Taiwanese), although some longitudinal studies have found that treatments may decrease psychological distress among Western individuals with SUDs. However, there have not been comparisons...
between different groups of individuals with different SUDs regarding levels of psychological distress. Therefore, it is also unclear whether these treatments have longer-term effects on psychological distress and self-stigma reduction among people being treated for different SUDs.

The present study used a 9-month longitudinal design to examine differences over time in psychological distress and self-stigma among people with different types of SUDs receiving treatment. Several hypotheses were proposed. First, patients with heroin or amphetamine use disorders as compared with patients with alcohol use disorder would have lower levels of psychological distress. Second, patients with heroin or amphetamine use disorders as compared with patients with alcohol use disorder would have higher levels of self-stigma. Third, changes in psychological distress between the groups with the three types of SUDs would differ over time. Fourth, changes in self-stigma between the groups with the three types of SUDs would differ over time.

Methods

Participants and procedure
Recognizing the growing problem of SUDs across Taiwan, a significant effort to initiate the Integrated Demonstrative Center of Addiction Treatment Pilot Program (IDCATPP) has been occurred since 2018. The Jianan Psychiatric Center (JPC) has guided the IDCATPP of Southern Taiwan, funded by the Ministry of Health and Welfare, in its efforts to help individuals with SUDs. Since 2018, the JPC has provided comprehensive treatment for people with different types of SUDs, including MMT for patients with opioid use disorder and other pharmacotherapies, including naltrexone and acamprosate, for patients with alcohol use disorder. In this 9-month longitudinal study, individuals with opioid (to heroin), amphetamine, or alcohol use disorders according to diagnostic criteria in the Diagnostic and Statistical Manual of Mental Disorders (5th ed.; DSM-5) were recruited by qualified psychiatrists from the addiction treatment clinic of the JPC from April 2019 to December 2021.

The inclusion criteria also involved (1) being more than 20 years old and (2) having sufficient mental capacity to understand all questions of the assessment scales used in the study (sufficient capacity was verified by research assistants with master’s degrees in psychology through conversation and use of the Mini International Neuropsychiatric Interview). Participants were typically invited to participate at the onset of their clinical and treatment course, after they had stable relationships with the psychiatrists. An exception involved some individuals with heroin use disorder, who may have discontinued and resumed MMT during the follow-up period. Thus, we invited patients with heroin use disorder with previous regular treatment histories, as compared with those at the onset of treatment. Exclusion criteria included (1) intellectual disabilities; (2) dementia, schizophrenia, or acute substance-induced psychotic disorders; and (3) addiction treatment that would be terminated within the longitudinal course of the study. All patients received ‘treatment-as-usual’ as described above because this is a governmental policy. That is, study participants received treatment because they were dependent on the aforementioned substances. While the term SUD is used in the present study, individuals had moderate to severe SUDs. SUDs refer to a broader group of conditions that includes heroin, amphetamine, and alcohol use disorders.

The data were collected for four times at 3-month intervals. Participants were assessed according to the following procedures. The psychiatrist and case managers helped to identify potential candidates meeting recruitment criteria. Two research assistants were trained and mutually standardized for data collection. Participants were invited to join the study during their outpatient visits or their clinical services. After providing written informed consent, eligible participants completed questionnaires first independently under the supervision of the research assistants in a quiet and isolated room without disturbance. This was followed by a standardized face-to-face procedure used to explain the meaning of the questions and assure the completeness and quality of the questionnaires. Average time for completion of the questionnaires was about 20 min. The study was approved by the Institutional Review Boards of the JPC (IRB numbers: 19-034 and 19-054).

Measures

Depression, Anxiety, Stress Scale assessing psychological distress. The Depression, Anxiety, Stress Scale (DASS-21) is a self-administered questionnaire containing 21 items that assess
individuals’ psychological distress. Each DASS-21 item was rated using a 4-point Likert-type-like scale (0 = did not apply to me at all; 3 = applied to me very much or most of the time), with higher scores indicating higher levels of psychological distress. An example item is, ‘I found it hard to wind down’. In the present study, the DASS-21 score was calculated using the summed score of the 21 DASS-21 items multiplied by 2. The DASS-21 has demonstrated satisfactory psychometric properties, including its Chinese version when used in Taiwan. The DASS-21 also demonstrated good internal consistency in the present study sample: Cronbach’s α = 0.95 (Time 1), 0.96 (Time 2), 0.96 (Time 3), and 0.97 (Time 4).

