Risk factors for methamphetamine use in youth: a systematic review
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Abstract

Background: Methamphetamine (MA) is a potent stimulant that is readily available. Its effects are similar to cocaine, but the drug has a profile associated with increased acute and chronic toxicities. The objective of this systematic review was to identify and synthesize literature on risk factors that are associated with MA use among youth.

More than 40 electronic databases, websites, and key journals/meeting abstracts were searched. We included studies that compared children and adolescents (≤ 18 years) who used MA to those who did not. One reviewer extracted the data and a second checked for completeness and accuracy. For discrete risk factors, odds ratios (OR) were calculated and when appropriate, a pooled OR with 95% confidence intervals (95% CI) was calculated. For continuous risk factors, mean difference and 95% CI were calculated and when appropriate, a weighted mean difference (WMD) and 95% CI was calculated. Results were presented separately by comparison group: low-risk (no previous drug abuse) and high-risk children (reported previous drug abuse or were recruited from a juvenile detention center).

Results: Twelve studies were included. Among low-risk youth, factors associated with MA use were: history of heroin/opiate use (OR = 29.3; 95% CI: 9.8–87.8), family history of drug use (OR = 4.7; 95% CI: 2.8–7.9), risky sexual behavior (OR = 2.79; 95% CI: 2.25, 3.46) and some psychiatric disorders. History of alcohol use and smoking were also significantly associated with MA use. Among high-risk youth, factors associated with MA use were: family history of crime (OR = 2.0; 95% CI: 1.2–3.3), family history of drug use (OR = 4.7; 95% CI: 2.8–7.9), family history of alcohol abuse (OR = 3.2; 95% CI: 1.8–5.6), and psychiatric treatment (OR = 6.8; 95% CI: 3.6–12.9). Female sex was also significantly associated with MA use.

Conclusion: Among low-risk youth, a history of engaging in a variety of risky behaviors was significantly associated with MA use. A history of a psychiatric disorder was a risk factor for MA for both low- and high-risk youth. Family environment was also associated with MA use. Many of the included studies were cross-sectional making it difficult to assess causation. Future research should utilize prospective study designs so that temporal relationships between risk factors and MA use can be established.
Background

Methamphetamine (MA), also known as crystal meth, is a synthetic stimulant that affects the brain and central nervous system[1-4]. Smoking is the most common route of administration for MA[5]. When smoked or injected, it produces an initial rush that lasts only a couple of minutes but is intensely pleasurable[5]. This is followed by a prolonged high that results in an extended period of euphoria[5]. The half-life of MA ranges from 10-30 hours depending on the purity of the drug, urine pH, and the amount consumed[2]. Like other psychoactive drugs of abuse, chronic MA use can result in tolerance, where increased amounts of MA are required to produce the same high[6].

Because MA is a stimulant, it produces physiological and psychological effects similar to those elicited by cocaine[1]. MA stimulates the release of dopamine, norepinephrine, and serotonin, and blocks their reuptake[7]. This excess amount of neurotransmitters in the synapses produces sensations of euphoria, lowered inhibitions, feelings of invincibility, increased wakefulness, heightened sexual experiences, and hyperactivity resulting from increased energy for extended periods of time[8]. Deleterious short-term effects include increased heart and respiratory rates, hyperthermia, chest pain, hypertension, increased respiration, decreased appetite, anorexia, irritability, confusion, tremors, convulsions, anxiety, aggressiveness, and symptoms of psychosis such as hallucinations and paranoia[4,9,10]. This is followed by mental and physical exhaustion, headaches, irritability, reduced concentration, hunger, decreased energy, anhedonia, and a craving for more MA[3,11]. Cognitive impairments and changes in the brain that result in symptoms similar to those of Parkinson's disease can occur[12,13]. Long-term use of MA use is associated with neurotoxicity, neurodegeneration, and clinical depression that may lead to homicidal and suicidal ideation and action[5].

