

Methamphetamine use, health and criminal justice system outcomes: a systematic review

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Abstract

Issues. Methamphetamine use is a problem for health and criminal justice systems (CJS) worldwide. Methamphetamine is used at higher rates in CJS-involved populations than the general community. This systematic review synthesises the evidence for health and CJS outcomes post-CJS contact for people reporting pre-CJS methamphetamine use.

Approach. Academic databases were searched to identify peer-reviewed original studies using a longitudinal design that investigated associations between pre-CJS methamphetamine use and health and criminal justice outcomes after CJS contact. Identified studies were screened in two stages; title and abstract, then full-text. Data from the included studies were extracted and analysed. Results are reported in line with the PRISMA statement.

Key Findings. Nine studies met the inclusion criteria; five investigated health and four investigated CJS outcomes. Pre-CJS methamphetamine use was associated with subsequent hospitalisation for drug-induced psychosis, increased risk of recidivism and higher crime costs after CJS contact. Pre-CJS methamphetamine use was not associated with subsequent hospitalisation for non-drug induced psychosis or post-release mortality.

Implications. Current evidence suggests that pre-CJS contact methamphetamine use increases the risk of subsequent drug-induced psychosis and recidivism. There is a need for more longitudinal research that measures mediators and moderators of health and criminal justice outcomes after CJS contact, to inform targeted prevention.

Conclusion. Methamphetamine use is a major problem that is contributing to serious mental illness and recidivism among CJS-involved populations. Prioritising treatment during CJS contact is recommended. Further research to identify key opportunities during health service and CJS contact for intervention is needed.

Key words: substance-related disorders, methamphetamine, mental disorders, risk, criminal justice

Introduction

Methamphetamine use is posing an increasing problem in many countries [1], due in part to the severe psychiatric [2] and physical health problems [3, 4] associated with its use, as well as the social [5] and criminal justice system (CJS) impact [6]. Justice costs make up a substantial proportion of the overall economic costs attributed to methamphetamine use [7, 8]. Australian research suggests that recent increases in methamphetamine availability have been associated with a commensurate increase in regular use and associated harms [6]. This may explain the doubling of the rate of deaths associated with methamphetamine use in Australia between 2009 and 2015 [3]. There is also evidence of a dose-response relationship between methamphetamine use and the use of psychiatric hospitals and emergency departments in Australia attributable to methamphetamine use [9]. In the United States, amphetamine-related hospitalisations increased from 55,447 to 206,180 per year between 2008 and 2015, at an estimated cost of US\$2.17 billion for 2015 hospitalisations alone [10]. Amphetamine-related hospitalisations are also associated with higher in-hospital mortality, and greater length of stay, compared with non-amphetamine-related hospitalisations [10]. There have also been recent increases in methamphetamine use in lower-income country settings including South Africa [11] and Iran [12], which pose ongoing public health concerns such as increased risk of HIV transmission [13]. These findings illustrate the substantial burden that methamphetamine use is currently having on health systems across different countries.

The impact of methamphetamine use is arguably most pronounced in the CJS. Urinalysis testing on arrestees detained at police watch-houses across Australia in 2016 found that 53% tested positive for amphetamine, the most prevalent of any illicit drug [14]. This is consistent with an Australian report estimating that 50% of prison entrants had used methamphetamine in the 12 months prior to prison – again, the highest prevalence of any illicit drug [15]. These results indicate a substantially higher prevalence of methamphetamine use in Australian justice-involved populations compared with an estimated 1.4% of the general Australian population [16]. These results are mirrored in the United States, where in Sacramento, California, 50% of a sample of arrestees tested positive for methamphetamine, followed by 16% in Denver, Colorado [17], compared with a 2014 estimate of 0.2% of the general United States population over 12 years of age who reported using methamphetamine in the past month [18].

People released from prison are at an increased risk of poor health outcomes including violent [19] and drug-related [20, 21] death, suicide [22, 23], non-fatal overdose [24] and hospitalisation for health problems including mental illness, skin disease, injury and poisoning [25]. Recent Australian trends show that increased methamphetamine use is associated with an increase in hospital admissions for drug psychosis, and increases in arrests of methamphetamine users for methamphetamine dealing and possession [6]. What appears unclear from the current evidence is how methamphetamine use by people who go on to have contact with the CJS may be associated with poor health and justice outcomes after contact with the CJS. Given the increasing harms and costs associated with methamphetamine use generally, and the high prevalence of methamphetamine use in people who have contact with the CJS, a review of the evidence regarding the relationship between prior methamphetamine use and post-CJS contact health and justice outcomes is warranted.

