UNODC
United Nations Office on Drugs and Crime

Systematic Literature Review

Risk and Transmission of HIV, HCV & HBV Among Stimulant Drugs Users: Review of the Evidence (A)

Part 1/5

Methodology and Summary

The literature review was conducted by UNODC consultant Dr Anna V. Williams (King's College London, Addictions Department), under the supervision of Fabienne Hariga, UNODC HIV Senior adviser. Riku Lehtovuori, UNODC HIV Monitoring & Evaluation Adviser provided comments on the different drafts.

This report is part of a series of five documents:

A. Stimulant use: HIV risk and transmission

1. Systematic Literature Review on HIV and Stimulant use: Methodology and summary of the findings.
2. Systematic Literature Review on HIV and Stimulant use: ATS and HIV Risk and Transmission
3. Systematic Literature Review on HIV and Stimulant use: Cocaine use and HIV Risk and Transmission
4. Systematic Literature Review on HIV and Stimulant use: NPS and HIV Risk and Transmission

B. Prevention of HIV, HCV & HBV and treatment

5. Systematic Literature Review on HIV and Stimulant use: Treatment and Prevention of HIV, HCV & HBV and treatment

Recommended citation

United Nations Office on Drugs and Crime. Risk and Transmission of HIV, HCV & HBV among stimulant drugs users. A review of the evidence (A). Part 1/5. Methodology and Summary. UNODC; Vienna 2017.

Contents

List of Abbreviations

MA- Methamphetamine

IV- intravenous

IDU- Injecting drug users

NIDU- non-injection drug users

CS- cross-sectional

SR- systematic literature review

CC- case-control

Long- longitudinal cohort study

CI- Confidence Intervals

Background

While the focus in HIV prevention among people who use drugs has concentrated on injection of opiate users, reports indicate that there are also HIV-related risks attached to other forms of drug use and to injection of other drugs including stimulant: cocaine and ATS. In particular, there seems to be a nexus between stimulant drugs and HIV transmission. The use of crack cocaine has been associated with sexual transmission of HIV, including in Brazil and the Caribbean, often mediated through sex work or other forms of transactional sex. Also, there have been reports of amphetamine type stimulants and its association with HIV, particularly in South-East Asia. Injection of ATS, new psychoactive substances (NPS) and cocaine has been reported a possible main contributor to HIV incidence among people who inject drugs in some regions such as in Eastern Europe

Areas of particular concern:

- Recent HIV increase in Eastern Europe possible link with stimulant use
- Use of crack-cocaine in Latin America and possible link with HIV prevalence
- ATS and NPS increase use in SE Asia and possible link with HIV prevalence (UNODC report, 2013).

Identify specific groups at risk:

- Environmental factors: geographic distribution
- Individual factors: gender, age, health
- Behavioural factors: exchange of sex for drugs or money, MSM

In addition, in its June 2009 session, the UNAIDS Programme Coordinating Board (PCB) called upon "Member States, civil society organizations and UNAIDS to increase attention on certain groups of non-injecting drug users, especially those who use crack cocaine and amphetamine type stimulants, who have been found to have increased risk of contracting HIV through high-risk sexual practices…''. The UNAIDS Fast Track strategy for 2020 and 2030 http://www.unaids.org/en/resources/documents/2014/JC2686_WAD2014 report requires a most focused response including for people who use drugs.

This review will support the future development of Technical Guidelines for HIV prevention, treatment and care among people who use: (1) crack and cocaine and (2) other stimulant drugs, particularly ATS and NPS both injecting and non-injecting use.

The objective of this review is to carry out a review of published and grey literature on the evidence of injecting and non-injecting stimulant use (particularly crack, cocaine and ATS) and their possible link to HIV, HCV & HBV vulnerability and transmission. To identify:

- The extent of HIV, HCV and HBC infection among stimulant users
- Specific subgroups of stimulant users at greater risk of HIV, HCV and HBV infection
- Temporal and geographical patterns of HIV, HCV and HBV infection among stimulant users

Method

Eligibility Criteria

Including Criteria

The primary criterion of the search was 'stimulant use' and 'HIV, HCV & HBV risk and transmission'. The eligibility criteria is detailed below:

Population	- Well-defined group of injecting or non-injecting stimulant users (use within the last 12 months). Outcomes should be separately specified for stimulants users (cocaine, crack-cocaine, amphetamine-type substances or new psychoactive substances).
Outcomes	- Prevalence, incidence and hazard rates of HIV, HCV and HBV status. - Sexual risk behaviour: number of sexual partners, condom use, safe sex, men who have sex with men and providing sex in exchange for money or drugs, UIA. - Drug use and unsafe injecting practices.
Comparison	- Other drugs of abuse.
Study Design	- Primary research data from prospective cohort studies, cross-sectional surveys, case-control studies and meta-analysis. Intervention studies including randomised controlled trials, clinical trials, pre and post intervention studies and meta-analysis - Observation: case reports, qualitative studies and small observational studies may be considered if new psychoactive substances (NPS) are being investigated.

Excluding Criteria

General reviews, commentaries, letters, editorials, books and book chapters were excluded. Animal studies and studies focused on genetics, drug pharmacology, drug interactions, genotype comparisons, brain and cognitive functions were beyond of the scope of this review. Studies were also be excluded if the drug of abuse (injected or not) is not specified, if the sample is formed primarily by opioid users or users' of drugs other than stimulants. Studies were also be excluded if the sample size is less than 30 (with exception of studies looking at NPS).

Search Methods

Electronic Searches

Searches focused on peer-reviewed journals, other scientific publications (e.g. scientific monographs). MEDLINE, EMBASE, PsycInfo, Global Health, HMIC Health Management Information Consortium, the Cochrane Data Base, CINAHL, Scopus were searched from 2004 up to April 2015. Details of the search strategies with results are listed in appendix. All searches included non-English language literature.

The searches were conducted using Medical Subject Headings (MeSH terms) and also free-text terms. The main terms used in the searches were the following: stimulant, crack-cocaine, amphetamine, ecstasy, crystal methamphetamine, new psychoactive substances, methylphenidate, non-injecting drug users, injecting drug users, smokers, human immunodeficiency virus, HIV viral hepatitis, hepatitis C, HCV, hepatitis B, HBV, sexually transmitted diseases, transmission, risk behaviour, condom use, multiple sexual partners, providing sex in exchange for money or drugs, men who have sex with men, sex workers, SW, Homosexuality (Male), sexual behaviour, needle sharing. The full list of index terms used (including synonyms, broad and specific terms) is available in appendix.