Self-Stigma Scale–Short assessing self-stigma. The Self-Stigma Scale–Short (SSS-S) is a self-administered questionnaire containing nine items to assess individuals’ self-stigma with respect to specific conditions they have (in the present study’s case, drug or alcohol use disorders). Each SSS-S item was rated using a 4-point Likert-type scale, with higher scores indicating higher levels of self-stigma. An example item is, ‘I fear that others would know that I am a (person)’, where the (person) was replaced with a name relating to the principal substance use; that is, patient with heroin, amphetamine, or alcohol use disorder. In the present study, SSS-S scores were calculated using the average scores of the nine SSS-S items. The SSS-S has demonstrated satisfactory psychometric properties, including its Chinese version when used in Taiwan. The SSS-S also demonstrated good internal consistency in the present study sample: Cronbach’s α = 0.93 (Time 1), 0.94 (Time 2), 0.95 (Time 3), and 0.95 (Time 4).

Severity of Dependence Scale assessing severity of dependence on drugs. The Severity of Dependence Scale (SDS) is a self-administered questionnaire containing five items to assess individuals’ severity of dependence on drugs. Each SDS item was rated using a 4-point Likert-type-like scale (0 = never/almost never or not difficult; 3 = always/nearly always or impossible), with higher scores indicating higher severity levels of dependence on drugs. An example item is, ‘Do you think your use of (drug) was out of control?’ where the (drug) was replaced with the name of the principal substance; that is, heroin, amphetamine, or alcohol in the present study. In the present study, the SDS score was calculated using the summed score of the five SDS items. The SDS has demonstrated satisfactory psychometric properties, including its Chinese version when used in Taiwan. The SDS also demonstrated good internal consistency in the present study sample: Cronbach’s α = 0.80 (Time 1), 0.78 (Time 2), 0.74 (Time 3), and 0.72 (Time 4).

Demographics and clinical characteristics. Apart from the standardized questionnaires mentioned above, a background information sheet was used to collect participants’ demographics and medical records were used to collect their clinical characteristics. Specifically, physical disease and mental disorder diagnoses were collected via medical records. For physical disease, the conditions included hypertension, endocarditis, diabetes mellitus, stroke, hepatitis B virus disease, hepatitis C virus disease, cirrhosis, human immunodeficiency virus disease, pancreatitis, upper gastrointestinal bleeding, and cellulites. For mental disorders, the diagnoses included depression, bipolar disorder, anxiety disorder, and schizophrenia.

Data analysis
Descriptive statistics were first applied to sample demographics, clinical characteristics, and measures of psychological distress and self-stigma. The age and sex distribution of the present sample was compared with the following populations: (1) those who did not participate in the present study but were in the JPC outpatient psychiatric center (mean age = 44.42 years; 88.0% male) and (2) those who received IDCATPP in the entirety of Taiwan (mean age = 40.5 years; 82.8%). The trajectories of psychological distress and self-stigma were illustrated using line charts. Two generalized estimating equation (GEE) models were then constructed to understand between-SUD-group differences in psychological distress and self-stigma across time. Repeated measures of psychological distress and self-stigma were the two dependent variables in each GEE model. Both GEE models shared the same independent variables, including sex (reference group: male), physical disease (reference group: yes), other mental disorder diagnosis (reference group: yes), SUD (reference group: alcohol), age, educational year, severity of SUD (assessed using the SDS), time (reference group: Time 1), and interaction between SUD group and time. Missing data for dependent and independent variables
were handled using multiple imputation in the GEE models. In addition, the attrition rates were 34% at the first follow-up (i.e. Time 2); 49% at the second follow-up (i.e. Time 3); and 60% at the third follow-up (i.e. Time 4). The attrition rate suggested that the drop-out rate of the patients in receiving the treatment-as-usual across 9 months was 60%. Moreover, the sample size estimation using GEE was conducted with the following assumptions: three groups with equal sample sizes, power at 0.9, type I error at 0.05, the contrast coefficients for slope comparisons at 2, –1, and –1 for the three groups. A total sample size of 210 participants was calculated as being sufficient. All statistical analyses were conducted using SPSS 20.0 (IBM Corp., Armonk, NY).