The main aim of this systematic review [26] is to identify and synthesise the existing evidence on health, health service and criminal justice outcomes for people who: (i) had contact with the CJS (including being arrested by police, incarcerated or being subject to a community-based supervision

order); and (ii) who had used methamphetamine prior to the index episode of contact with the CJS considered by the study. Because this review focussed on outcomes after contact with the CJS, evidence included was limited to longitudinal studies where temporal inferences were possible.

Methods

Information sources

We systematically searched Scopus, Web of Science, PsycInfo and PubMed for the period beginning at inception and ending on 28 June 2018.

Search strategy

Each database was searched by author CC using the terms outlined in Table 1.

INSERT TABLE 1

Author CC conducted the search and performed a two-stage screening process to identify studies that met the inclusion criteria. Firstly, all records were screened using title and abstract, then studies not excluded during this first stage were screened using their full text. Additionally, the reference lists of included studies were searched for potentially eligible studies.

Study selection

The criteria for inclusion of publications in the review were as follows:

1. Original research (both quantitative and qualitative);
2. Involving human participants who have had contact with the CJS;
3. Incorporating a longitudinal study design;
4. Written in English;
5. Published in a peer-reviewed journal;
6. Were deemed to be methodologically sound and suitable for inclusion using the Joanna Briggs Critical Appraisal Checklist for cohort studies [27];
7. Reporting on at least one of the following outcomes after contact with the CJS:
 - a. health or health service use outcomes;
 - b. criminal justice outcomes; including
 - i. Police arrests;
 - ii. Incarceration; and
 - iii. Self-reported criminal activity;
8. Where methamphetamine use prior to the index episode of criminal justice contact was considered as a potentially associated exposure.

There were no restrictions placed on the nature of the index episode of contact with the CJS, meaning that studies involving participants who had contact that did not involve incarceration were eligible for inclusion. Studies that compared participants with and without CJS contact were also considered.

Author CC conducted the search and screening of studies for potential inclusion, and recorded the results of each step for reporting pursuant to the PRISMA statement [28].

Data extraction

Using a structured data extraction template developed for this study, the following data were extracted: author(s); publication date; setting; study design; study measures; type of methamphetamine exposure measured (Table 2); study group/population; study period (if available); mean/median age (if reported); percentage of female participants; outcomes investigated; relevant socio-environmental factors of interest; and significant relationships reported between factors of interest and outcomes (Table 3).

INSERT TABLES 2 and 3

Risk of bias (quality) assessment

The Joanna Briggs Critical Appraisal Checklist for cohort studies [27] was used by author CC to assess the quality of identified studies, and to determine their suitability for inclusion in the review. The process of determining the quality assessment ratings for each item for each study is described in more detail in the supporting information.

Data synthesis and analysis

The health, health service and justice outcomes investigated by the included studies were extracted using the extraction template mentioned above, and categorised as either health or justice outcomes.

Results

Search results and study selection

Figure 1 shows a flow diagram of the literature search and screening process and results. The initial search identified 6334 records. After the removal of 2520 duplicates, 3814 studies were screened on title and abstract. Following title and abstract screening, the full text of 86 records was screened, resulting in nine publications meeting the inclusion criteria [19, 29, 31-33, 36-39]. The results of the quality assessment are included in the supporting information available online (Table S1). Of the studies excluded during title and abstract screening, 110 were review articles. None of these reviews had focussed on the specific aim being investigated by this review.

INSERT FIGURE 1

Quality assessment

The quality of the included studies was high overall with a mean score of 89% (range: 70-100%), with all studies deemed to be of sufficient quality for inclusion. The items that the smallest proportion of studies were endorsed for were groups/participants being free of the outcome at the start of the study/time of exposure (75%) and strategies used to address incomplete follow up (67%). It should be noted however that incomplete follow up was only an issue for three of the studies [29, 31, 33]. All studies were endorsed for recruiting study groups from the same population, measuring

exposure in a valid/reliable way, identifying confounding factors and measuring outcomes in a valid/reliable way.