Grey Literature Search

Reference lists of articles, reviews and conference abstracts were also searched. Reference lists of all selected articles were scrutinised for further references.

Consultation with Experts and Users Groups

Experts (lead authors of important studies) were contacted and asked about their knowledge of other studies, published or unpublished, relevant to this review. Contacts from the global UNODC were also asked to contribute.

Data Extraction and Analysis

Study selection

Studies retrieved were assessed for inclusion on the basis of the title and abstract. Those clearly not related to the primary criteria (HIV, HCV, HBV among stimulant users) were excluded. The remaining studies were assessed in more detail against the inclusion and exclusion criteria for the review. Full-text articles were assessed for the studies meeting eligibility criteria.

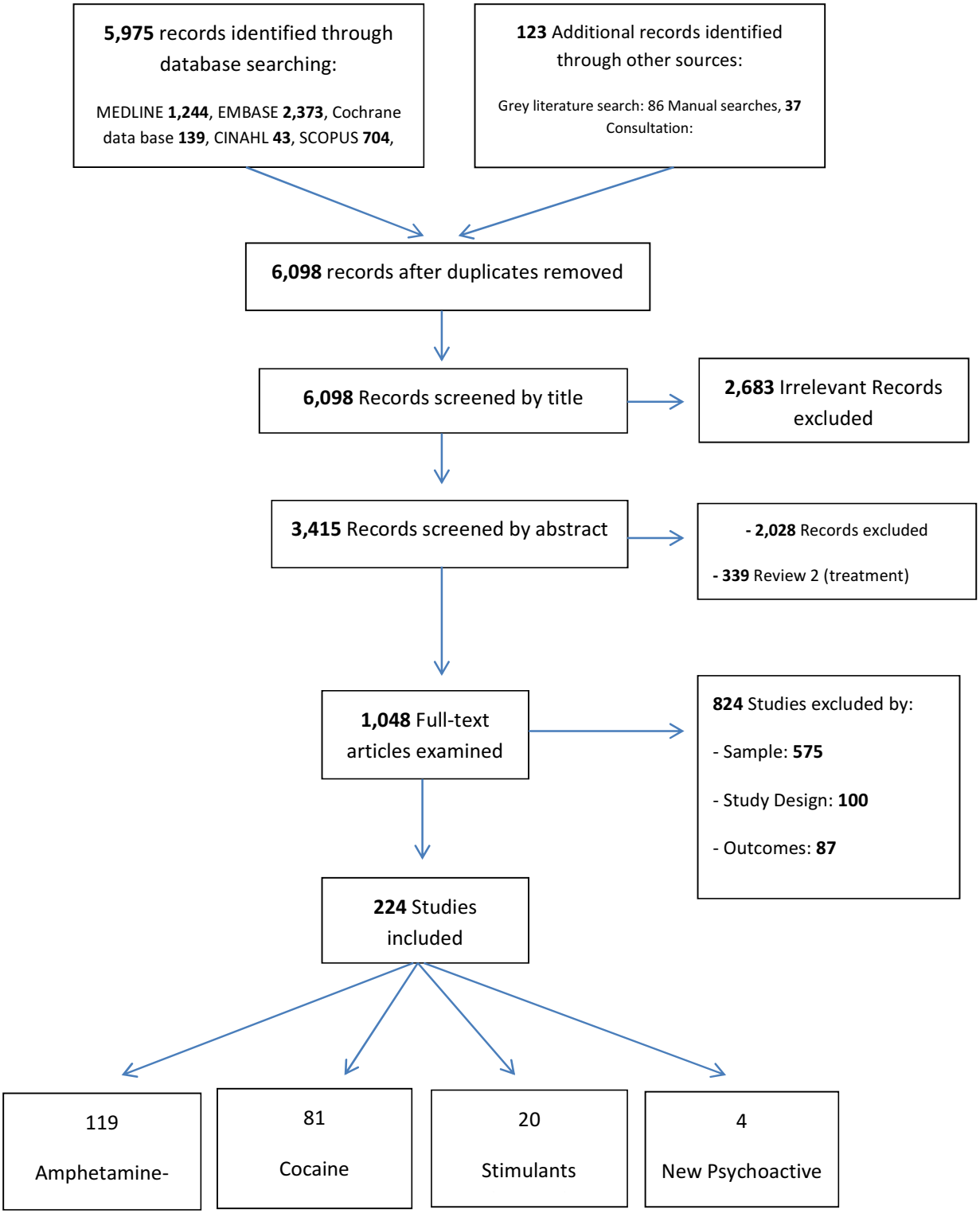
Data Extraction and Management

Data was extracted in a standardised format for the studies that satisfy inclusion criteria. Data was extracted by author, year, location, study design, sample size, population, mean/median age, gender, age, gender, drug use, route of administration, HIV prevalence/incidence/hazard ratios and key findings.

Quality Assessment

The article quality was assessed using quality assessment criteria adapted for cross-sectional studies from Boyle (REF) and for case-control and longitudinal studies from Wells et al. (REF) (the checklist is provided in Supplementary 1). According to these quality criteria, a score of 1 was assigned for each of the items included and articles were assigned a summative score on a scale of 0 to 9 for cross-sectional studies, 0 to10 for case-control studies and 0 to11 for longitudinal studies.