MA is produced, or 'cooked' quickly, reasonably simply, and cheaply by using legal and readily available ingredients, including ephedrine, pseudoephedrine, red phosphorus, iodine, ammonia, paint thinner, lye, camping fuel, drain cleaner, and lithium[5]. These components and cooking tools can be purchased at local drug stores and hardware stores, and recipes can be found on the Internet[14]. Many of the chemicals used in the production of MA are explosive and the generated waste products are corrosive and toxic[15].

In 2004, the US National Survey on Drug Use and Health surveyed persons over the age of 11 and found that 1.4 million people (0.6% of the population) had used MA in the past 12 months, and 600,000 (0.2%) had used it in the previous month[16]. School-based drug surveys administered in Ontario and Manitoba specifically asked about MA use[17,18]. They found that between 2.7% and 3.3% of students reported using MA within the last year. In another Canadian province, 4% (108,000) of Albertans aged 15 or older reported using more than one amphetamine-type stimulant[4]. In 2002, street youth aged 14–30 years were surveyed and 71% of respondents reported using amphetamine-type stimulants and 57% had used them on more than ten occasions[4].

Because MA is easily accessible, relatively cheap, and has reinforcing properties, chronic use can pose a significant danger[4]. If risk factors for MA use could be identified, physicians and other health care professionals who work with youth may be better equipped to identify MA users and develop education and prevention programs that could be targeted to youth at greater risk for using MA. Thus, we performed a systematic review to identify factors at the individual, family, and community level that are associated with MA use among children and adolescents.

Methods

Literature search

We searched over 40 electronic databases, including MEDLINE*, Ovid MEDLINE®, In-Process & Other Non-Indexed Citations, EBM Reviews – Cochrane Central Register of Controlled Trials, EMBASE, CINAHL*, PsycINFO®, International Pharmaceutical Abstracts, Pascal, Global Health, Science Citation Index Expanded and Social Sciences Citation Index (via Web of Science®), Social Sciences Abstracts, and Psychology and Behavioral Sciences Collection. Trials registers (Current Controlled Trials, ClinicalTrials.gov, the Australian Clinical Trials Registry, and the National Research Register in the United Kingdom) were searched for additional trials. Search terms such as methamphetamine, variant spellings of methamphetamine, amphetamine-related disorders, and crystal meth, were adapted for each database and appropriate subject headings and keywords were used. In addition, an extensive search for grey literature was conducted. Hand searching was conducted in relevant scientific journals, scientific meetings, and the reference lists of relevant reviews and included studies were reviewed. We restricted the search results to English-language studies. The literature search is considered up to date as of May 15, 2006. Full search strategies and lists of resources searched are available [see Additional file 1].

Study selection and inclusion criteria

Two reviewers independently screened the titles and, when available, the abstracts. Based on general inclusion criteria, studies were classified as 'potentially relevant', 'irrelevant', and 'unclear'. The full text of studies described as "potentially relevant" and "unclear" was
obtained and two reviewers independently applied the specific inclusion criteria. Studies were included if they compared children ≤ 18 years of age who did and did not use MA (the comparison group could be other drug users or children who do not use drugs). The following study designs were included: case-control, cohort, and cross-sectional. Studies were excluded if they did not have a comparison group, if the outcomes were not measured quantitatively or if they were uncontrolled before and after studies, case-series, or case studies. Disagreements were resolved through discussion or through third party adjudication, as necessary.

**Methodological quality assessment**

Two reviewers independently assessed methodological quality; discrepancies were resolved through consensus or by third party adjudication as required. Observational studies were assessed using the Downs and Black checklist[19]. This tool comprises six sections that assess reporting, external validity, internal validity (bias), internal validity (confounding), and power.

**Data extraction**

Data were extracted by one reviewer and checked for accuracy and completeness by a second reviewer. A standard data extraction form was developed and the data were subsequently entered into an electronic database. For each included study, we extracted information about the population (demographics and sources), type of study (study design, prospective or retrospective data collection), definitions and details of risk factors, and the numeric results.