Study setting and design

The nine included studies were set in Sweden [19, 36-39], the United States [29, 32], Taiwan [31] and Canada [33]. Six of the included studies solely involved participants who were in custodial settings at some stage during the study period [29, 31, 32, 37-39]. Two of the studies involved participants who were either in custody or subject to community corrections orders at some stage during the study period [19, 36]. One study involved participants who were recruited in the community and who may or may not have reported prior and/or subsequent contact with the CJS (incarceration, community-based supervision or arrest) or criminal activity [33].

Follow-up times varied by study; four studies did not report a fixed follow-up time due to participants entering or exiting the cohort at different times [19, 33, 36, 38]. The shortest fixed follow-up time reported was nine months [29] and the longest was five years [31].

Study participants

Participants across all but one study [33] were adults with a history of contact with the CJS. Enns *et al* [33] was the only included study that involved some participants who did not report prior contact with the CJS. Sample sizes ranged from 794 [31] to 6217 [39], and all but one study [31] included both male and female participants, with 43% being the highest proportion of female participants reported [32]. Four studies [29, 31, 32, 36] included a no-methamphetamine use comparison group, three [19, 33, 38] included only methamphetamine users, one study used a comparison group that reported no current drug problem, described by the authors as a “less severe and perhaps terminated substance use” group [39], and one study compared death rates of methamphetamine using participants with national mortality data [37].

Measures and data collection

All studies used a survey tool to collect baseline data. The tool most commonly used was the Addiction Severity Index (ASI) [40], with different versions of the ASI used across six studies [19, 32, 36-39]. All but one included study [29] used administrative records to measure post CJS contact outcomes.

Outcomes investigated across studies

Recidivism was the most common outcome investigated across included studies, with three studies focusing on this [31, 32, 36]. Two studies investigated either mortality [19, 37] or hospitalisation for psychosis [38, 39], which were the next most common outcomes investigated. Of the other studies, Cartier *et al* [29] investigated whether elevated HIV risk behaviours persisted from the period before through to the period after incarceration, and Enns *et al* [33] investigated monthly crime costs.

Methamphetamine-related findings

The methamphetamine-related findings were grouped into two categories, health and criminal justice. Five of the included studies reported on health outcomes [19, 29, 37-39] and four reported on criminal justice-related outcomes [31-33, 36]. None of the included studies reported on both health and criminal justice outcomes. Findings of no association were also included here.

Among the health-focused studies, Rognli *et al* [39] found that reporting an amphetamine problem at baseline (i.e. during index CJS contact) was positively associated with subsequent hospitalisation

for drug-induced psychosis [odds ratio (OR) 3.61; 95% confidence interval (CI) 1.25-10.40]; however, no association was found for primary psychosis. Rognli *et al* [38] found no evidence of an association between hospitalisation for psychosis and three measures of patterns of amphetamine use; age of onset, number of years of use and days of use in the past month, measured at baseline.

Similarly, Cartier *et al* [29] found no association between methamphetamine use reported at baseline and increased odds of unsafe sex, unsafe injecting or concurrent unsafe sex and injecting practices at nine-month follow-up. This study did, however, find that baseline methamphetamine use was associated with methamphetamine use at post-sentence follow-up, which in turn was associated with greater odds of risky sexual behaviour and risky injecting at follow-up [29]. Ericsson *et al* [19] found a small but statistically significant negative association between a greater number of days of amphetamine use in the past 30 days and risk of death in their study sample (hazard ratio 0.96; 95% CI 0.93-0.98). They also found a similarly small but statistically significant positive association between greater number of days of sedative use in the past 30 days and risk of death (hazard ratio 1.03; 95% CI 1.00-1.06) [19]. Hakansson and Berglund [37] found no association between lifetime amphetamine use for a period of at least six months and post-release death.