Results

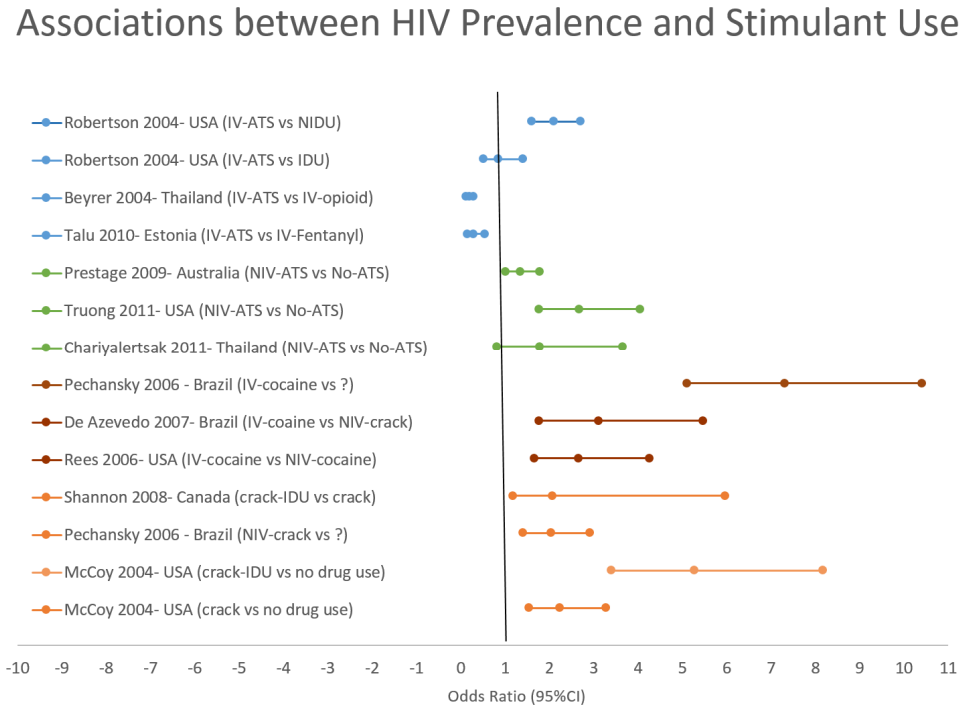

5,975 records identified through database searching:
MEDLINE **1,244**, EMBASE **2,373**, Cochrane data base **139**, CINAHL **43**, SCOPUS **704**,
123 Additional records identified through other sources:
Grey literature search: 86 Manual searches, **37** Consultation:
6,098 records after duplicates removed
6,098 Records screened by title
2,683 Irrelevant Records excluded
3,415 Records screened by abstract
- **2,028** Records excluded
- **339** Review 2 (treatment)
1,048 Full-text articles examined
824 Studies excluded by:
- Sample: **575**
- Study Design: **100**
- Outcomes: **87**
224 Studies included
119
Amphetamine-
81
Cocaine
20
Stimulants
4
New Psychoactive

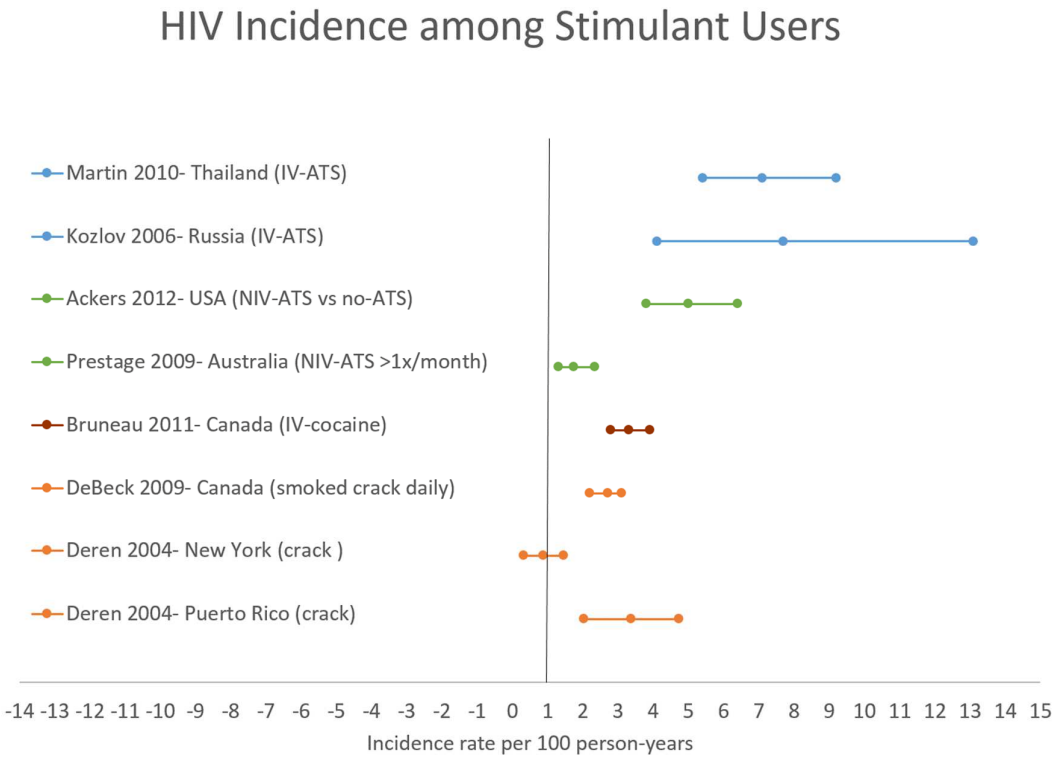
Summary of findings part A

- *It is difficult to quantify the exact role of stimulant use in increasing HIV infection*
- *Evidence seems to point towards a positive association between these two factors*
- *There is great variability on the outcomes possibly due to local epidemiology and studies' differences*
- *Groups at risk: Injecting and non-injecting stimulant users MSM and SW*
- *Stimulant injectors seem to be at particular great risk of HIV-infection (when compared to non-IDU) and seem to engage in more injecting risk behaviours than other IDUS*
- *Sex risk behaviour is also prevalent and significantly associated with stimulant use (ATS and crack)*
- *Mediator factors should be taken into count: impulsivity, social support access to clean needles*
- *There might be structural, social, interpersonal and personal factors linking HIV and stimulant use*
- *Gap in the literature: scarce of longitudinal cohort studies, lack of focus on minorities, controlling for polydrug use, self-reported data, few studies from LMIC*