**Data analysis**

After reviewing the studies that met our inclusion criteria, we made a post hoc decision to group the studies and conduct the data analysis by the nature of the comparison group: 1) youth who did not use illicit drugs (referred to as “low-risk”) and 2) youth who abused illicit drugs other than MA or were recruited from juvenile detention centers (referred to as “high-risk”). For dichotomous risk factors (e.g., sex) we calculated pooled odds ratios (OR) with 95% confidence intervals (95% CI), where appropriate. For continuous risk factors (e.g., years of education) we calculated weighted mean difference (WMD) and 95% CI using the DerSimonian and Laird random effects model[20]. A random effects model was used because it allows for combining heterogeneous results where the heterogeneity cannot readily be explained[21]. The resulting estimate is more conservative because the resulting confidence intervals are wider. Statistical heterogeneity was assessed using the I² statistic, which describes the percentage of total variation across studies that is due to heterogeneity rather than chance. For this review a value greater than 50% was considered as substantial heterogeneity[22]. In instances where only one study reported the specific risk factor or where pooling was not appropriate, the effect estimate (OR or WMD) and 95% CI were reported for each risk factor.

**Results**

**Literature search**

The database, grey literature searches and hand searching yielded 2,376 potentially relevant studies. In total, 106 unique studies were reviewed and 13 met our inclusion criteria. Of these, two studies assessed risk factors in the same population and are treated as one study for the purposes of this report[23]. Therefore, our review includes 13 publications but only 12 unique studies. Study retrieval and selection is outlined in Figure 1.

Studies were excluded from the review for the following reasons: not relevant to the topic (n = 34), incorrect study population (n = 33), inappropriate study design (n = 12), not primary research (n = 13), and inadequate data (n = 1).

**Description of included studies**

The characteristics of the 12 included studies and populations are presented in Tables 1 [see Additional file 2] and 2 [see Additional file 3]. Most studies relied on self-reported MA use. Three studies administered urine tests to determine MA use[24-26] and one study diagnosed children with MA dependence[27]. The remaining studies relied on self-reported MA use. Seven studies were conducted in North America [27-33] and the remaining five in Asia[23,24,26,34,35]. The majority of the studies were published recently: the median year of publication was 2004. The median sample size was 604 and ranged from 60 to 78,715. Three studies used a case-control design and the remaining nine were cross-sectional.

In five studies, youth who reported using MA were compared to youth who did not use illicit drugs, hereafter referred to as “low-risk” youth. These low-risk youth were sampled from school populations. For the remaining seven studies, youth who reported using MA were compared to youth who abused illicit drugs other than MA, and/or youth who were sampled from juvenile detention centers, hereafter referred to as “high-risk” youth. Youth were recruited from a variety of locations, including schools, detention centers, juvenile homes, or treatment facilities. One study included youth up to the age of 24 and one study did not report the age of participants. The studies assessed a variety of risk factors, including demographic variables, mental health status, and risky behaviors.

**Methodological quality of included studies**

The median Downs and Black score was 15 of a possible score of 29 and ranged from 12 to 28 [Table 1] suggesting a risk of bias for those studies that received lower quality scores. Six of the twelve studies reported adjusted results,
that is, the risk factor of interest was adjusted for other potentially confounding risk factors[23,26,28,31,32,34]. Six studies disclosed their funding source and the most common source was a government agency[23,26,29,30,32].

**Quantitative results: comparing MA users to low-risk youth**

Five studies compared risk factors for MA among low-risk youth, as defined above (Table 2) [23,24,26,28,29]. There was considerable heterogeneity among the studies, which precluded the calculation of pooled estimates of effects in most cases. Pooled estimates are presented where appropriate.

**Sex**

Two cross-sectional studies examined sex as a risk factor and both independently indicated a significant association showing that males are more likely to use MA than females[26,29].

**Ethnicity**

One cross-sectional study using survey data examined ethnicity as a risk factor for MA[29]. The results showed that Caucasian youth were more likely to use MA than African-American youth and Asian youth. However, Caucasian youth were significantly less likely to use MA than Hispanic and Native American youth.