With respect to criminal justice outcomes, Håkansson and Berglund [36] reported that injection use of methamphetamine both alone (OR 1.95; 95% CI 1.74-2.18) and concurrently with heroin (OR 2.08; 95% CI 1.81-2.40), and non-injection use of methamphetamine both alone (OR 1.28; 95% CI 1.13-1.45) and concurrently with heroin (OR 1.43; 95% CI 1.07-1.93), were associated with increased risk of recidivism compared with those who reported no use of methamphetamine or heroin. Enns *et al* [33] found that there were higher monthly crime-related costs associated with daily (CAD\$5845) and non-daily (CAD\$5723) methamphetamine use when compared to no use, as well as for daily (CAD\$8893) and non-daily (CAD\$5449) poly-stimulant use involving methamphetamine compared to no poly-stimulant use. They found that route of methamphetamine administration was not a significant factor in crime-related costs, with injection of methamphetamine not associated with significantly higher costs compared to non-injection use [33]. Chiang *et al* [31] found that the odds of recidivism were greater for participants testing positive for methamphetamine at intake compared to those testing negative (OR 1.6; 95% CI 1.2-2.1). Chiang *et al* [31] also found that methamphetamine use in their all-male sample was associated with lower rates of recidivism and longer survival time to recidivism when compared to heroin use. Similarly, Du *et al* [32] found that for female participants, recidivism was less likely to occur for participants who used methamphetamine when compared to those who used cocaine.

Discussion

We found few longitudinal studies that investigate outcomes associated with methamphetamine use in CJS populations. The extant evidence suggests that people who use methamphetamine prior to CJS contact are at increased risk of subsequent contact compared to their counterparts who have not used methamphetamine [31, 36, 41]. However the risk recidivism of was lower for pre-CJS methamphetamine users when compared to those who used heroin [31] or cocaine [32] during the same period. The evidence around associations between pre-CJS methamphetamine use and poor health outcomes was mixed. One study found an association between pre-CJS methamphetamine use and subsequent hospitalisation for drug-induced psychosis [39], however no such associations were found for hospitalisation for non-drug induced psychosis [38] or mortality [19] (in contrast to heroin [37]).

Previous research into drug-related health outcomes after contact with the CJS has focussed on outcomes more commonly associated with opioid use, such as death [21, 42, 43] and non-fatal drug

overdose [24, 44]. The results from the relatively small body of literature in this space suggest that methamphetamine use poses different types of health challenges to opioid use post-CJS contact [21, 29], with psychosis being a key area of concern [38, 39]. This has implications for transitional planning for criminal justice agencies: rather than overdose prevention strategies, people with a history of methamphetamine use may require more tailored mental health support.

The included studies provide evidence of a positive association between methamphetamine use and both crime costs [33] and recidivism [36]. These findings echo elsewhere in the literature [7, 33, 36, 42], and highlight the potential for interventions that reduce methamphetamine use and related harm after CJS contact to be cost-effective, as well as the importance of health economic evaluation of such interventions. Given the relationship between methamphetamine use and crime, implementing effective psychosocial interventions aimed at reducing or ceasing methamphetamine use [46, 47] should be considered in CJS-involved populations.

Strengths and limitations of the included studies

As reflected in the results of the quality assessment, the key strengths of the included studies generally lay in their design and data sources. All but one study [33] drew their participants from comprehensive administrative justice datasets. These datasets included methamphetamine exposure data, and routinely collected outcome data for appropriate follow up periods. Enns *et al* [33] used an established survey tool to collect both exposure and outcome data, and utilised a wide range of costing data to comprehensively estimate costs from a societal perspective. Follow-up was generally good across the studies, with exceptions where loss to follow up was either mentioned but not explored further [29, 33], or described in detail but not accounted for in the statistical methods used [31].

One of the main limitations across studies is that they are observational, so no causal inferences between methamphetamine use and the outcomes of interest could be made. Relatedly, methamphetamine use was only measured at one time point across studies, usually a considerable time prior to the outcomes being investigated. This limits the temporal connection between methamphetamine use and those outcomes, and raises the possibility that other unmeasured exposures may have contributed to the outcomes reported.

The small number of health-focused studies and their narrow scope (limited to HIV risk behaviours [29], mortality [19, 37] and psychosis [38, 39]), made it difficult to compare outcomes across studies. Importantly, most of the adverse health outcomes associated with methamphetamine use (including depression, cardio-vascular disease, methamphetamine dependence and suicide [4, 48]), were not investigated by the included studies. This gap in the literature needs to be addressed in light of the high prevalence of methamphetamine use among CJS populations [14, 15, 17], and the impact that this has on health and CJS services [6, 8-10].