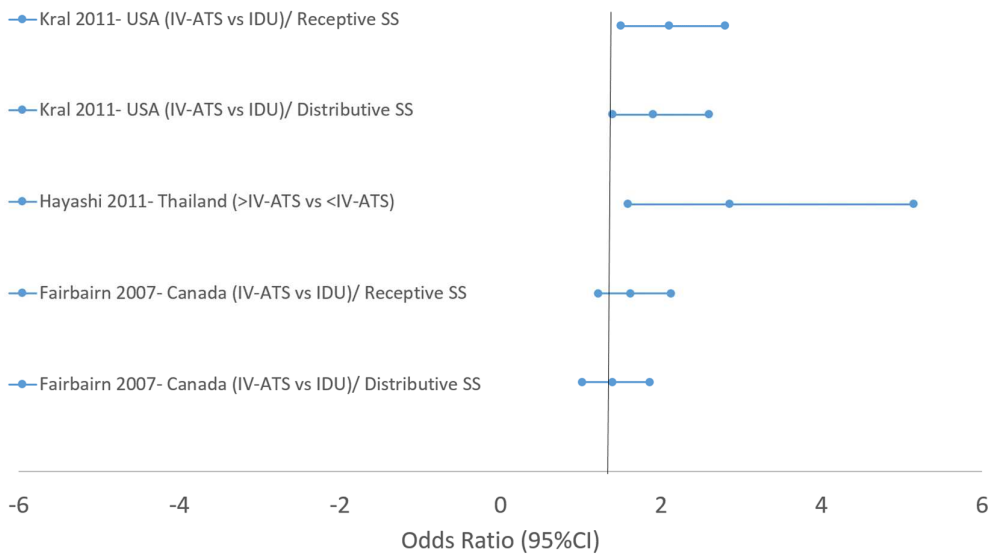
Annexes

Annex 1 Figures

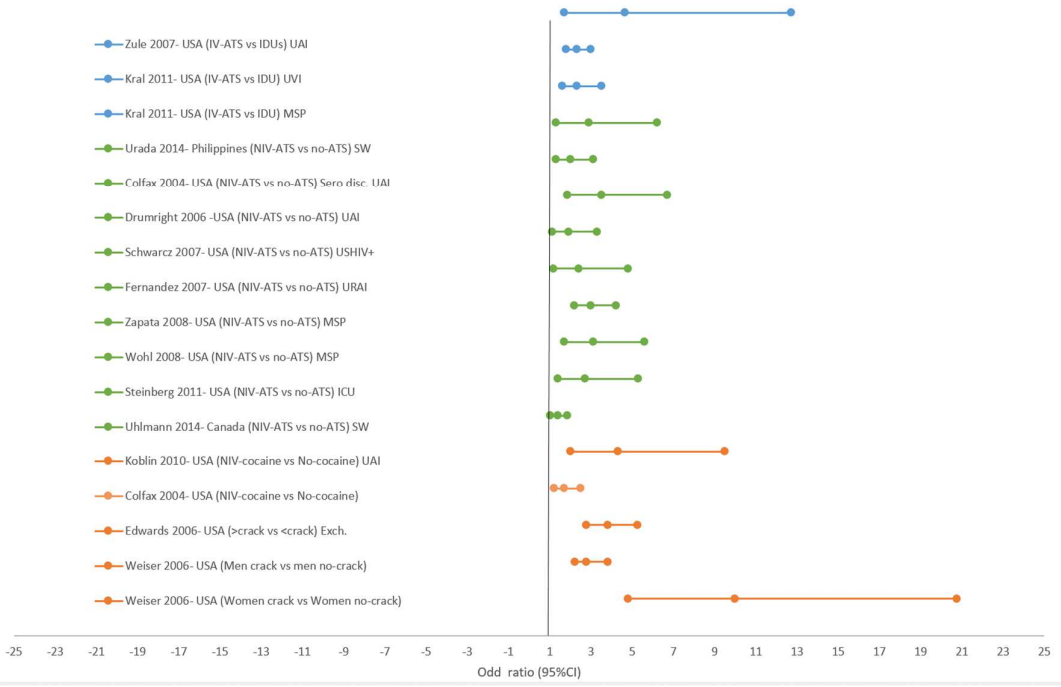




Association Between Injecting Risk Behaviour and Injected ATS



Sexual Risk Behaviour among Stimulant Users



Annex 2: Tables of references

Injected cocaine:

*Injected cocaine associated with **HIV prevalence**, ORs, 95% CI, and comparison group*

Study	Effect Size/Association
Pechansky 2006 (Brazil)	Injection of cocaine (7.30, 95% CI 5.10–10.40) and crack use (2.03, 95% CI 1.40–2.92) associated with HIV prevalence. **Unclear what is the comparison group.**
De Azevedo 2007 (Brazil)	Those who injected cocaine had RR 3.11 of being HIV positive compared **to crack use**rs (95% CI 1.77-5.47)
Rees 2006 (USA, Harlem)	Injecting cocaine more likely to be HIV positive compared to **non-injection of cocaine or crack cocaine** (2.66, 95% CI 1.66-4.26)
Hagan 2011 (USA, NY)	HIV infection was independently associated with crack use (13.2, 95% CI = 2.7–64.5) compared to **no-crack-cocaine use among IDUS**.
Shannon 2008 (Canada)	Females reporting crack smokers IDU (dual users) reported higher HIV prevalence compared to **smokers only** (aOR = 2.07, 95% CI: 1.18–5.96).

*Injected cocaine associated with **HIV incidence**, RRs, 95% CI, and comparison group*

Study	Effect Size/Association
Bruneau 2011 (Canada)	Intravenous cocaine use independently statistically significantly associated with an increased risk of HIV seroconversion in 3 multivariate analyses (main sample PWID).

*Injected cocaine associated with **injecting risk behaviours**, ORs, 95% CIs, and comparison group*

Study	Effect Size/Association
Buchanan 2006 (USA)	Injecting crack users reported higher rates of risky drug behaviour compared to non-crack injectors

*Injected cocaine associated with **sexual risk behaviours**, ORs, 95% CIs, and comparison group*

Study	Effect Size/Association
De Carvalho 2009 (Brazil)	Crack cocaine users reporting injection were less likely to report frequent sexual intercourse compared to NIDU crack cocaine users.

Buchanan 2006 (USA)	Female crack cocaine injectors reported higher rates of sexual behaviour compared to female non-crack cocaine injectors (sexual behaviour not defined)

Regular sniffing cocaine:

*Sniffing cocaine associated with **sexual risk behaviours**, ORs, 95% CIs, and comparison group*

Study	Effect Size/Association
Diehl 2014 (Brazil)	Those who reported sniffing/snorting cocaine were more likely (OR 1.66) to report high risk sexual behaviours when compared to crack cocaine users who did not report NIDU cocaine use.
Koblin 2010 (USA)	UAI with casual partners (4.3, 95%CI 2.0, 9.5) and with exchange partners (5.7, 95%CI 2.4, 13.8) was associated with frequent cocaine use compared to never using cocaine.
Colfax 2004(USA)	Sniffed cocaine (1.7, 95% CI 1.2, 2.5, P= 0.004) use in the prior 6 months, were independently associated with serodiscordant unprotected anal sex, compared to no use.