Results

The present sample consisted of 319 patients with SUDs [112 (35.1%) heroin; 151 (47.3%) amphetamine; and 56 (17.5%) alcohol]. The mean age of the present sample was 42.19 (SD = 8.86) years, and most participants were male (n = 273, 85.6%). The individuals in the present sample were younger than those who did not participate but were in the JPC outpatient psychiatric center (mean age = 44.42 years; t = 4.50; p < 0.001); and older than those who received IDCATPP in the entirety of Taiwan (mean age = 40.5 years; t = 3.41; p < 0.001). The present sample also had fewer males than the group that did not participate in the present study but were in the JPC outpatient psychiatric center (88.0%) and more males than in the group that received IDCATPP in the entirety of Taiwan (82.8%). Over one-third of participants had physical disease (n = 123, 38.6%). Their psychological distress level decreased between Times 1 and 2 (from 24.50 to 20.13); thereafter, psychological distress levels were similar across Times 2, 3, and 4 (Table 1). Self-stigma and SUD-severity levels were similar across time. Table 1 shows the comparisons of demographics and clinical characteristics between the three groups. Figure 1 displays trajectories of psychological distress and self-stigma levels over time.

The first GEE model (Table 2) showed that patients with heroin and amphetamine use disorders had lower levels of psychological distress as compared with patients with alcohol use disorder (B = -9.17, 95% confidence interval (CI) = -17.59 to -0.76 for heroin use disorder; B = -8.37, 95% CI = -15.42 to -1.31 for amphetamine use disorder). Moreover, severity of dependence on drugs was a significant statistical predictor of higher levels of self-stigma (B = 3.07, 95% CI = 2.50–3.64). The GEE model further showed that levels of psychological distress were lower from Time 2 to Time 4 as compared with Time 1 (B = -6.91 to -14.08, p values = 0.14, 0.01, and <0.001). Significant interactions between type of SUD and time were also observed for psychological distress. As compared with patients with alcohol use disorder, patients with heroin use disorder demonstrated less improvement in psychological distress at Time 4 (B = 15.33, 95% CI = 5.38–25.28, p value = 0.003). Similarly, patients with amphetamine use disorder demonstrated less improvement in psychological distress at Time 2 (B = 18.53, 95% CI = 7.77–19.64, p value = 0.03) and Time 4 (B = 10.45, 95% CI = 1.45–19.44, p value = 0.023). Findings approaching but not reaching statistical significance were also observed. As compared with patients with alcohol use disorder, patients with heroin use disorder demonstrated numerically less improvement in psychological distress at Time 2 (B = 6.61, 95% CI = -0.96 to 14.17, p value = 0.087).

Another GEE model (Table 2) showed that patients with heroin and amphetamine use disorders had significantly higher levels of self-stigma as compared with patients with alcohol use disorder (B = 0.54, 95% CI = 0.30–0.79 for patients with heroin use disorder; B = 0.50, 95% CI = 0.28–0.72 for patients with amphetamine use disorder). Moreover, severity of dependence on drugs was a significant statistical predictor of higher levels of self-stigma (B = 0.07, 95% CI = 0.05–0.09). The GEE model further showed that self-stigma levels were similar across time (p values = 0.18–0.61), and there were no significant interactions between SUD type and time (p values = 0.26–0.93).

Given that the final sample size of the alcohol use disorder subgroup contained only 56 participants, a power calculation under GEE was performed. With the use of three groups with equal sample size at 50, type I error at 0.05, the contrast coefficients for slope comparisons at 2, –1, and –1 for the three groups, the power was 0.84. Therefore, the current sample provides reasonable power.
The results of the present longitudinal study supported the first two hypotheses (i.e. patients with heroin and amphetamine use disorders had lower levels of psychological distress and higher levels of self-stigma than did patients with alcohol use disorder). Moreover, the results partially supported the third hypothesis (i.e. psychological distress between the three SUD types would differ over time during treatment) but did not support the last hypothesis (i.e. self-stigma between the three SUD types would differ over time during treatment). Specifically, reductions in psychological distress were observed from Time 1 to Time 2, and effects were larger for patients with alcohol use disorder than those with heroin or amphetamine use disorders. The reductions in psychological distress were similar between patients with