**Years of education**

One case-control[23] and two cross-sectional studies[24,26] examined education as a risk factor for MA use and all three studies concluded that MA use was significantly associated with fewer years of education. Two studies reported the mean years of education among MA users and non-MA users. The pooled WMD indicated that non-MA users had more years of education than youth who used MA (WMD = 2.63; 95% CI: 2.45 to 2.80)[24,25]. The third study categorized respondents' educational attainment of Grades 1–3 versus Grades 4 or more and also showed that non-MA users were 1.3 times more likely to have more education (95% CI: 1.06 to 1.62)[26].

**Sexual behavior**

Two cross-sectional studies independently reported a significant association between having ever previously engaged in sexual intercourse and using MA[8,36]. One study found the following behaviors were significantly associated with MA use: engaging in unprotected sex, engaging in unplanned sex under the influence of alcohol, and engaging in sexual intercourse with an alcohol-intoxicated partner[24].

**Alcohol, cigarette and opiate use**

Two studies (one case-control[23] and one cross-sectional[26]) independently reported statistically significant associations between alcohol use, smoking, and heroin/opiate use.

**Psychiatric disorders**

Two studies of the same population examined the relationship between psychiatric disorders and MA use; however, the studies did not examine the same psychiatric conditions and their results could not be pooled[23,25]. The presence of the following conditions were found to be significantly associated with MA use: having any psychiatric-
Table 1: Risk factors for MA: quality of included studies

<table>
<thead>
<tr>
<th>Study Year</th>
<th>Study Design</th>
<th>Downs and Black Score</th>
<th>Present Adjusted OR</th>
<th>Funding Source</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Low-risk youth as the comparison group</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lampinen 2006</td>
<td>Cross-sectional</td>
<td>15</td>
<td>Yes</td>
<td>Other</td>
</tr>
<tr>
<td>Oetting 2000</td>
<td>Cross-sectional</td>
<td>12</td>
<td>No</td>
<td>Government</td>
</tr>
<tr>
<td>Sattah 2002</td>
<td>Cross-sectional</td>
<td>15</td>
<td>Yes</td>
<td>Government</td>
</tr>
<tr>
<td>Yen 2006*</td>
<td>Case-control</td>
<td>15</td>
<td>Yes</td>
<td>Government</td>
</tr>
<tr>
<td>Yen 2004†</td>
<td>Cross-sectional</td>
<td>13</td>
<td>No</td>
<td>NR</td>
</tr>
<tr>
<td><strong>High-risk youth as the comparison group</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kim 2002</td>
<td>Cross-sectional</td>
<td>16</td>
<td>No</td>
<td>Government</td>
</tr>
<tr>
<td>Miura 2006</td>
<td>Case-control</td>
<td>15</td>
<td>Yes</td>
<td>NR</td>
</tr>
<tr>
<td>Palmar 2005</td>
<td>Case-control</td>
<td>13</td>
<td>No</td>
<td>NR</td>
</tr>
<tr>
<td>Rawson 2005</td>
<td>Cross-sectional</td>
<td>14</td>
<td>Yes</td>
<td>NR</td>
</tr>
<tr>
<td>Shillington 2005</td>
<td>Cross-sectional</td>
<td>18</td>
<td>Yes</td>
<td>Other</td>
</tr>
<tr>
<td>Shillington 2003</td>
<td>Cross-sectional</td>
<td>17</td>
<td>No</td>
<td>NR</td>
</tr>
<tr>
<td>Uchida 1995</td>
<td>Cross-sectional</td>
<td>12</td>
<td>No</td>
<td>NR</td>
</tr>
</tbody>
</table>

* Age and sex matched  
† Sex matched

Psychiatric disorder, adjustment disorder, conduct disorder, and attention deficit and hyperactivity disorder (ADHD). Oppositional defiance disorder, anxiety disorder, major depressive disorder, dysthmic disorder, bipolar disorder, and eating disorder were not significantly associated with MA use among low-risk youth.

Other risk factors
Several other risk factors were associated with MA use among low-risk youth: being homosexual or bisexual[28], experiencing disruptive parenting[23], peers using or providing MA[23], and family history of drug use[23].