Smoking crack cocaine:

*Smoking crack associated with **HIV prevalence**, ORs, 95% CI, and comparison group*

Study	Effect Size/Association
Compared to not smoking crack	
Pechansky 2006 (Brazil)	Smoking of crack cocaine highly associated with HIV prevalence compared to those **not smoking crack cocaine** (no effect size given)
Reid 2006 (Tobago)	HIV prevalence was higher among use of crack cocaine sample compared to **non-crack cocaine users** ($p<0.05$). But Use of crack cocaine was not a significant predictor of HIV serostatus when other risk factors were considered.
Dias 2011 (Brazil)	Positive HIV test upon admission ($p=0.046$) were associated with long term use of crack cocaine, **compared to no-crack use or alternated crack-use.**
Compared to non-drug users	
Day 2007 (St. Lucia)	HIV prevalence was 7.5% among sample of NIDU crack users compared to 0% in control group (non-drug users)
McCoy 2004 (USA, FL)	IDU Crack-cocaine smokers (dual users) [OR 5.27 (95%CI 3.40, 8.17)] and crack smokers [OR 2.24 (95%CI 1.54, 3.27)]

	were more likely to be HIV positive when compared to **non–drug-user controls.**
Harawa 2004 (USA)	Among MSM, HIV was associated with sex while on crack cocaine (AOR 3.3, 95%CI 1.1, 9.8) **compared to never used**

*Smoking crack associated with **HIV incidence**, RRs, 95% CI, and comparison group*

Study	Effect Size/Association
Day 2007 (Caribean)	Of the 106 crack cocaine users from Saint Lucia tested, 7.5% were HIV-infected compared to none in a control group of **non-crack users.**
Deren 2004 (USA)	Crack use was significantly related to seroconversion in the New York sample (P < 0.01), compared to **no crack-use.**
DeBeck 2009 (Canada)	IDU Daily crack smokers were more likely to become HIV positive over time (all participants were injecting drug users): HR 1.03, 95% CI 0.57–1.85 (period 1); HR 1.68, 95% CI 1.01–2.80 (period 2); HR 2.74, 95% CI 1.06–7.11 (period 3), **compared to IDU who did not smoke crack**

Smoking crack associated with sexual risk behaviours, ORs, 95% CIs, and comparison group

Study	Effect Size/Association
Compared to no drug use	
Day 2007 (St. Lucia)	NIDU female crack users more likely to report having unprotected sex (p=0.045) and exchanging sex for drugs or money (p=0.049) **compared to females who did not use drugs.** Males NIDU crack users reported always having unprotected sex **compared male to non-drug users** (p=0.008)
Day 2007 (Caribean)	Crack-cocaine users were more likely to report always having unprotected sex than were **non-drug us**ers (30.8% vs. 12.0%, p=0.045). Female drug users compared to non-drug users were more likely to report exchanging sex for money or crack (76.5% vs. 25%, p=0.049). Males were more likely to report always having unprotected sex when compared to male non-drug users (31.5% vs. 5.3%, p=0.008).
Compared to injectors	

De Azevedo 2007 (Brazil)	**Compared to cocaine injec**tors, NIDU crack users more likely to report risky sexual behaviour
McCoy 2004 (USA, FL)	Women who were crack injector/smokers (dual users) users and those who smoked crack only reported exchanging sex for money/drugs significantly more frequent than women **who injected drugs but did not smoked crack and non–drug-user controls**. Dual users (men and women) were more likely than **the other drug user groups** and the control group to engage in high risk sexual practices.
Lejuez 2005 (USA)	Crack and cocaine use associated with sexual risk behaviour **compared to heroin use** (sexual risk assessed using 5-item sexual risk behaviour subscale of the HIV-risk-taking behaviour scale (HRBS-SRB; Darke et al., 1991))
Shannon 2008 (Canada)	Females reporting smoking crack and not injecting drugs reported lower levels of exchanging sex for money/drugs **compare to dual IDU/NIDU users.** Males reporting smoking crack and not injecting drugs reported lower levels of exchanging sex for money/drugs compare to dual IDU/NIDU users (but did not differ in terms of HIV prevalence). **Note that IDU drugs not specified in paper; only divided sample by injection/smoking crack vs crack smoking only/No IDU
Compared to those who do not exchange sex/drugs	
Risser 2006 (USA)	African American female crack cocaine users who currently traded sex for money more likely to smoke larger quantities of crack compared to **previous traders**.
Duff 2013 (Canada)	Exchanging sex for crack was significantly associated with having a greater number of clients per week (aIRR = 1.34; 95% CI: 1.07-1.69) compared to **not-exchanging sex for crack.**
Bastos 2014 (Brazil)	HIV prevalence was higher among those who exchange sex for crack/money (6.55%, IC95% 4.62-9.19) **than among those who did not** 2.89% (IC95% 1.95-4.25) p<0.0001
Compared to not smoking crack or smoking less	

Corsi 2006 (USA)	Smoking crack was associated to having sex without a condom during follow-up period **compared to non-smoking of crack cocaine**
Edwards 2006 (USA)	women who use crack heavily are more likely to trade sex than women who **do not use crack as heavily** (3.82, 95% CI 2.77–5.27)
Weiser 2006 (USA)	Crack cocaine use was associated with sex work for men and women compared to **non-crack cocaine users**: men (OR = 2.77; CI = 2.23–3.80), women (OR = 9.99; CI = 4.80–20.75).
Harzke 2009 (USA, Tx)	Recent crack-cocaine bingers had more sex partners in the last six months, were more likely to have never used a condom in the last 30 days, and were more likely to report lifetime trading of sex for drugs, compared to **crack-cocaine users who did not report recent crack binge.**
Tobin 2011 (USA)	Among MSM African American, crack use was independently associated bisexual identity and networks with a greater number of exchange partners, overlap of drug and sex partners, and less condom use, **compared to non-crack use**.

Injected ATS/methamphetamine

*Injected ATS/methamphetamine associated with **HIV prevalence**, ORs, 95% CI, and comparison group*

Study	Effect Size/Association
Compared with no-ATS use	
Peck 2005 (USA)	Those who reported injection of methamphetamine were more likely to be HIV infected (P=0.056), **compared to NIDU methamphetamine users**
Robertson 2004 (USA, CA)	Nearly a third of the sample ever injected ATS and 15.9% of those were HIV positive: OR 2.1 (95% CI: 1.6, 2.7), **compared to never injecting ATS.**
Wagner 2014 (USA, CA)	462 participants were tested for HIV: 12.9% of synthetic cathinones users were HIV-positive while 8.6% of **non-synthetic cathinones users** were HIV-positive (p= 0.34).
Compared to other IDUs	
Giese 2015 (Ireland)	IDU-Cathinone alpha-PVP associated with recent HIV infection compared to those **not injecting this drug/IDUS** (AOR 49.0, 95% CI 3.6–669, p= 0.003)