Discussion

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| Table 1. Participants’ demographics and clinical characteristics \( N=319 \). |
|-----------------------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| \( \text{Mean (SD) or } n (\%) \) | \( \text{Entire sample} \) | \( \text{1. Heroin use} \) | \( \text{2. Amphetamine use} \) | \( \text{3. Alcohol use} \) | \( F \) or \( \chi^2 \) (\( p \) value) | \( \text{Post hoc} \) |
| \( \text{Age in years at baseline} \) | 42.19 (8.86) | 46.57 (6.76) | 39.38 (8.90) | 41.04 (9.14) | 25.07 (<0.001) | 1 > 2, 1 > 3 |
| \( \text{Sex (male)} \) | 273 (85.6) | 99 (88.4) | 122 (80.8) | 52 (92.9) | 5.92 (0.052) | – |
| \( \text{Years of education} \) | 10.39 (2.62) | 9.35 (2.38) | 10.83 (2.59) | 11.32 (2.49) | 15.92 (<0.001) | 1 < 2, 1 < 3 |
| \( \text{Physical disease (yes)} \) | 123 (38.6) | 63 (56.3) | 47 (31.1) | 13 (23.2) | 23.88 (<0.001) | – |
| \( \text{Mental disorder (yes)} \) | 89 (28.1) | 28 (25.0) | 44 (29.5) | 17 (30.4) | 0.83 (0.662) | – |
| \( \text{Heroin use disorder} \) | 112 (35.1) | – | – | – | – | – |
| \( \text{Amphetamine use disorder} \) | 151 (47.3) | – | – | – | – | – |
| \( \text{Alcohol use disorder} \) | 56 (17.5) | – | – | – | – | – |
| \( \text{Severity of dependence on drugs (Time 1)} \) | 4.97 (4.02) | 28.50 (27.56) | 19.89 (23.28) | 28.89 (37.62) | 3.94 (0.020) | 1 > 2 |
| \( \text{Severity of dependence on drugs (Time 2)} \) | 4.42 (3.74) | 24.36 (28.97) | 17.66 (26.41) | 15.53 (24.13) | 1.93 (0.148) | – |
| \( \text{Severity of dependence on drugs (Time 3)} \) | 4.48 (3.50) | 25.01 (25.46) | 17.74 (26.47) | 16.22 (24.52) | 1.87 (0.157) | – |
| \( \text{Severity of dependence on drugs (Time 4)} \) | 4.94 (3.50) | 25.81 (30.68) | 15.96 (22.93) | 14.32 (19.49) | 2.44 (0.091) | – |
| \( \text{Psychological distress (Time 1)} \) | 24.50 (28.01) | 6.99 (3.95) | 3.69 (3.06) | 4.36 (4.84) | 25.97 (<0.001) | 1 > 2, 1 > 3 |
| \( \text{Psychological distress (Time 2)} \) | 20.13 (27.30) | 6.27 (3.80) | 3.17 (2.65) | 2.88 (4.04) | 22.55 (<0.001) | 1 > 2, 1 > 3 |
| \( \text{Psychological distress (Time 3)} \) | 20.83 (25.83) | 6.05 (3.54) | 3.39 (2.68) | 2.56 (3.21) | 17.56 (<0.001) | 1 > 2, 1 > 3 |
| \( \text{Psychological distress (Time 4)} \) | 20.60 (26.99) | 5.84 (3.41) | 4.02 (2.78) | 4.11 (4.58) | 4.5 (0.013) | 1 > 2 |
| \( \text{Self-stigma (Time 1)} \) | 2.42 (0.81) | 2.71 (0.78) | 2.39 (0.73) | 1.93 (0.84) | 19.18 (<0.001) | 1 > 2 > 3 |
| \( \text{Self-stigma (Time 2)} \) | 2.26 (0.82) | 2.48 (0.81) | 2.28 (0.76) | 1.66 (0.75) | 13.42 (<0.001) | 1 > 3, 2 > 3 |
| \( \text{Self-stigma (Time 3)} \) | 2.31 (0.82) | 2.49 (0.74) | 2.33 (0.78) | 1.72 (0.88) | 9.77 (<0.001) | 1 > 3, 2 > 3 |
| \( \text{Self-stigma (Time 4)} \) | 2.26 (0.85) | 2.51 (0.79) | 2.10 (0.81) | 1.81 (0.93) | 6.76 (0.002) | 1 > 2, 1 > 3 |

Post hoc test used Bonferroni adjustment.
SD, standard deviation; SUD, substance use disorder.
heroin and amphetamine use disorders. Moreover, patients with alcohol use disorder had the highest level of psychological distress at Time 1 as compared with the other two patient groups. However, with a high drop-out rate and lack of a control group, treatment effects cannot be specifically attributed. Regarding self-stigma, patients with heroin use disorder had the highest level, following by patients with amphetamine and alcohol use disorders. Levels of self-stigma appeared stable across four assessment time for all three patient groups. Implications are discussed below.