Multivariate analyses
Three studies conducted adjusted or multivariable logistic regression analyses (i.e., the risk factor of interest was adjusted for other potentially confounding factors). Lampinen et al. found that age and sexual preference were significant risk factors for MA use; sex was not found to be a risk factor in their analysis[28]. After adjusting for other psychiatric conditions and peer and family characteristics, Sattah et al. reported that the following risk factors were associated with MA use: recent alcohol or tobacco use, history of marijuana use, not having a family confidant, peer pressure, having a positive attitude towards MA use, and sexual experience[26]. The third study found that conduct disorder, a positive attitude toward MA use, poor understanding of MA use, disruptive parenting, low level of caregiver education, friends using or providing MA, and a more interactive interaction with peers were significant risk factors for MA[25]. Sex was not found to be statistically significant in this multivariable analysis.

Quantitative results: comparing MA users to high-risk youth
Seven studies examined risk factors for MA among high-risk youth (Table 3)[27,30-35]. Because of substantial heterogeneity among the studies, pooling of estimates was generally not appropriate.

Sex
Five studies (one case-control and four cross-sectional) independently reported that female sex was significantly associated with MA use[30,31,33-35].
Table 2: Comparing MA users to Low-Risk Youth

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Study</th>
<th>Statistical Measure</th>
<th>Point Estimate (95% CI)</th>
<th>Conclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td>Oetting 2000</td>
<td>OR</td>
<td>0.72 (0.70, 0.75)</td>
<td>Odds of using MA were higher for males.</td>
</tr>
<tr>
<td>Years of education</td>
<td>Sattah 2002</td>
<td>OR</td>
<td>0.34 (0.27, 0.43)</td>
<td>Odds of using MA were higher for those with less education.</td>
</tr>
<tr>
<td></td>
<td>Yen 2004</td>
<td>MD</td>
<td>2.70 (2.36, 3.04)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pooledd</td>
<td>WMD</td>
<td>2.60 (2.40, 2.80)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sattah 2002</td>
<td>OR</td>
<td>2.63 (2.45, 2.80)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sattah 2002</td>
<td>OR</td>
<td>1.31 (1.06, 1.62)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sattah 2002</td>
<td>OR</td>
<td>2.79 (2.25, 3.46)</td>
<td>Odds of using MA was higher for those who had previously engaged in sexual intercourse.</td>
</tr>
<tr>
<td>Alcohol use</td>
<td>Yen 2004</td>
<td>OR</td>
<td>31.79 (15.56, 64.93)</td>
<td>Odds of using MA was higher for those who drink alcohol.</td>
</tr>
<tr>
<td></td>
<td>Sattah 2002</td>
<td>OR</td>
<td>8.02 (4.53, 14.18)</td>
<td></td>
</tr>
<tr>
