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## Prevalence of adverse childhood experiences and their association with suicidal ideation and non-suicidal self-injury among incarcerated methamphetamine users in Japan

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### ABSTRACT

**Background:** Adverse childhood experiences (ACEs) are distressing and/or traumatic events that occur during childhood that increase the risk of negative health outcomes in adulthood.

**Objective:** This study estimated the prevalence of ACEs in a nationwide sample of Japanese methamphetamine users in prison and examined associations among ACEs, suicidal ideation, and non-suicidal self-injury.

**Participants and setting:** Participants were 636 inmates (418 male and 218 female) who were newly incarcerated in Japan for Stimulants Control Act violations.

**Methods:** First, 699 participants completed an anonymous self-report questionnaire. Of these, 636 participants who did not have any missing responses were included in the analysis. After calculating descriptive statistics, the associations between ACEs and suicidal behaviors were assessed using binary logistic regression analyses.

**Results:** Results showed that 76.1 % of the participants reported at least one ACE before the age of 18, and female participants reported a significantly higher number of adversities than their male counterparts. The most common ACEs were parental death or divorce, followed by psychological abuse. Logistic regression analyses revealed that ACE scores significantly increased the risk of suicidal ideation (SI; adjusted odd ratio [AOR] = 1.18,  $p < .001$ ) and non-suicidal self-injury (NSSI; AOR = 1.18,  $p < .001$ ) after controlling for possible confounding variables.

**Conclusions:** Findings suggest the importance of early prevention and intervention for traumatic experiences, and have implications for the recommendation of gender-responsive, trauma-focused interventions, especially for female inmates in the criminal justice system, to break the inter-generational chain of abuse. Future research directions and treatment are discussed.

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## 1. Introduction

### 1.1. Substance use in Japan

Japan has one of the lowest rates of lifetime individual use of illegal drugs. A national survey on the use of illegal drugs shows that the lifetime experience rate in Japan is lower than that in other countries. Specifically, the lifetime experience rate of illegal drugs in 2019 was estimated to be 0.4 % for methamphetamine, 0.3 % for cocaine, 0.3 % for MDMA, and 1.8 % for cannabis (Shimane et al., 2021). These figures are low when compared with similar surveys in Europe and the United States (Peacock et al., 2018; Substance Abuse and Mental Health Services Administration, 2020).

Japan has traditionally perpetuated a zero-tolerance policy toward illicit drugs, and the use of methamphetamine has been strictly prohibited by the Stimulants Control Act (Shimane et al., 2022). According to official statistics in 2019, methamphetamine users account for >60 % of all arrests for illegal drug offenses, and approximately 80 % of those arrested are men (Ministry of Justice, Japan, 2020). In terms of sentences in district courts for violations of the Stimulants Control Act, >90 % of the sentences ranged from 1 to 3 years. In 2019, a total of 4378 people (3811 men and 567 women) were imprisoned in Japan due to violations of the Stimulants Control Act. Despite the above-mentioned lower lifetime experience rate of illicit drugs in the general population, the high recidivism rate of methamphetamine related inmates has become a serious problem. According to the White Paper on Crime, among those in violation of the Stimulants Control Act who were released from prison, almost half of them returned to prison after release within 5 years, indicating the highest recidivism rate among all types of offenders (Ministry of Justice, Japan, 2020).

### 1.2. Adverse childhood experiences among offender population

Justice-involved individuals are one of the groups with the highest accumulation of adverse childhood experiences (ACEs). ACEs refer to distressing and/or traumatic events that occur during childhood, including household dysfunction and child maltreatment. It is widely accepted that offenders have experienced higher levels of exposure to ACEs compared to the general population (Ford et al., 2019; Messina & Grella, 2006). Previous research has demonstrated that the majority of adult and youth offenders reported exposure to multiple adverse events (Baglivio et al., 2015; Friestad et al., 2014), and exposure to ACEs were associated with higher recidivism (Dalsklev et al., 2019; Drury et al., 2019; Weber & Lynch, 2021; Wolff et al., 2017).