Kral 2005 (USA, CA)	MSM who inject amphetamines were more likely to be HIV positive compared to **non-IDU of amphetamines** (p=0.044)
Robertson 2004 (USA, CA)	Among MSM sample, ATS injectors more likely to be HIV positive compared to **non-ATS injectors** (OR = 1.6, 95% CI 1.1-2.4)
Marshall 2011a (Canada)	HIV prevalence among MA IV users of 10.8%, compared to 15.1% **non-MA IDUs** (non-significant difference)
Robertson 2004 (USA, CA)	ATS injectors less likely to be HIV positive compared to **non-ATS injectors** (ns) (OR = 0.85, 95% CI 0.51-1.4)
Beyrer 2004 (Thailand)	Methamphetamine injectors were less likely to be HIV infected compared to **non-methamphetamine injectors (non-MA users were all drug users however**).
Talu 2010 (Estonia)	HIV prevalence **among fentanyl inject**ors was 62% (95% CI: 56.97–67.03), which is significantly higher (at p<0.001 level) than the HIV prevalence among amphetamine users 27% (95% CI: 18.45–35.51)

Injected ATS/methamphetamine associated with **HIV incidence**, RRs, 95% CI, and comparison group

Study	Effect Size/Association
Compared to other IDUs	
Martin 2010 (Thailand)	Injecting methamphetamine independently associated (1.7 times more likely to be infected with HIV) with HIV incidence compared to non-methamphetamine injectors. HIV incidence was highest amongst participants injecting methamphetamine, 7.1 (95% CI, 5.4–9.2) per 100 person years, compared to non-methamphetamine injector IDUs. Injecting heroin and injecting methamphetamine were independently associated with HIV infection incident.
Kozlov 2006 (Russia)	Stimulant injection associated with higher HIV incidence compared to non-stimulant injectors: 7.7/100 person-years (95% CI: 4.1-13.1) compared to 2.6 (95% CI: 1-5.3). Incidence increased with increased frequency of weekly amphetamine injection (3 times per week: 20/100PY; 2 or less per week: 5.5/100PY, p=0.032)

*Injected ATS/methamphetamine associated with **injecting risk behaviours**, ORs, 95% CIs, and comparison group*

Study	Effect Size/Association
Compared to other IDUs	
Lorvick 2012 (USA- CA)	Female methamphetamine injectors more likely to report receptive syringe sharing and syringe sharing partner compared to female injectors who do not inject methamphetamine (so compared MA-IDU to non-MA-IDU females, all of whom are IDU) (P< 0.05).
Braine 2005 (USA)	Amphetamine IDU from NSP are more likely to report receptive and distributive sharing compared to non-amphetamine IDU from NSP (p < .01.).
Kral 2011 (USA)	Methamphetamine injectors were more likely to report receptive syringe sharing (AOR=2.1; 95% CI=1.5, 2.8), and distributive syringe sharing in past 30 days (AOR = 1.9; 95% CI = 1.4, 2.6), compared to non-methamphetamine injectors.
Marshall 2011a (Canada)	Injection of methamphetamine associated with syringe sharing (AOR = 2.60, P<0.001) and difficulty accessing sterile syringes (AOR = 2.19, P<0.001) compared to non-methamphetamine IDU
Compared to heroin injectors	
Tarjan 2015 (Hungary)	Those with ATS injection were more likely than heroin injectors to report sharing of injection equipment, higher frequency of injection and reuse of last syringe
Martin 2010 (Thailand)	Sharing needles was higher among methamphetamine injectors (33%) when compared to heroin injectors (21%).
Compared to intensity/severity of MA use	
Hayashi 2011 (Thailand)	More than weekly methamphetamine injection associated with syringe sharing (AOR = 2.86, 95%CI: 1.59–5.15) compared to weekly or less weekly methamphetamine injectors
Mehrjerdi 2014 (Iran)	Methamphetamine IDU with 3+ year history more likely to report sharing injection equipment compared to those with less than 3 years history of MA injection.
Compared to MA non injectors	
Semple 2004 (USA, CA)	MA-injectors reported more years of methamphetamine use (P < .05), greater frequency (p<.01) and amount of methamphetamine us (P < .001), compared to non -injection methamphetamine-using.

Fairbairn 2007 (Canada)	Methamphetamine injectors more likely to report syringe borrowing(AOR = 1.62, 95% CI 1.22 - 2.13) and syringe lending (AOR = 1.40, 95% CI 1.02 - 1.86) compared to MA NIDU
Uhlmann 2014 (Canada)	Injecting drug use reported high levels of Methamphetamine use (AOR = 3.40; 95% CI: 2.76 – 4.19) compared to non-injectors users.

Injected ATS/methamphetamine with sexual risk behaviours, ORs, 95% CIs, and comparison group

Study	Effect Size/Association
Compared to Non-injecting MA users	
Semple 2004 (USA- CA)	Male methamphetamine injectors reported twice as many sexual partners they traded sex for drugs with compared to **male methamphetamines who do not inject.**
Lorvick 2012 (USA- CA)	Female methamphetamine injectors more likely to report unprotected anal intercourse, multiple sex partners compared to **non-injecting methamphetamine females**.
Tavitian-Exley (Global)	Amphetamine IDU reported higher rates of risky sexual behaviour compared to those **not injecting amphetamines** (no effect size given)
Compared to other IDUs	
Zule 2007 (USA-NC)	Methamphetamine used by both sexual partners was associated with unprotected anal intercourse (OR = 4.63, 95% CI 1.69-12.70), unprotected sex with a new partner (OR = 5.20, 95% CI 2.09-12.93) compared to **non-methamphetamine IDUs**.
Kral 2011 (USA, CA)	Methamphetamine injectors were more likely to have unprotected vaginal intercourse (AOR = 2.3; 95% CI 1.8, 3.0), or multiple sex partners in last six months (AOR = 2.3; 95% CI 1.6, 3.5), **compared to non-methamphetamine IDUs**

Non-injected ATS/methamphetamine use:

Non-injected ATS/methamphetamine use associated with HIV prevalence, ORs, 95% CI, and comparison group