<td>Heroin/opiate use</td>
<td>Yen 2006</td>
<td>OR</td>
<td>51.31 (12.27, 214.68)</td>
<td>Odds of using MA was higher for those who had a history of heroin/opiate use.</td>
</tr>
<tr>
<td></td>
<td>Sattah 2002</td>
<td>OR</td>
<td>30.66 (9.38, 100.17)</td>
<td></td>
</tr>
<tr>
<td>Smoking</td>
<td>Yen 2006</td>
<td>OR</td>
<td>22.53 (1.24, 409.59)</td>
<td>Odds of using MA were higher for those who smoke.</td>
</tr>
<tr>
<td></td>
<td>Sattah 2002</td>
<td>OR</td>
<td>13.72 (1.06, 17.60)</td>
<td></td>
</tr>
<tr>
<td>Family history of drug use</td>
<td>Yen 2006</td>
<td>OR</td>
<td>154.85 (81.95, 292.60)</td>
<td>Odds of using MA were higher for youth with family history of drug use.</td>
</tr>
<tr>
<td></td>
<td>Yen 2006</td>
<td>OR</td>
<td>8.65 (3.36, 19.25)</td>
<td>Odds of using MA were higher for youth who were homosexual or bisexual.</td>
</tr>
<tr>
<td>Homosexual or bisexual</td>
<td>Lampinen 2006</td>
<td>OR</td>
<td>17.02 (4.83, 60.01)</td>
<td>Odds of using MA were higher for youth who experienced disruptive parenting.</td>
</tr>
<tr>
<td>Experiencing disruptive parenting</td>
<td>Yen 2006</td>
<td>OR</td>
<td>7.84 (5.25, 11.71)</td>
<td>Odds of using MA were higher for youth who engaged in unprotected sex.</td>
</tr>
<tr>
<td>Peers using or providing MA</td>
<td>Yen 2006</td>
<td>OR</td>
<td>40.94 (24.64, 68.03)</td>
<td>Odds of using MA were higher for youth with peers using or providing MA.</td>
</tr>
<tr>
<td>Engaging in unprotected sex</td>
<td>Yen 2004</td>
<td>OR</td>
<td>15.68 (8.04, 30.58)</td>
<td>Odds of using MA were higher for youth who engaged in unprotected sex.</td>
</tr>
<tr>
<td>Engaging in unplanned sex under the influence of alcohol</td>
<td>Yen 2004</td>
<td>OR</td>
<td>70.42 (9.34, 531.06)</td>
<td>Odds of using MA were higher for youth who engaged in unplanned sex under the influence of alcohol.</td>
</tr>
<tr>
<td>Engaging in sex with an alcohol-intoxicated partner</td>
<td>Yen 2004</td>
<td>OR</td>
<td>29.33 (6.70, 128.36)</td>
<td>Odds of using MA were higher for youth who engaged in sexual intercourse with an alcohol-intoxicated partner.</td>
</tr>
<tr>
<td>Any psychiatric disorder</td>
<td>Yen 2006</td>
<td>OR</td>
<td>3.05 (2.12, 4.39)</td>
<td>Odds of using MA were higher for youth who had any psychiatric disorder.</td>
</tr>
<tr>
<td>Adjustment disorder</td>
<td>Yen 2006</td>
<td>OR</td>
<td>2.89 (1.53, 5.47)</td>
<td>Odds of using MA were higher for youth who had adjustment disorder.</td>
</tr>
<tr>
<td>Conduct disorder</td>
<td>Yen 2006</td>
<td>OR</td>
<td>3.91 (1.60, 63.41)</td>
<td>Odds of using MA were higher for youth who had conduct disorder.</td>
</tr>
<tr>
<td>Attention-deficit hyperactivity disorder</td>
<td>Yen 2006</td>
<td>OR</td>
<td>2.84 (1.81, 4.47)</td>
<td>Odds of using MA were higher for youth who had ADHD.</td>
</tr>
</tbody>
</table>