Previous studies have also established that ACEs are associated with increased risk of substance use (Afifi et al., 2020; Mersky et al., 2013). One possible reason why ACEs and substance use are likely to co-occur is that the relationship between them is mediated by symptoms of post-traumatic stress disorder (PTSD). That is, ACEs increase the risk of suffering from PTSD, and individuals with PTSD are more likely to engage in substance use as a means of dealing with intolerable distress caused by trauma (Cloutier et al., 2018). From a clinical perspective, ACEs are one of the factors that may influence treatment outcomes for substance users in prison. Correctional facilities may be uniquely suited to integrative treatment approaches for offenders with ACEs who are generally reluctant to seek help or treatment voluntarily by providing an opportunity for required treatment regardless of initial motivation. However, to date, no studies have examined ACEs among incarcerated substance users in Japan, and the prevalence of ACEs in this population remains unclear. Furthermore, the relationship between ACEs and substance use has been examined mainly in North America, and less is known about ACEs among substance users in other regions. Previous research has indicated that the existing literature on ACEs was overwhelming from Western perspectives, leaving a gap in non-Western contexts (Oei et al., 2021); hence, further research is required.

### 1.3. ACEs and suicidality in correctional inmates

Although the suicide rate in Japan has been decreasing in recent years, approximately 20,000 people die by suicide annually. According to WHO statistical data, Japan has the highest suicide rate among the G7 countries, with 16.8 per 100,000 people, and suicide is the leading cause of death for people aged 15 to 39 years (Ministry of Health, Labour and Welfare, Japan, 2021). Thus, suicide prevention is an urgent issue in Japanese society.

Suicide is one of the leading causes of death among inmates and released inmates (Fazel et al., 2011; Zlodre & Fazel, 2012). It is widely accepted that inmates in correctional facilities are more likely to have a history of suicide attempts and self-injury in comparison with the general population (Dixon-Gordon et al., 2012; Larney et al., 2012). Here, suicide and self-injury are not always performed with the same intention, and clinically, it is useful to distinguish between them. However, a history of self-injury has also been confirmed to increase the risk of future suicidal ideations and attempts in follow-up studies (Cooper et al., 2005; Mars et al., 2019). In any case, suicide attempts and non-suicidal self-injury (NSSI) by correctional inmates are major security risks and challenges that correctional agencies must address.

Substance users are a high-risk population for suicide and self-injury. A recent meta-analysis with 253,719 participants found the strongest association between problematic drug use and interpersonal and self-directed violence (Hughes et al., 2017), and research has shown that exposure to ACEs is closely related to suicide (Thompson et al., 2019) and non-suicidal self-injury (Baiden et al., 2017), thereby posing a security risk in correctional facilities. Choi et al. (2017) stated that the suicidal desire caused by thwarted belongingness, perceived burdensomeness, and hopelessness about these states were possible explanations for the high rates of suicide attempts among those who have experienced ACEs. Substance use, suicide attempts, and NSSI frequently co-occur, and all of them could be interpreted as a result of ineffective coping strategies for distress rooted in childhood adversity.

The association between ACEs and suicidal behaviors among incarcerated substance users remains unknown. Further research is needed to elucidate these relationships and to inform effective prevention strategies for inmates' self-destructive behaviors. This study,

which examines the effects of ACE history on suicide and self-injury in a criminal offender population, has the potential to contribute new insights to this field in terms of providing information not only for reducing inmates' security risk but also for reconsidering psychological interventions for individuals with severe substance dependence.

#### 1.4. Purpose of the current study

The main purpose of this study is to estimate the prevalence of ACEs in a nationwide sample of methamphetamine users in prison in Japan. Sex differences will also be considered in the analyses because, to begin with, it is not clear whether the prevalence rate of ACEs among prison inmates differs between men and women. This study also addresses the relationship between ACEs and suicide-related behaviors such as suicidal ideation (SI) and NSSI after controlling for possible confounding variables such as sex. It is expected that a greater number of ACEs will be associated with a higher likelihood of lifetime SI and NSSI.