Strengths and limitations of this review

The main strength of this systematic review was the comprehensive search strategy, which was informed by the PRISMA statement [28]. An additional strength was the quality assessment conducted. One limitation of the study is the exclusion of grey literature and non-English literature. However, no non-English literature was retrieved during the literature search, and grey literature was considered in the background research done for the review; none of which would have met the eligibility criteria for inclusion. There is a possibility that these exclusion criteria may have resulted in relevant literature not being included in the review. A further limitation is that screening of the full-text of articles was not performed by an independent assessor; this may have resulted in studies being screened as ineligible that may have been picked up by a second assessor.

Implications for future research

To address the issues around the temporal connection between methamphetamine exposure and outcomes, studies involving people who have been incarcerated should be designed to investigate exposures and outcomes at multiple time points after baseline measures are administered. This would enable further investigation of time-varying risk factors that may impact different stages of a person's reintegration into the community. This would also assist researchers to investigate possible effect mediators and moderators.

Given that people who have contact with the CJS are inherently vulnerable and often difficult to engage with outside of a custodial setting, a program of systematic data collection should be considered in prison systems to support further high-quality research in this important area. One example of this is the systematic use of the ASI in the Swedish correctional system, which enabled five of the studies in this review [19,36-39] to be conducted.

There is also a need for more research to understand the mechanisms that result in poor health and criminal justice outcomes for people who use methamphetamine. With much of the existing literature focused on very specific health or justice outcomes, future research should consider broader contextual health and social factors (e.g. education, employment, income, housing, domestic violence and the role of families) which may impact on recidivism. Such research would provide valuable findings for policy makers and practitioners who are responsible for addressing the often-complex needs of people who go to prison.

Conclusion

There is some evidence that pre-CJS contact methamphetamine use is associated with subsequent recidivism, crime-related costs and drug-induced psychosis, with no current evidence of an association with non-drug-induced psychosis or mortality. This highlights the need for interventions that reduce methamphetamine use in the CJS setting to prevent the associated poor outcomes. Methamphetamine use in CJS settings is associated with different adverse health outcomes than the more established harms associated with opioid use. Further research is needed to better understand the broader range of harms associated with methamphetamine use in the CJS, and the context in which these harms occur.

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Conflict of Interest

Apart from the funding resources disclosed in the acknowledgements section, all authors declare no conflicts of interest.

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Table 1. Search terms

Terms A		Terms B
ATS Amphetamine type stimulant\$ \$amphetamine metamfetamine \$amphetamine hydrochloride n-methylamphetamine stimulant\$	and	legal prison\$ justice police incarcerat\$ detention detain\$ arrest\$ crim\$ correcti\$ court

Table 2. Study setting and design

Author, date [ref]	Country	Setting	Study design	Measures used	Type of methamphetamine exposure reported	Socio-environmental factor(s) of interest
Cartier, 2008 [29]	USA	Prisons in Colorado, Connecticut, Kentucky and Oregon and the community	Prospective cohort	<u>Exposure:</u> - Department of Criminal Justice-Therapeutic Community Intake Form (Simpson & Knight 1998) [30] <u>Outcome:</u> - Department of Criminal Justice-Therapeutic Community Intake Form (Simpson & Knight 1998) [30]	Any use in past 30 days	Age Race/ethnicity Marital status Living with partner/alone Education level Employment (past six months) Methamphetamine use Substance abuse treatment episodes
Chiang, 2006 [31]	Taiwan	Acute detoxification unit with detention centre in Taiwan	Retrospective Cohort	<u>Exposure:</u> - Urinalysis - Semi-structured psychiatrist-administered interview to assess AOD use <u>Outcome:</u> - Administrative incarceration data from the Taiwan Ministry of Justice	Lifetime abuse or dependence Positive urinalysis test at intake	Methamphetamine use Heroin use Age of first drug use Family relationship status