a Female = 1, Male = 0
b Combine Yen 2004 and Yen 2006, P = 0%

Age
One cross-sectional study categorized participants into two age groups: 13–14 years and 15–18 years[31]. The results show that age was not significantly associated with MA use.

Ethnicity
Three studies (one case-control and two cross-sectional) examined the association between ethnicity and MA use among high-risk youth[27,31,32]. Compared to African-American and Asian youth, Caucasian youth were significantly more likely to use MA. There was no significant diff-
### Table 3: Comparing MA Users to High-Risk Youth

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Study</th>
<th>OR (95% CI)</th>
<th>Conclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sexa</td>
<td>Uchida 1995</td>
<td>6.55 (2.34, 18.34)</td>
<td>Females were more likely to use MA than males.</td>
</tr>
<tr>
<td></td>
<td>Kim 2002</td>
<td>1.53 (1.27, 1.85)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Shilkington 2003</td>
<td>4.00 (3.49, 4.58)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Rawson 2005</td>
<td>9.53 (5.40, 16.79)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Miura 2006</td>
<td>4.57 (2.92, 7.17)</td>
<td></td>
</tr>
<tr>
<td>Ageb</td>
<td>Rawson 2005</td>
<td>2.10 (0.84, 5.26)</td>
<td>Age was no significantly associated with MA use.</td>
</tr>
<tr>
<td>Alcohol use</td>
<td>Rawson 2005</td>
<td>1.04 (0.56, 1.95)</td>
<td>No association between a history of alcohol use and MA use</td>
</tr>
<tr>
<td>Family history of crimec</td>
<td>Miura 2006</td>
<td>2.00 (1.22, 3.29)</td>
<td>Odds of using MA was higher for youth with family history of crime.</td>
</tr>
<tr>
<td>Family history of drug use</td>
<td>Miura 2006</td>
<td>4.70 (2.79, 7.90)</td>
<td>Odds of using MA was higher for youth with family history of drug use.</td>
</tr>
<tr>
<td>Family history of alcohol abuse</td>
<td>Uchida 1995</td>
<td>3.61 (1.39, 9.39)</td>
<td>Odds of using MA was higher for youth with family history of alcohol abuse.</td>
</tr>
<tr>
<td></td>
<td>Miura 2006</td>
<td>2.94 (1.44, 6.00)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pooledd</td>
<td>3.16 (1.78, 5.61)</td>
<td></td>
</tr>
<tr>
<td>Child abuse</td>
<td>Uchida 1995</td>
<td>3.13 (1.24, 7.92)</td>
<td>Odds of using MA was higher for youth who experienced child abuse; the association was not statistically significant.</td>
</tr>
<tr>
<td></td>
<td>Miura 2006</td>
<td>1.49 (0.73, 3.07)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pooledd</td>
<td>2.04 (0.99, 4.17)</td>
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<td>Receiving psychiatric treatment</td>
<td>Miura 2006</td>
<td>6.78 (3.55, 12.94)</td>
<td>Odds of using MA was higher for youth who were receiving psychiatric treatment.</td>
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<tr>
<td>Greater than two admissions to juvenile home</td>
<td>Miura 2006</td>
<td>2.70 (1.77, 4.13)</td>
<td>Odds of using MA was higher for youth with greater than two admissions to juvenile home.</td>
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<tr>
<td>History of violence</td>
<td>Miura 2006</td>
<td>0.35 (0.20, 0.62)</td>
<td>Odds of using MA was lower for youth with history of violence.</td>
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<tr>
<td>Strict parental monitoring</td>
<td>Shilkington 2005</td>
<td>0.25 (0.11, 0.57)</td>
<td>Odds of using MA was lower for youth with strict parental monitoring.</td>
</tr>
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</table>

*a Female = 1, Male = 0  
b13–14 years vs. 15–18 years  
cP = 0%  
dI² = 34.7% 

Comparison in MA use between Caucasian versus Hispanic, Asian, or Native American.

**Alcohol use**

One cross-sectional study found no association between a history of alcohol use and MA use[31].

**Family history**

One cross-sectional study found that a family history of crime or drug use was significantly associated with MA use[34]. The pooled analysis of two cross-sectional studies showed a significant association between family history of alcohol abuse and MA use[34,35].
Child abuse
The pooled analysis of one cross-sectional and one case-control study showed a two-fold association between children who experienced abuse and MA use; however, the result was not statistically significant[34,35].

Other risk factors
The following factors were significantly associated with MA use: receiving psychiatric treatment, greater than two admissions to juvenile home, and history of violence[34]. However, strict parental monitoring was found to be protective for MA use among high-risk youth[32].

Multivariable analyses
Three studies conducted a multivariable logistic regression analysis. Shillington et al. found that strict parental monitoring, after controlling for age, was a statistically significant protective factor against MA use among high-risk youth[32]. After controlling for age and race, Rawson et al. found that female sex was significantly associated with MA use[31]. In the third study, female sex, age, more than two admissions to a juvenile home, non-violent history, psychiatric treatment, family history of drug misuse, and child abuse were significantly associated with MA use; a family history of crime was not significantly associated with MA use[34].

Discussion and conclusion
This systematic review presents the best-available evidence regarding risk factors for MA use among youth. An exhaustive search of over 40 electronic databases, grey literature, and hand searching identified 12 unique studies that met our inclusion criteria. The majority of the studies (9/12) were cross-sectional in design and therefore it is not possible to determine whether the risk factors precede or follow MA use.