## 2. Method

### 2.1. Participants

This study was conducted as a secondary analysis of the original project titled "Health survey for drug offenders 2017," conducted by the Research and Training Institute, Ministry of Justice, Japan. The initial participants in the survey were newly incarcerated inmates located in prisons throughout Japan (78 prisons excluding medical prisons). Inmates placed in medical prisons were excluded from the study because of the severity of their physical or mental condition. More specifically, the participants were inmates who had violated the Stimulants Control Act and had used methamphetamine at least once in their lifetime. Inmates who were unable to read and write Japanese were excluded. The research period was from July to August 2017 for male participants and from July to November 2017 for female participants. For the survey, the prison staff distributed the questionnaire to the participants, asked them to complete it either in a living room or a classroom within the facility, and collected the questionnaires immediately after. The participants were assured that the answers in the questionnaire and whether or not they answered them would not affect their evaluation in the prison and that participation in the survey was voluntary. The participants checked either the "I will answer the questionnaire" or "I will not answer the questionnaire" box on the cover page of the questionnaire to express agreement/refusal to participate in the study. After providing informed consent, the participants completed a self-report questionnaire.

Among 806 inmates (542 men and 264 women) who were asked to participate in the study, 107 refused to participate (response rate: 86.7%). A total of 699 inmates were then selected. Of the 699 potential survey participants, 63 were excluded because of missing values for the variables used in the study. Finally, 636 participants were included in the analysis. The final participants comprised 418 male participants (mean age = 44.2,  $SD = 10.5$ , range 22–78) and 218 female participants (mean age = 41.8,  $SD = 9.0$ , range 24–70).

To understand the characteristics of methamphetamine related inmates in Japan, a comparison was made with the total inmate population with respect to demographic variables based on official statistics (Ministry of Justice, Japan, 2020). People in their 40s accounted for approximately 40% of inmates using methamphetamine, which is higher than the overall inmate population. Regarding marital status, more than half of the male inmates were divorced or bereaved from their partners, which was also higher than the overall trend. The proportion of male inmates who were employed was higher than those who were in prison for other crimes. Among female inmates, no significant differences were observed in terms of marital status or occupation compared to the overall inmate population. Regarding educational status, approximately 27% of inmates using methamphetamine had at least a high school diploma, which is lower than that of the overall inmate population.

### 2.2. Measures

#### 2.2.1. ACEs

Participants were asked about their exposure to ACEs up to the age of 18 years. In total, 12 ACEs were assessed, including items from the original ACE Study (Felitti et al., 1998). More specifically, our study included seven household dysfunction items (alcohol problems, substance abuse, mental illness, suicide attempts, parental death or divorce, incarcerated family member, and mother treated violently) and five child maltreatment items (physical neglect, emotional neglect, physical abuse, psychological abuse, and sexual abuse). Although there are subtle differences, the items adopted in this study overlap with the Adverse Childhood Experiences Questionnaire (ACE-IQ; World Health Organization, 2018). ACE items were coded as binary (0 = no and 1 = yes), yielding 12 dichotomous ACE variables. It is well known that various childhood adversities tend to co-occur, and previous studies have employed the simple addition of ACE items as an indicator when examining the cumulative effects of different types of adversities. Thus, in this study, an ACE score (cumulative ACEs) was created by using the sum of all positive responses to each experience, resulting in a possible total score ranging from 0 to 12.

#### 2.2.2. SI and NSSI

The dependent variables examined in this study were history of NSSI and SI. A history of NSSI was assessed by asking participants "Have you ever deliberately self-injured with no intention of killing yourself?" Those with a history of NSSI were coded as 1, and those with no history of NSSI were coded as 0. Similarly, lifetime SI was also coded dichotomously.

### 2.2.3. Control variables

The current study also controlled for the following variables: age, sex, and number of incarcerations. Age at the time of the survey and number of incarcerations were measured as continuous variables, whereas sex was coded as a binary variable with male as the reference category.

### 2.3. Ethical considerations

This study has been carried out in accordance with the Code of Ethics of the World Medical Association. Informed consent was obtained from each participant. After the National Center of Neurology and Psychiatry signed a material transfer agreement with the Research and Training Institute, Ministry of Justice, researchers obtained an anonymized dataset for secondary analysis. The study protocol was reviewed and approved by the Ethics Committee of the National Center of Neurology and Psychiatry (approval number: A2017–107).

### 2.4. Statistical analyses

First, descriptive statistics for all the variables were calculated. Next, the prevalence rate of ACEs by sex and NSSI/SI group was computed. Finally, to examine the research question, a series of binary logistic regression analyses were conducted with the NSSI and SI groups as dependent variables, using the ACE score as the explanatory variable. Demographic variables such as sex, age, and number of incarcerations were also included in the model as possible confounders.