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<p>Du, 2013 [32]</p>	<p>USA</p>	<p>California's Proposition 36 Mental Health Service for people who had offended</p>	<p>Prospective and retrospective Cohort</p>	<p><u>Exposure:</u> - ASI - Mental Health Records <u>Outcome:</u> - Administrative arrest data from the California Department of Justice</p>	<p>Addiction severity</p>	<p>Methamphetamine use Other AOD use Gender Race Marital Status Treatment modality Treatment retention Mental Illness (anxiety, depression, psychotic disorder)</p>
<p>Enns, 2017 [33]</p>	<p>Canada</p>	<p>Community drug using groups</p>	<p>Retrospective Cohort</p>	<p><u>Exposure:</u> - Structured survey incorporating CES-D scale (Radloff 1977) [34] <u>Outcome:</u> - Structured survey incorporating CES-D scale (Radloff 1977) [34] - Administrative data on crime incident costs derived from Vancouver Police Department operating budget</p>	<p>Daily or non-daily use in previous 6 months</p>	<p>Stimulant use (methamphetamine, powdered cocaine, crack-cocaine, polystimulant) Mode of use Frequency of use</p>
<p>Ericsson, 2014 [19]</p>	<p>Sweden</p>	<p>Swedish prisons and community corrections</p>	<p>Prospective Cohort</p>	<p><u>Exposure:</u> - ASI-X (Oberg 1999) [35] <u>Outcome:</u> - Administrative mortality data from the Swedish National Causes of Death Register</p>	<p>Days of use in previous 30 days</p>	<p>Days of opioid, sedative, cocaine, amphetamine, and cannabis use History of injecting Hepatitis C Prior psychiatric medication use Previous suicide attempt Previous suicidal ideation Previous cognitive symptoms Age at intake</p>

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Håkansson, 2012 [36]	Sweden	Swedish prisons and community corrections	Prospective cohort	<p><u>Exposure:</u></p> <ul style="list-style-type: none"> - ASI <p><u>Outcome:</u></p> <ul style="list-style-type: none"> - Administrative justice data from the Swedish Criminal Justice Registry 	<p>Lifetime history of Injecting use for greater than 6-month period</p> <p>Lifetime history of non-Injecting use for greater than 6-month period</p>	<p>Age</p> <p>Gender</p> <p>Homelessness in last 30 days</p> <p>Lifetime history of psychiatric problems</p> <p>Lifetime history of substance use</p> <p>Number of substance types used in last 30 days</p> <p>Duration of index sentence</p> <p>Main crime in index verdict</p>
Håkansson, 2013 [37]	Sweden	Swedish prisons	Prospective cohort	<p><u>Exposure:</u></p> <ul style="list-style-type: none"> - ASI-X <p><u>Outcome:</u></p> <ul style="list-style-type: none"> - Administrative mortality data from the Swedish National Causes of Death Register 	<p>Lifetime history of use for greater than 6-month period</p>	<p>Socio-demographic factors (age, gender, housing status pre-incarceration, country of Birth)</p> <p>Psychiatric symptoms during 30 days pre-incarceration or lifetime</p> <p>Psychiatric hospitalisation</p> <p>Previous drug overdose</p> <p>Substance types used and substance use history</p> <p>Crime type</p>
Rognli, 2014 [38]	Sweden	Swedish prisons	Prospective cohort	<p><u>Exposure:</u></p> <ul style="list-style-type: none"> - European version of the ASI <p><u>Outcome:</u></p> <ul style="list-style-type: none"> - Administrative health data from the Swedish National Patient Register 	<p>Age of first use</p> <p>Years of use</p> <p>Days of use in previous month</p> <p>Injection the main route of administration</p>	<p>Socio-demographic factors (genders, age, education, employment, homelessness, country of birth)</p> <p>Methamphetamine use history and patterns of use</p> <p>Psychiatric history</p> <p>Family psychiatric history and substance use</p> <p>Sexual and physical abuse</p>

Rognli, 2015 [39]	Sweden	Swedish prisons and community corrections	Prospective cohort	<u>Exposure:</u> - ASI-X <u>Outcome:</u> - Administrative health data from the Swedish National Patient Register	Self-reported amphetamine use as main drug problem at baseline interview	Socio-demographic factors (age, education, pre-incarceration homelessness, country of birth) Substance type Previous psychiatric hospitalisation Non drug-related hallucinations Relative with psychiatric or substance use problems Sexual or physical abuse
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AOD, alcohol and other drugs, ASI, Addiction Severity Index; ASI-X, Addiction Severity Index (adapted); CES-D, Centre for Epidemiologic Studies Depression Scale.