The reductions in psychological distress over time show differences and similarities with respect to previous studies on quality of life.\textsuperscript{50–53} Kreb et al.\textsuperscript{50} used the EuroQoL-5D (EQ5D) to assess quality of life in patients with opioid use disorder who received opioid agonist treatment and found that participants’ quality of life was stable over time. Such a stable pattern was also observed by studies conducted by Nosyk et al.\textsuperscript{51,52} Wang et al.\textsuperscript{53} examined changes in quality of life among participants receiving MMT and found that their quality of life improved in the first 3 months and then was stable beyond the 3-month point. These findings resonate with the current ones suggesting that treatment may be helpful in reducing psychological distress early in treatment (in the first 3 months). However, attributing decreases to treatment should be done with caution given the high drop-out rate (34% at the third month and 60% at the ninth month) and lack of a control group.

Reductions in psychological distress seemed largest for patients with alcohol use disorder. This may in part be explained by two reasons. First, patients with alcohol use disorder who seek mental health service may focus on their psychological distress instead of their alcohol-consumption problems.\textsuperscript{29} In contrast to patients with alcohol use disorder, those with heroin or amphetamine use disorders may be more likely to have sought psychiatric treatment because they wished to defer prosecution or sentencing.\textsuperscript{27} As a result, patients with alcohol use disorder may have exhibited greater reductions in psychological distress than did patients with heroin or amphetamine use disorders. Second, the magnitudes of possible treatment effects may be stronger for patients with alcohol use disorder than for the other two patient groups. However, suicide mortality has been reported to be high in individuals with opioid or amphetamine use disorders,\textsuperscript{54,55} and mental health professionals should address psychological distress.

Patients with alcohol use disorder had lower levels of self-stigma, which may be explained by the social norms regarding illicit drug use versus alcohol consumption. Heroin and amphetamine are defined as first and second levels of controlled drugs,\textsuperscript{26} while alcohol is a legal substance. Individuals with heroin or amphetamine use disorders may receive prison sentences if they are found to have been using heroin or amphetamines. For patients with alcohol disorder, as long as they do not drive under the influence of alcohol, they are less likely to be arrested.

Figure 1. Psychological distress (a) and self-stigma (b) in patients with three types of substance use disorders across time. Time 1 = baseline; Time 2 = 3 months after baseline; Time 3 = 6 months after baseline; Time 4 = 9 months after baseline. Psychological distress was assessed using the Depression, Anxiety, Stress Scale (DASS-21); self-stigma was assessed using the Self-Stigma Scale–Short (SSS-S).
alcohol, their consumptions of alcohol is typically considered legal. Thus, individuals with heroin or amphetamine use disorders may experience greater self-stigma. Our findings indicated that self-stigma levels remained stable over time despite current treatments. A reason for the persistence of self-stigma could be that the treatments did not focus on self-stigma. Therefore, health care programs should seriously consider assessing and targeting treatments for self-stigma because self-stigma may generate amotivation to receive further treatment, especially for patients with SUDs who often exhibit poor adherence to treatment.

There are limitations in the present study. First, the present study was not a randomized controlled trial and did not control treatments for participants. That is, treatments varied and could be changed (including dosages of medications) according to clinical judgment. Moreover, there was no control group in the present study for comparison. Therefore, we cannot conclude that reductions in psychological distress reduction were related to treatment effects. Second, measures used in the present study were all self-reported, which are subject to biases like social desirability. Third, although we controlled for some potential confounding variables (e.g., age, sex, and severity of dependence on drugs), others (such as life events) were not considered in the GEE models. Fourth, we did not recruit participants aged below 20 years (e.g., 18- and 19-year-old patients) because of the current Civil Law in