## 3. Results

### 3.1. Sample characteristics

Table 1 shows the demographic variables of all participants by sex. Compared with female participants, the male counterparts were more likely to be older, unmarried, and have a history of prior incarceration. Regarding NSSI and SI variables, significant differences were also found between male participants and female participants; specifically, female participants were more likely to have engaged in NSSI and experienced SI during their lifetime ( $p < .001$  for both).

### 3.2. Prevalence of ACEs by sex

Table 2 demonstrates the sex-specific ACE scores, indicating the prevalence in each ACE category and ACE cumulative score. More than half of both male and female participants reported having experienced a parental death or divorce, which was the highest among all the ACE categories. Furthermore, >30 % of all participants were physically or psychologically abused (31.8 % and 31.9 %, respectively). Among the male participants, the second highest prevalence was observed for physical abuse (28.0 %), followed by psychological abuse (23.9 %). In contrast, for female participants, the second highest prevalence was observed for psychological abuse (47.2 %), followed by physical abuse (39.0 %). The chi-square tests for each ACE category between male and female participants revealed significant differences in all categories except parental death or divorce. Specifically, prevalence rates were higher among female participants than among male participants for all 11 items. Of all the participants, 72.0 % of the male participants and 83.9 % of the female participants reported that they had at least one ACE before 18 years of age, and more than half of the participants (54.1 %) were exposed to multiple ACEs.

Participants in this study had an average of 2.45 ACEs ( $SD = 2.36$ , range = 0–11). The average ACE score was 2.03 ( $SD = 2.14$ ) for male participants and 3.26 ( $SD = 2.56$ ) for female participants. This shows that the ACE score of female participants is significantly higher than that of their male counterparts (Welch's  $t(377.4) = 6.03$ ,  $p < .001$ ,  $d = 0.53$ ). As shown in Table 2, the number of female participants with an ACE score of 5 or more is approximately twice that of male participants. To illustrate, 16.1 % of the female

**Table 1**  
Descriptive statistics.

	Male ( $n = 418$ )	Female ( $n = 218$ )	Total ( $N = 636$ )	$p$ value( $\chi^2$ or $t$ )
Age	44.2 (10.5)	41.8 (9.0)	43.4 (10.0)	0.002
Marital status (%)				<0.001
Married	19.6	41.3	27.0	
Never married	32.8	14.2	26.4	
Divorce	47.4	43.1	45.9	
Death	0.2	1.4	0.6	
Prior incarceration (%)	77.8	66.1	73.7	0.001
NSSI (%)	8.1	40.8	19.3	<0.001
SI (%)	20.3	45.4	28.9	<0.001

Note. NSSI = non-suicidal self-injury. SI = suicide ideation. Parenthesis in the age row indicates standard deviation.

**Table 2**  
Prevalence of ACEs by sex.

	Male (n = 418)	Female (n = 218)	Total (N = 636)	p value
Household dysfunction				
Alcohol problem	17.5	27.1	20.8	0.005
Substance abuse	10.5	21.6	14.3	<0.001
Mental illness	13.9	24.8	17.6	<0.001
Suicide attempt	8.9	14.7	10.8	0.025
Parental death or divorce	50.7	58.7	53.5	0.055
Incarcerated family member	8.9	17.9	11.9	<0.001
Mother treated violently	20.3	30.7	23.9	0.004
Abuse and neglect				
Physical neglect	5.0	9.6	6.6	0.026
Emotional neglect	15.6	27.5	19.7	<0.001
Physical abuse	28.0	39.0	31.8	0.005
Psychological abuse	23.9	47.2	31.9	<0.001
Sexual abuse	0.2	6.9	2.5	<0.001
ACE scores				
0	28.0	16.1	23.9	
1	26.6	13.3	22.0	
2	15.1	16.1	15.4	
3	8.4	12.8	9.9	
4	6.0	11.0	7.7	
5 or more	16.0	30.7	21.1	

Note. ACE = adverse childhood experience.

participants and 28.0 % of the male participants were not exposed to an ACE, while 30.7 % of the female participants and 16.0 % of the male participants were exposed to five or more ACEs.