Table 3. Study results

Author, date [ref]	Population/sample and observation period	Mean age \pm SD	% female	Outcome variables	Significant relationships between study factors and outcomes
Cartier, 2008 [29]	812 prisoners; study period not provided	34.1	25	HIV risk behaviours (unprotected sex and injecting using unclean needles)	Methamphetamine use and risky sex Methamphetamine use and risky injecting Risky sex and risky injecting Age and unprotected sex
Chiang, 2006 [31]	794 prisoners; 1999-2004	28.4 \pm 7.7	0	Recidivism Recidivism for drug crimes	Significantly greater odds of recidivism for participants with positive urinalysis test for methamphetamine at intake compared to those testing negative Heroin users had significantly higher rates of recidivism than meth users Heroin users had a shorter survival time to recidivism than meth users
Du, 2013 [32]	1444 adults with criminal convictions who received AOD services under a Proposition 36 program	36.1 \pm 10.0	43	Recidivism at 12 months follow-up	Younger age predicted recidivism Recidivism was more likely for female cocaine compared to methamphetamine users Screening for drug problems on the ASI predicted recidivism Residential treatment was protective against recidivism compared to methadone therapy Number of prior arrests predicted recidivism Number of prior AOD treatment episodes protected against recidivism

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<p>Enns, 2017 [33]</p>	<p>1599 participants (youth and adult); September 2005 - May 2015</p>	<p>Median=39, IQR: 26, 46</p>	<p>34</p>	<p>Monthly crime cost \$\$</p>	<p>Injection methamphetamine use associated with higher costs than non-injection use Daily crack use associated with higher crime costs than no use Both daily and non-daily methamphetamine use associated with higher crime costs than no use Both daily and non-daily polystimulant use associated with higher crime costs than no use Any powdered cocaine use associated with higher crime costs than no use</p>
<p>Ericsson, 2014 [19]</p>	<p>1396 justice-involved adults reporting amphetamine as primary drug and amphetamine use in last 30 days prior to incarceration</p>	<p>37.4 ±</p>	<p>15</p>	<p>Death</p>	<p>Days of sedative use positively predicted death Days of amphetamine use was protective against death</p>
<p>Håkansson, 2012 [36]</p>	<p>4152 justice-involved adults; 2001-2006</p>	<p>33.2 ± 9.9</p>	<p>11</p>	<p>Return to criminal justice system (recidivism)</p>	<p>Multiple variables associated with recidivism: - Male gender - Homelessness in last 30 days - Hospitalisation for psychiatric problem - Difficulty controlling violent behaviour - Injection and non-injection use of heroin - Injection and non-injection use of meth - Injection and non-injection use of both meth and heroin concurrently - Injection use of drugs other than methamphetamine and heroin - Higher number of substance types used on last 30 days Multiple variables protective against recidivism: - Binge drinking - Opioid use other than heroin or methadone - Use of hallucinogenic drugs - Lower duration of index sentence</p>

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<p>Håkansson, 2013 [37]</p>	<p>4081 adult prisoners reporting a substance use problem; 2001-2006</p>	<p>33.4</p>	<p>10</p>	<p>Death</p>	<p>Death positively associated with: - Older age - Heroin use - Drug overdose Negatively associated with: - history of depressive symptoms No association between amphetamine use and death</p>
<p>Rognli, 2014 [38]</p>	<p>1709 adult prisoners reporting primary methamphetamine use; 2001-2010</p>	<p>Median=37, IQR: 30, 44</p>	<p>15</p>	<p>Future hospitalisation for: Primary psychosis Substance-induced psychosis</p>	<p>Multiple factors associated with future hospitalisation for primary psychosis: - Being born outside of a Nordic country - Previous psychiatric hospitalisation - Experienced hallucinations unrelated to drug use Being homeless in the past month was associated with future hospitalisation due to substance-induced psychosis More years completed at school was protective against future hospitalisation due to substance-induced psychosis Age of onset of amphetamine use not associated with future hospitalisation due to psychosis Number of years of amphetamine use not associated with future hospitalisation due to psychosis Amphetamine use in past month not associated with future hospitalisation due to psychosis</p>

Rognli, 2015 [39]	6217 adults either in prison or under community supervision - 1074 reporting no substance use problems - 5143 reporting a substance use problem; 2001-2006	Medians (IQR) for each substance category: No problem: 28 (23-38.5) Alcohol: 36 (26-46) Cannabis: 24 (21-31) Amphetamine: 37 (30-44) Heroin: 31 (26-37) Poly-drug: 30 (24-39)	12	Future hospitalisation for: Primary psychosis Substance-induced psychosis	Substance-induced psychosis associated with: - Homeless in month before incarceration - Alcohol, cannabis, amphetamine, heroin, poly-drug use - Previous psychiatric hospitalisation - Non drug-related hallucinations Primary psychosis associated with: - age (negative) - cannabis - Previous psychiatric hospitalisation - Non drug-related hallucinations
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AOD, alcohol and other drugs; ASI, Addiction Severity Index; IQR, interquartile range