Study	Effect Size/Association
Compared to no drug/MA use	

Katchman 2013 (Israel)	Cathinone injection was associated with primary HIV infection compared to **non-use/non-injection of drugs** (50.7 vs 0%, p<0.01)
Prestage 2009 (Australia)	Among MSM, Methamphetamine (HR = 1.34, CI = 1.01–1.78, p= 0.041) independently associated with HIV seroconversion **compared to no-methamphetamine use**.
Truong 2011 (USA)	Among MSM, recent HIV infection associated with amphetamine use (NIDU) (AOR 2.67 p<0.01) **compared to non-amphetamine users**
Fisher 2011(USA)	Men who used both MA and sildenafil showed a significantly higher prevalence of HIV compared to those **who used only one or neither drug** (X2= 11.06, p= .0114). The MA-only group was also more likely to report being positive for HIV than those who **used neither drugs.**
Koblin 2007 (USA)	MSM who used amphetamines were significantly more likely to be HIV infected, **compared to those who did not use amphetamines**: 29.8% of men reporting amphetamine use were HIV positive compared to 16.6% who did not use amphetamines (p = 0.029).
Chariyalertsak 2011 (Thailand)	Among MSM/TG, HIV was marginally associated with ever using methamphetamine **compared to never using methamphetamine** (OR 1.78; 95% CI: 0.81-3.65, P=0.098).
Compared to HIV negative	
Halkitis 2008a (USA)	Among MSM, seropositive men were more likely to report methamphetamine use **than seronegative men** (32.4 vs 20.9%; p=0.02).
Drumright 2009 (USA)	HIV-infected MSM were more likely than **HIV-negative MSM** to report methamphetamine in the previous 12 months (1.98, 95%OR 1.01, 3.88, p= 0.05) and with their last three sexual partners (1.96, 95%OR 0.97, 3.96, p= 0.06).
Lyons 2013 (Australia)	Among MSM, AOR of HIV-positive men reporting methamphetamine use were 2.5 times (95%CI 1.47–4.27; P= 0.003) those of **HIV-negative men**. Reported methamphetamine use was considerably more prevalent among HIV-positive (24%) than HIV-negative men (11%).
Shannon 2011 (Canada)	Among street-based female SWs, HIV prevalence among SWs was 23%, with no statistically significant difference in likelihood of **crystal MA use by HIV status** (p=0.83)
Compared to heroin injectors	

Srirak 2005 (Thailand)	Female methamphetamine users (NIDU) had nearly 50% less HIV prevalence **compared to heroin injectors** (p<0.001)
Macdonald 2008 (UK)	Among MSM, no association between MA use HIV status was found between cases (HIV+) and **controls (HIV-)** (OR 1.30; 95%CI: 0.60-2.83).
Compared to no recent use or no prior treatment for MA and other comparisons	
Peck 2005 (USA)	HIV infection status was strongly associated with prior treatment for methamphetamine dependence **compared to those who reported no prior treatment** (4.3, 95% CI 1.9, 10.0, p=.0006)
Morineau 2011 (Indonesia)	Among MSM, HIV infection was associated with recent use of methamphetamine use compared **no recent of methamphetamine** use (OR = 2.69; 95% CI = 1.33–5.43).
Robertson 2014 (Mexico)	Among men, those who recently used methamphetamine were 6% more likely to have HIV/STIs (p<0.05**), compared to those with no recent use.**
Bao 2012 (China)	HIV infection was independent associated with increased frequency of sexual behaviour after using ATS (2.0, 95%CI 1.1 to 4.1) compared to no increased frequency of sexual behaviour after using ATS.

*Non-injected ATS/methamphetamine use associated with **HIV incidence**, RRs, 95% CI, and comparison group*

Study	Effect Size/Association
Compared to no-ATS drug users	
Prestage 2009 (Australia)	Among MSM, those who used MA once a month HIV incidence was 2.71 per 100 person-years; Hazard ratio (HR) 5.21 (1.85–14.65) compared to **those who used other drugs than crystal**.
Buchacz 2005 (USA)	HIV incidence among MSM amphetamine users was 6.3% per year (95% CI 1.9–10.6%), compared with 2.1% per year (95% CI 1.3–2.9%) among **MSM no-amphetamine users** (RR 3.0, 95% CI 1.4–6.5). Amphetamine use was associated with HIV seroconversion (AOR 2.4, 95% CI 0.9–6.3), compared to no amphetamine use.
Koblin 2006 (USA)	Among MSM, HIV hazard rate of amphetamine users was 1.96 (95%CI 1.44, 2.69). The HIV attribute risk of amphetamine use was 16.3%, **compare to no methamphetamine drug users.**

Plankey 2007 (USA)	Among MSM, methamphetamine users had a 1.46 (95%CI: 1.12 to 1.92) increased relative hazard of HIV seroconversion, **compared to no methamphetamine use.**
Ackers 2012 (USA)	Seroincidence rates among MSM who reported amphetamines use: IRR 5.0/100 py (95% CI 3.8, 6.4) and HR 2.9 (2.2–3.9). Amphetamine were significantly linked to higher risks of seroconversion (aHR=1.6; 95% CI 1.1, 2.1, p=0.007)**, compared to no amphetamine use.**
Compared to no drug users	
Rudy 2009 (USA)	Among MSM, newly recognized HIV status (OR: 3.02 95% CI: 2.30, 3.99) was associated with methamphetamine use **compared with nondrug users,** an association not found among other club drug users.
Prestage 2009 (Australia)	Among those who used MA more than once a month HIV incidence was 1.75 per 100 person-years; HR 3.50 (0.87–13.99) compared to those who used **no illicit drugs or oral erectile dysfunction medications.**

Non-injected ATS/methamphetamine use associated with sexual risk behaviours, ORs, 95% CIs, and comparison group

Study	Effect Size/Association
Compared to no-MA use	
Parry 2011 (South Africa)	Methamphetamine use associated with casual sex behaviours, earlier first sex experience, compared to non-methamphetamine users
Rawstorne 2007 (Australia)	Among MSM, compared to crystal non-users, crystal users reported having more sex partners, looking for sex in more types of venues, and being more likely to engage in unprotected anal intercourse with casual partners (UAIC) and in esoteric sex.
Urada 2014 (Philippines)	Sex work was independently associated with methamphetamine use (19% vs 4%; AOR2.9; 95% CI 1.3–6.2), compared to no MA use
Colfax 2004(USA)	Amphetamines use in the prior 6 months, were independently associated with serodiscordant unprotected anal sex, compared to no use of amphetamine in the prior 6 months (2.0, 95% CI 1.3, 3.1, P=0.0008).