### 3.3. Prevalence of ACEs by histories of NSSI and SI

Table 3 presents the results of the experience rate of ACEs up to the age of 18 in the NSSI and SI groups. First, those with a history of NSSI showed a significantly higher rate than those without NSSI for most of the items. However, no statistical differences were found for the two items “parental death or divorce” and “incarcerated family member.” Likewise, those with a history of SI had significantly higher rates than those without an SI history for all items other than the three items: substance abuse, parental death or divorce, and incarcerated family member. Those with a history of both NSSI and SI showed significantly higher ACE scores than those without such histories (Welch's  $t(165.2) = 5.78, p < .001, d = 0.65$  for NSSI; Welch's  $t(308.8) = 5.64, p < .001, d = 0.52$  for SI). As expected, higher ACE scores were associated with higher rates of SI and NSSI than lower scores.

**Table 3**  
Prevalence of ACEs by NSSI and SI group.

	NSSI		p value	SI		p value
	Yes (n = 123)	No(n = 513)		Yes (n = 184)	No (n = 452)	
Household dysfunction						
Alcohol problem	33.3	17.7	<0.001	28.3	17.7	0.003
Substance abuse	18.7	13.3	0.121	16.8	13.3	0.243
Mental illness	26.8	15.4	0.003	23.4	15.3	0.015
Suicide attempt	18.7	9.0	0.002	19.0	7.5	<0.001
Parental death or divorce	56.1	52.8	0.514	58.2	51.5	0.130
Incarcerated family member	15.4	11.1	0.183	12.0	11.9	0.997
Mother treated violently	35.8	21.1	<0.001	31.5	20.8	0.004
Abuse and neglect						
Physical neglect	11.4	5.5	0.018	9.8	5.3	0.039
Emotional neglect	37.4	15.4	<0.001	32.1	14.6	<0.001
Physical abuse	48.8	27.7	<0.001	42.4	27.4	<0.001
Psychological abuse	56.1	26.1	<0.001	50.0	24.6	<0.001
Sexual abuse	6.5	1.6	0.002	6.5	0.9	<0.001
Mean ACE scores	3.7	2.2	<0.001	3.3	2.1	<0.001
Distribution of ACE scores						
0	12.2	26.7		12.0	28.8	
1	13.8	24.0		16.8	24.1	
2	12.2	16.2		19.0	13.9	
3	13.8	9.0		10.3	9.7	
4	10.6	7.0		9.2	7.1	
5 or more	37.4	17.2		32.6	16.4	

Note. NSSI = non-suicidal self-injury. SI = suicide ideation. ACE = adverse childhood experience.

In this study, participants were not asked about the frequency and severity of suicidal ideation or the history of suicide attempts. To further explore the relationship between ACEs and suicidality, an additional analysis was conducted by dividing the participants into three groups according to whether they had neither NSSI nor SI, either NSSI or SI, or both NSSI and SI. It is well known that SI is one of the predictors of suicide attempts, and NSSI is also one of the strongest predictors of suicide attempts, though NSSI and suicide are different from each other in several ways (Asarnow et al., 2011). Thus, individuals with a history of both NSSI and SI can be considered to be at a higher risk for future suicide attempts than others. The mean ACE scores were 2.02 for the group with no history of both NSSI and SI ( $n = 412$ ), 2.85 for the group with either NSSI or SI ( $n = 141$ ), and 3.94 for the group with both NSSI and SI ( $n = 83$ ). One-way ANOVA showed a significant main effect for the suicidal condition ( $F(2,633) = 27.51, p < .001$ , partial  $\eta^2 = 0.08$ ).

### 3.4. Logistic regression analyses

Logistic regression was performed to examine the relationships between self-reported ACEs and suicide-related thoughts and behaviors. Table 4 shows the results of logistic regression analyses with NSSI, SI, and both NSSI and SI as the dependent variables and cumulative ACEs as the independent variables. Age, sex, and number of incarcerations were also included in the model as possible confounders. As shown in Table 4, for all the dependent variables, the adjusted odds ratio (AOR) of the ACE score was 1 or above and significant. These results indicate that each additional increase in ACE score increased the odds of engaging in NSSI by 18 % (AOR = 1.18, 95 % C.I. = 1.08–1.28), SI by 18 % (AOR = 1.18, 95 % C.I. = 1.09–1.27), and both NSSI and SI by 21 % (AOR = 1.21, 95 % C.I. = 1.10–1.34).