PRISMA 2009 Flow Diagram

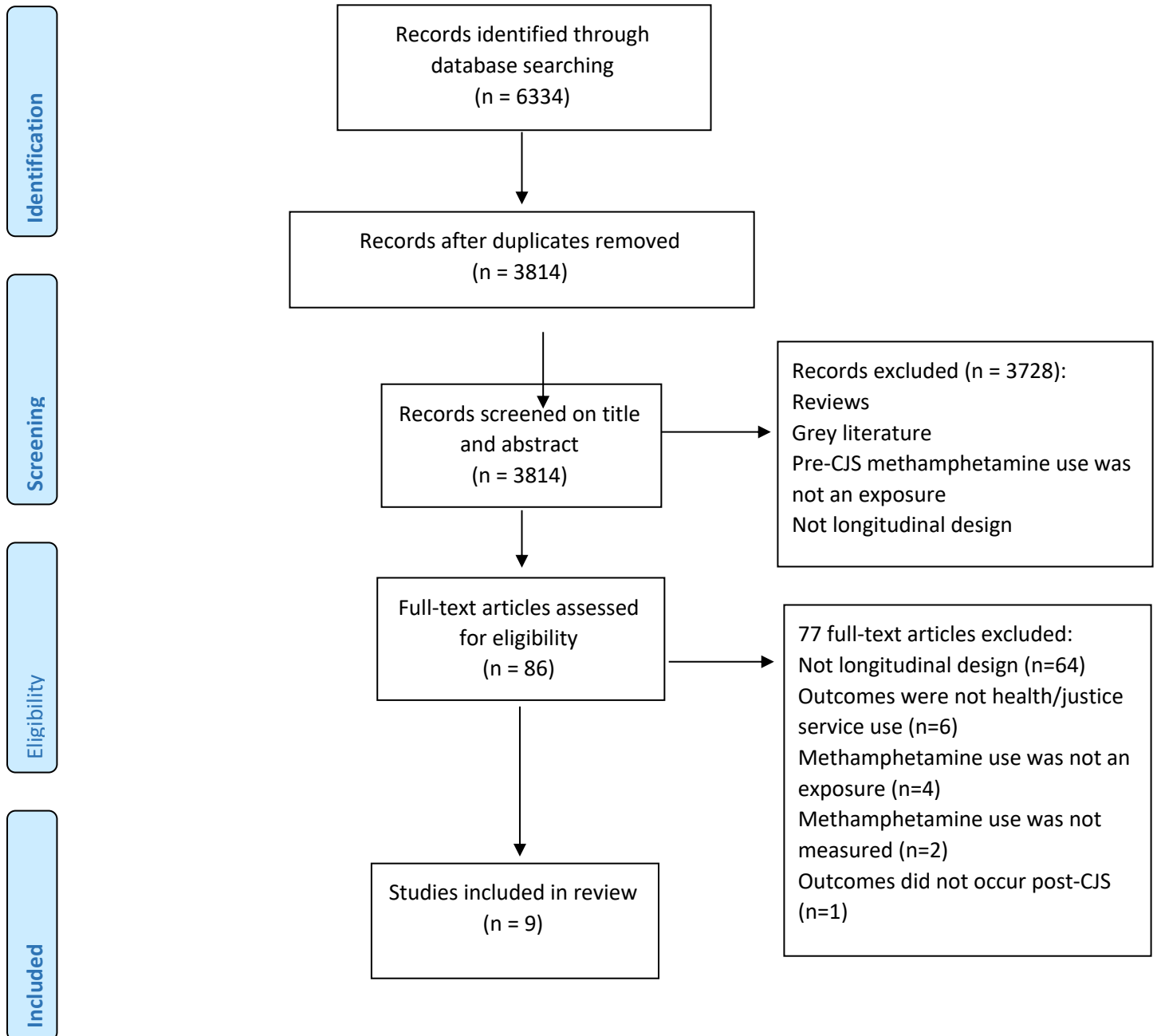


Figure 1. PRISMA flow diagram of study selection process. CJS, criminal justice system.