Buchacz 2005 (USA)	Among MSM, compared with non-ATS -users, amphetamine users were more likely to report either unprotected anal sex in the past year or 10 or more sex partners in the past year.
CDC 2006 (USA)	Methamphetamine use (NIDU) was associated with higher rates of casual or anonymous sex partners, multiple partners, a partner that is an IDU, or receiving drugs or money for sex (all $p<0.01$), in comparison with people who never used MA.
Drumright 2006 (USA)	Among MSM, methamphetamine user reported more unprotected anal intercourse than non-MA users (3.52, 95%CI 1.86 to 6.69, P= 0.001).
Schwarcz 2007 (USA)	Among MSM, methamphetamine was independently predictive of high-transmission–risk sexual intercourse among the men who were HIV infected (OR 1.9; 95% CI=1.1, 3.3.), compared to no methamphetamine use.
Fernandez 2007 (USA)	Among MSM, crystal users were more likely to report unprotected receptive anal sex than non-ATS users (2.39, 95%CI 1.19, 4.80, $p\leq0.05$).
Vaudrey 2007(USA)	High-risk sex was more frequently reported among those who reported MA use during sex, compared to those who did not report methamphetamine during sex ($p<0.01$).
Cartier 2008 (USA)	Methamphetamine users more likely to engage in unprotected sex, unprotected sex with casual partners or while partner (any type of partner) was on drugs, at baseline and follow-up compared to non-MA users (longitudinal study results).
Zapata 2008 (USA)	Lifetime use of methamphetamine use associated with recent sexual intercourse (AOR 1.8, 95% CI 1.5-2.3) and multiple sex partners (AOR 3.0, 95% CI 2.2-4.2) (both $p<0.05$), compared to never using MA.
Wohl 2008 (USA)	Compared to MSM with no history of methamphetamine use, MSM methamphetamine users were more likely reported more than 10 sexual partners in the

	previous 12 months (OR = 3.1, 95% CI: 1.7, 5.6)
Carey 2009 (USA)	Among MSM, MA use was a proxy marker for persons engaged in high risk sexual activities.
Semple 2009 (USA)	Those who reported sexual risk behaviour and co-administration of methamphetamine in the past two months reported significantly more unprotected anal and oral sex and a greater number of casual, anonymous, and paid sex partners in this time frame compared to men who used methamphetamine alone.
Steinberg 2011 (USA)	Methamphetamine users reported increased inconsistent condom use compared to non-methamphetamine users (OR = 2.7, 95% CI 1.40, 5.30)
Shannon 2011a (Canada)	Among street-based female SWs, No significant associations between methamphetamine use and sexual risk patterns were found, compared to no-MA use.
Uhlmann 2014 (Canada)	Methamphetamine users reported higher levels of sex work involvement compared to non-methamphetamine users (AOR = 1.39; 95% CI: 1.03 – 1.86).
Muñoz 2010 (Mexico)	Having used methamphetamine at least once in one's lifetime (AdjOR = 0.68, 95% CI: 0.40–0.83) was independently negatively associated with consistent condom use, compared to never using MA.
Compared to heroin users	
Weiser 2006 (USA, CA)	Methamphetamine use associated with sex trade **compared to crack/heroin use** (among women)
Jia 2010 (China)	HIV infection by drug use mode mainly results from heroin users (R = .5). ATS (R =−.9) and other drug users (R =−.4) have a negative relationship with HIV infection by drug use mode. However, for HIV infection by sexual transmission mode, ATS (R = 5.5) and other drug users (R = .6) show a positive association, **compared to heroin users.**

Jia 2013 (China)	Higher levels of risky sexual behaviour among ATS users including increased sexual intercourse after taking drug, multiple sexual intercourse, casual sex partners, and never using condoms with steady and casual partners **compared to heroin users without ATS use**
Compared to HIV negatives	
Halkitis 2005a (USA)	Among MSM, HIV status was associated with the context of methamphetamine use at sex clubs [χ2(2)=25.17, P<.001] and sex (2)=35.95, P<.001], **compared to HIV negative MSM**.
Thiede 2009 (USA)	Methamphetamine during unprotected anal intercourse was significantly more prevalent among HIV-positive MSM (29.3%) compared with **HIV-negative MSM** (6.1), p=0.01. Prevalence MA use during UAI was 34.4% among HIV-positive MSM and 12.7% among HIV-negative MSM, p <.01
Bousman 2009 (USA)	METH+/HIV+ group had greater likelihood of unprotected sex (95% CI 2.3 ± 0.5 vs. 3.5 ±0.4; p < .005) than **METH-/HIV+ group**. They also had higher number of partners than **METH–/HIV- group** (ĝ =.42).
Halkitis 2005b (USA)	MSM MA users, reported equivalent rates of unprotected anal insertive and receptive intercourse when comparing their sexual acts while under the effects of methamphetamine, of other drugs and sober. Significant more frequent risky sexual behaviours among HIV positive men when **compared to HIV negative** men were found: anal insertive [t(40)=2.05, p < 0.05], anal receptive [t(30)=2.42, p < 0.02], and oral receptive intercourse [t(29)=2.80, p < 0.01].
Intensity of MA use and other comparisons	
Semple 2006a (USA)	Among HIV-positive meth-using MSM, the intensity of methamphetamine use and sexual risk behaviour were significantly correlated (r = .16, p <.01).

Semple 2006c (USA)	Among HIV-positive MSM, higher scores on sexual compulsivity were associated with methamphetamine use before or during sex r(216)=.30, p<.01.
Semple 2006b (USA)	HIV-positive meth-using MSM engaged in significantly fewer acts of anal sex with serodiscordant partners (9.3, SD 14.0) as compared to seroconcordant partners (12.7, SD 20.0) (t= 1.9 , p <.05).

Mediation Analysis: where stimulant use leads to risk behaviour and/or larger number of higher risk partners which then leads to HIV infection.

Study	Results
Semple 2005 (USA)	Negative self-perceptions predicted intensity of methamphetamine use and depressive symptoms
Lejuez 2005 (USA)	Among inner-city crack/cocaine users and heroin users: Impulsivity was assessed as a mediator of drug choice and sexual risk behaviour: A significant effect of impulsivity was observed, F(1, 106) = 5.54, P = 0.020, ES =0.05.
Edwards 2006 (USA)	Among African American women who use crack cocaine: childhood abuse is associated with trading sex and this relationship is, in part, mediated by psychological distress.
Semple 2006a (USA)	A plot of the interaction revealed that the relationship between intensity of methamphetamine use and total unprotected sex was strongest among participants who had higher levels of impulsivity.
Nakamura 2011 (USA)	The relation between methamphetamine frequency and unprotected sex was significant for individuals who had more negative attitudes toward condoms
Buttram 2013 (USA)	Mediation analyses showed that BMSM's higher rates of substance dependence and buying sex are partially mediated by lower levels of social support
Marshall 2011a (Canada)	Difficulty accessing sterile syringes partially mediated the association between injecting MA and syringe sharing.
Levesque 2013 (Canada)	Psychological distress increased needle sharing among cocaine users (Adjusted Odds Ratio (AOR): 2.1, 95% CI: 1.1-3.8).