## 4. Discussion

The findings from the current research confirmed that ACEs were prevalent in Japanese substance users in prisons, and increased exposure to ACEs was associated with an increased likelihood of both SI and NSSI. Approximately three out of four male participants and four out of five female participants had at least one ACE. In particular, among the female participants, the ratio was higher than their male counterparts in most of the ACE categories, indicating cumulative adversities, especially for female participants with methamphetamine use convictions. Moreover, those who reported a greater number of cumulative ACEs were significantly more likely to have a history of SI and NSSI, indicating the need for suicide prevention and treatment for inmates with multiple adverse experiences.

### 4.1. Prevalence of ACEs in a sample of substance users in Japan

To the best of our knowledge, this is the first published study on ACEs of substance users in Japanese prisons. First, we compared the results of this study with those of previous studies examining the prevalence rate of ACEs in the general population in Japan. Fujiwara et al. (2011) examined the relationships between ACEs up to the age of 18 years and subsequent mental health issues in 1722 Japanese community members. Their study confirmed that 32 % of the participants reported having experienced at least 1 of the 12 listed ACEs. In contrast, >70 % of male participants and 80 % of female participants in our study had experienced at least one of the 12 ACEs. In addition, the prevalence rate was overwhelmingly higher among this study's participants in all comparable items. A similar trend can be seen when compared to figures from other studies (Amemiya et al., 2018; Isumi & Fujiwara, 2016). Although no direct comparison could be made due to the differences in the definition and the number of items used in the survey, the concepts that previous studies tried to measure were similar and often overlapped with those used in this study. Thus, it can be concluded that the prevalence rate of ACEs among incarcerated substance users is much higher than that among the general population in Japan, indicating greater adversities during their childhood.

Although it is not possible to compare results unequivocally, it is certain that the prevalence of ACEs among Japanese substance users is much higher than in the general Japanese population but also in those of other countries. The WHO World Mental Health Surveys across 21 countries demonstrated that 38.39 % of the participants reported at least one ACE, and the prevalence of reporting at least four ACEs was 2.3 % (Kessler et al., 2010). A recent meta-analysis excluding high-risk and clinical populations revealed that 57 %

**Table 4**  
Logistic regression analyses targeting NSSI, SI, and both.

	NSSI		SI		Both	
	AOR	95%CI	AOR	95%CI	AOR	95%CI
Sex (0 = Male, 1 = Female)	6.96***	4.39–11.18	2.84***	1.94–4.16	5.84***	3.36–10.17
Age	0.96***	0.93–0.99	1.00	0.97–1.02	0.97	0.94–1.01
Number of incarcerations	1.09	0.96–1.23	1.03	0.94–1.13	1.06	0.92–1.22
ACE scores	1.18***	1.08–1.28	1.18***	1.09–1.27	1.21***	1.10–1.34
Nagelkerke's $R^2$		0.27		0.13		0.23

Note. NSSI = non-suicidal self-injury. SI = suicide ideation. ACE = adverse childhood experience. AOR = Adjusted Odds Ratio. CI=Confidence Interval.

\*\*\*  $p < .001$ .

of the participants across all studies reported at least one ACE and 13 % reported at least four (Hughes et al., 2017). There are variations in the estimation of the prevalence rate of ACEs among studies due to the differences in categories used to establish ACEs. Based on Table 2, the percentage of participants in this study who had at least four or more ACEs was 22.0 % for male participants and 41.7 % for female participants, which is far beyond the two studies mentioned above. Our results are consistent with the results of previous overseas studies showing that substance users have a high ACE experience rate. Oei et al. (2021) demonstrated that the effect of cumulative ACEs on substance use prevalence is also true among young offenders in Singapore, which has a low crime rate and stringent drug laws similar to Japan. Our findings are consistent with these findings and thus provide further evidence that the association between ACEs and substance use is robust and generalizable across cultural, clinical, and criminal justice populations.