| Psychological distress | Self-stigma |
|-------------------------|-------------|
| 95% CI                  | p value     | 95% CI          | p value     |
| B (SE)                  |             | B (SE)          |             |
| Age                     | −0.40 (0.16)| −0.71 to −0.09  | 0.01        |
| Sex (Ref: male)         | −2.48 (3.59)| −9.52 to 4.56   | 0.49        |
| Years of education      | −0.67 (0.50)| −1.65 to 0.30   | 0.18        |
| Physical disease (Ref: yes) | −7.87 (2.57) | −12.91 to −2.84 | 0.002       |
| Mental disorder diagnosis (Ref: yes) | −16.72 (2.96) | −22.53 to −10.91 | <0.001     |
| Heroin use disorder (Ref: alcohol) | −9.17 (4.29) | −17.59 to −0.76 | 0.03        |
| Amphetamine use disorder (Ref: alcohol) | −8.37 (3.61) | −15.42 to −1.31 | 0.02        |
| Severity of dependence on drugs | 3.07 (0.29) | 2.50 to 3.64 | <0.001 |
| Time 2 (Ref: Time 1)    | −8.20 (3.11) | −14.30 to −2.09 | 0.01        |
| Time 3 (Ref: Time 1)    | −6.91 (4.63) | −15.98 to 2.16  | 0.14        |
| Time 4 (Ref: Time 1)    | −14.08 (3.18) | −20.32 to −7.84 | <0.001     |
| Heroin × Time 2         | 6.61 (3.86) | −0.96 to 14.17  | 0.087       |
| Heroin × Time 3         | 6.90 (5.29) | −3.47 to 17.28  | 0.19        |
| Heroin × Time 4         | 15.33 (5.08) | 5.38 to 25.28   | 0.003       |
| Amphetamine × Time 2    | 8.19 (3.79) | 0.77 to 15.62   | 0.03        |
| Amphetamine × Time 3    | 7.26 (5.38) | −3.28 to 17.81  | 0.18        |
| Amphetamine × Time 4    | 10.45 (4.59) | 1.45 to 19.44   | 0.023       |

CI, confidence interval; SE, standard error; SUD, substance use disorder.
Taiwan. That is, the Taiwanese government states that an adult should be aged 20 years or above (the Taiwanese government has passed an amendment for defining adults as being aged 18 years or above, with the law becoming effective beginning in January 2023). Because we were unable to obtain parental informed consents for those aged 18 or 19 years, we set the inclusion criterion of age being 20 years or above. Thus, the representativeness of the present sample was restricted. Finally, the present study did not use specific objective measures to assess participants’ mental capacity.

Conclusion
In conclusion, the present longitudinal study showed that patients with alcohol use disorder had higher levels of psychological distress than patients with heroin or amphetamine use disorders. Patients with heroin or amphetamine use disorders had higher levels of self-stigma than did patients with alcohol use disorder. Levels of psychological distress decreased from Time 1 to Time 2 (i.e. after 3 months of treatment), and self-stigma was maintained stable across Time 1 to Time 4 in the three SUD groups. Therefore, the present treatments may have had some effect on psychological distress but not self-stigma. However, the effects that may be attributable to treatment should be interpreted with caution given the high drop-out rate and lack of a control group. Addiction treatment professionals should consider designing, testing, and implementing appropriate programs to reduce self-stigma for people with SUDs.

Declaration

Ethics approval and consent to participate
The study was approved by the Institutional Review Boards of the JPC (IRB numbers: 19-034 and 19-054). All participants have provided a written informed consent.

Consent for publication
Not Applicable.

Author contributions

Kun-Chia Chang: Conceptualization; Data curation; Investigation; Methodology; Project administration; Resources; Validation; Writing – original draft.

Hsin-Pao Chen: Conceptualization; Funding acquisition; Methodology; Resources; Validation; Writing – original draft.

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Acknowledgements
Dr. Potenza has consulted for Opiant Pharmaceuticals, Idorsia Pharmaceuticals, AXA, Game Day Data, and the Addiction Policy Forum; has been involved in a patent application with Yale University and Novartis; has received research support (to Yale) from Mohegan Sun Casino and the National Center for Responsible Gaming; has participated in surveys, mailings or telephone consultations related to drug addiction, impulse-control disorders or other health topics; has consulted for and advised gambling and legal entities on issues related to impulse-control/addictive disorders; has provided clinical care in a problem gambling services program; has performed grant reviews for research-funding agencies; has edited journals and journal sections; has given academic lectures in grand rounds, CME events, and other clinical or scientific venues; and has generated books or book chapters for publishers of mental health texts.

Funding
The authors disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: This research was supported in part by (received funding from) the Ministry of Science and Technology, Taiwan (MOST 110-2410-H-006-115). Hsin-Pao Chen was funded by intramural funding of the E-Da Hospital (EDAHP107048).
Competing interests
The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Availability of data and materials
The datasets generated during or analyzed during the current study are available from the corresponding author on reasonable request.

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