#### 4.2. Relationship of ACEs on suicide and self-injury in incarcerated offenders

This study makes a unique contribution by demonstrating that cumulative adversity is associated with SI and NSSI in a sample of simulant drug offenders. Our findings have revealed that inmates who experienced multiple adversities during their childhood are at a higher risk of engaging in NSSI and having SI. This suggests that routine assessment procedures in correctional facilities should incorporate a history of ACEs to prevent self-destructive behaviors. Although forensic practitioners implement thorough screening to prevent inmates from committing suicide or self-injury, these are carried out primarily for the purpose of identifying security risks, and inmates' substance use history, suicide-related behaviors, and ACEs are commonly evaluated separately and not integrated adequately. The current assessment practices would be even more comprehensive and effective if they also systematically took ACEs into account. Screening for a history of ACEs can also help criminal justice practitioners understand the underlying causes of substance use, NSSI, and suicide attempts by inmates, and enable better-informed treatment options to reduce maladaptive coping behaviors. Our results show that having more ACEs is associated with more NSSI, which has important clinical implications. Generally, inmates' repeated self-injurious behavior is likely to be regarded by correctional staff as an intention to deceive or manipulate others (Sousa et al., 2019) rather than intrapersonal functions such as emotion regulation or self-punishment. If prison officers consider inmates' actions as manipulative or aimed at getting their attention, the relationship between the two turns into a power game, which is not beneficial for either party. Therefore, it is necessary to encourage not only forensic psychologists but also prison guards to develop a deeper understanding of the mechanism underlying NSSI and its relationship with traumatic childhood experiences. Enhancing emotion regulation skills might help inmates cope with psychological trauma and prevent future suicide-related behaviors as well as substance use.

Finally, participants in this study were asked to indicate whether they had SI. It should be noted that although SI and NSSI are predictors of suicide attempts, SI does not necessarily lead to suicide attempts. However, Mars et al. (2019) showed that illicit drug use was a factor leading to the transition from ideation to attempt. Thus, inmates with a history of both substance use and SI are considered to be at risk for future suicide attempts. Recently, there has been a growing body of research distinguishing factors that predict SI from those that predict suicide attempts (Klonsky et al., 2016), but further research is warranted to identify factors that predict the transition, as this will strengthen clinical assessments of suicide risk.

#### 4.3. Practical implications

Our findings have some implications for criminal justice practice, policy, and prevention, especially for the delivery of treatment services for incarcerated substance users. Since the prevalence rate of ACEs is high among this population, trauma-informed service provision is required in correctional institutions in the therapeutic context. Correctional facilities could be one of the few places where substance users and staff jointly deal with the intertwined issues of substance use, self-injury, and past trauma simultaneously. Interventions targeting offenders with a history of ACEs should also aim to foster a sense of trust in others and an attitude of seeking others' help. In addition, our findings have shown that most incarcerated methamphetamine users have multiple ACEs, and research has shown that different combinations of ACEs may shape risk in different ways (Lanier et al., 2018). Thus, it would be beneficial if treatment approaches were individualized according to the ACEs participants had experienced. Considering the results of this study, it is crucial to intervene in traumatic stress, especially for incarcerated female offenders. In a review article focusing on sex and gender differences in substance use, the effectiveness of gender-responsive treatment is discussed, which addresses factors that are more prevalent in women and may influence their treatment outcomes, including exposure to trauma (McHugh et al., 2018). Based on an analysis of a randomized controlled trial of trauma-focused group treatment for female substance users with comorbid PTSD, Hien et al. (2010) found that PTSD severity reductions were associated with subsequent substance use improvement among female heavy drug users; they stated that their results supported the self-medication model of coping with PTSD symptoms. As mentioned earlier, our findings have demonstrated that the ACE score of female inmates is significantly higher than that of their male counterparts, and the number of female participants with an ACE score of 5 or more is nearly twice that of their male counterparts. Thus, an integrated intervention to address co-occurring PTSD symptoms would be more effective in achieving substance use improvement, especially for female inmates. We must also mention the issue of the social exclusion of drug offenders in Japan. Low prevalence rates of illicit drug use and low familiarity with substance abuse problems among the public may increase stigmatization of drug users. As described earlier, in Japan, the lifetime prevalence rate of illicit drug use is lower than that in other countries. However, the low lifetime experience rate of illegal drugs does not always have only positive aspects. The fact that a significant proportion of people do not experience illicit drugs during their lifetime means that there are few substance abusers in their surroundings. Therefore, for the vast majority, it is not perceived as a familiar problem to be tackled, and the stigma against drug offenders is deep-rooted. In addition, social resources to support recovery are considerably fewer, and ex-inmates are likely to be isolated. As the results of this study show, it is

reasonable to consider that substance users in prison have experienced many childhood adversities, and these experiences influence their drug addiction. In some cases, what was initially an attempt at self-treatment has ironically led to an addiction to illicit drugs. Although discussion on the decriminalization of illicit drugs is beyond the scope of this study, this issue must be addressed immediately to improve recovery and support systems for the purpose of decreasing societal exclusion. As Cheung et al. (2021) noted, community education should emphasize the importance of treating substance users as individuals, not as problems. Intolerant attitudes, which attribute illicit drug use solely to individual responsibility, cause stigma toward and hindrance for substance users in terms of seeking help. Our findings might contribute to changing the image of substance users and reducing stigma by broadening public understanding of the associations between substance use and ACEs.

Intergenerational chains of ACEs in inmates could be discussed as a potential implication of this research. Although parental incarceration itself constitutes an item of ACE that cannot be changed, integrated services for correctional inmates would reduce the likelihood that their own children, in turn, will be affected by ACEs. Correctional institutions are not only responsible for preventing recidivism to create a safer society but also for dealing with inmates' ACEs to minimize their negative impact on the next generation and break the intergenerational chain through therapeutic interventions for inmates with histories of ACEs. A recent literature review on the intergenerational transmission of trauma indicated that it is imperative to specifically address parental PTSD as a means of preventing ACEs in children because parents with unresolved ACEs are more likely to increase their own children's risk of ACEs (Narayan et al., 2021). PTSD symptoms could act as mediators of the intergenerational transmission of ACEs. Therefore, it is indispensable for service providers to implement comprehensive screening and treatment of ACEs and PTSD symptoms of substance users in prison in the rehabilitative context.

Finally, in Japan, we have experienced an increase in mental health problems due to the COVID-19 pandemic (Ueda et al., 2020); this may potentially increase illicit drug use as vulnerable people attempt to self-medicate due to higher levels of anxiety and depression, suggesting the urgency and importance of developing effective treatment for substance users.

#### 4.4. Limitations

Some methodological limitations in the present study should be mentioned. First, the cross-sectional design restricts causal inferences between ACEs and suicide-related variables. In the current study, for ACEs, participants were asked about their experiences up to the age of 18 years, while for SI and NSSI, they were asked about their lifetime experiences, including those after the age of 18. Thus, it is more plausible that the adverse experience would be the leading factor, rather than the NSSI and SI occurring first and causing adverse experiences. However, any causal interpretation of the results should be treated carefully. The second limitation is the exclusive reliance on self-report questionnaires to collect information on participants' ACEs. Since this study had a retrospective design, recall bias might have affected the outcome of the survey. It can be noted that participants with suicidal or self-injurious tendencies are more likely to recall or report ACEs, or to interpret their past experiences in a manner consistent with definitions of ACEs. Therefore, a longitudinal study that does not rely solely on self-reports is desirable. Third, our measure of ACEs did not capture nuanced differences in experiences among participants. Measurement issues of cumulative ACEs have been discussed by researchers and practitioners (e.g., Lacey & Minnis, 2020). Although it would be desirable to consider duration, frequency, severity, and timing in developmental stages of adversity, we were unable to include these questions in this study due to the limited size of the questionnaire. Further research is needed to capture the detailed aspects of ACE. Additionally, other variables, including protective factors that were not measured in the current research, could mediate associations between ACEs and outcomes. Fourth, the proportion of participants engaged in NSSI might have been underestimated, and the outcome variable might have captured subtle differences. Assessing NSSI using a single item often results in a lower prevalence rate than assessment with a specific behavior checklist. More detailed information about NSSI, such as the method, onset, duration, frequency, and functions of NSSI, would provide information on the relationship between NSSI and ACE in a more sophisticated way.

## 5. Conclusions

The current study revealed a high prevalence rate of ACEs and an association between ACEs and suicide-related ideation/behaviors using data from stimulant drug offenders serving prison terms nationwide in Japan. Our findings suggest the importance of early prevention and intervention for traumatic experiences, and have implications for the recommendation of gender-responsive, trauma-focused interventions, especially for female inmates in the criminal justice system, to break the intergenerational chain of abuse. Exploring the details of the ACEs of these populations and linking the results obtained to improving criminal justice policy will be significant not only from the viewpoint of public health but also from that of public safety.

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## Declaration of competing interest

All authors declare that they have no conflicts of interests with regards to this article.

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