Because we believe that factors associated with MA use may differ among socially integrated (i.e., low-risk) and marginalized (i.e., high-risk) youth, we chose to analyze these studies separately. Compared to low-risk youth, there were some clear patterns of risk factors associated with MA use. A history of engaging in a variety of risky behaviors (e.g., sexual activity, unplanned, or under the influence of alcohol, alcohol consumption, and opiate use) was significantly associated with MA use among low-risk youth. Engaging in high-risk behavior may be a gateway for MA use or vice versa. Homosexual or bisexual lifestyle is also a risk factor. This is not surprising, as MA is believed to heighten sexual pleasure and gay and bisexual men cite this as a reason for using MA[36]. A history of a psychiatric disorder and, in particular, adjustment disorder, conduct disorder, or ADHD, is a risk factor for MA use. This is consistent with previous research that shows psychiatric conditions to be risk factors for drug use in general[37].

Several risk factors were associated with MA use among high-risk youth (i.e., those that used other illicit drugs or were in detention/juvenile centers). Unlike low-risk youth, females were significantly more likely to use MA. Youth who grew up in an unstable family environment (e.g., family history of crime, alcohol use, and drug use) were significantly more likely to use MA. While child abuse was not a significant risk factor, it approached statistical significance. High-risk youth who had received treatment for psychiatric conditions were more likely to use MA. One study found that strict parental monitoring was found to be protective against MA use among this group of youth.

Limitations
There were only 12 studies that met our inclusion criteria. These studies were fairly heterogeneous, which precluded pooling of results for most risk factors. Furthermore, many of the risk factors were assessed in only one study and the sample size was small. This is reflected in the wide confidence intervals and imprecise effect estimates. Most studies were either cross-sectional or retrospective making it impossible to assess a causal relationship between the risk factors and MA use. As with any systematic review, there is the possibility of publication and selection bias. However, we feel the risk for publication bias was minimized by our exhaustive search process. In addition to electronic databases, the reference lists of the included studies were searched, relevant conference proceedings and key journals were hand searched, and a thorough grey literature search was conducted.

Implications for clinicians and front-line workers
Youth who engage in risk-taking behaviors, live in an unstable home environment, have a psychiatric condition, and have peers that use or sell MA have a higher propensity for MA use. In order to identify youth at risk for MA use, health care workers and counsellors need to conduct a holistic assessment that includes psychiatric, lifestyle, and family history.

Authors' contributions
KR co-ordinated the project, prepared the manuscript, and assisted with assessing studies for inclusion, methodological quality assessment, data extraction, summarizing the qualitative results.

DD provided methodological expertise and provided feedback on the manuscript.

YL completed the statistical analysis and provided feedback on the manuscript.
CF designed and executed the literature searches. She coordinated and assisted with all stages of the systematic review process, including manuscript preparation, related to the policy component.

KO assisted with assessing studies for inclusion, methodological quality assessment, data extraction, summarizing the qualitative results, and provided feedback on the manuscript.

TD assisted with designing and executing the literature searches and provided feedback on the manuscript. She also assisted with assessing studies for inclusion, methodological quality assessment, and data extraction.

TCW provided methodological and clinical expertise and provided feedback on the manuscript.

TPK provided methodological and clinical expertise and provided feedback on the manuscript.

Additional material

Additional File 1
Electronic Databases and Search Strategies. This file contains the literature databases and search strategies. Click here for file
[http://www.biomedcentral.com/content-supplementary/1471-2431-8-48-S1.doc]

Additional File 2
Table1. Risk factors for methamphetamine use: description of the population. This file contains a table. Click here for file
[http://www.biomedcentral.com/content-supplementary/1471-2431-8-48-S2.doc]

Additional File 3
Table2. Risk factors for methamphetamine use: description of the risk factors. The file contains a table. Click here for file
[http://www.biomedcentral.com/content-supplementary/1471-2431-8-48-S3.doc]

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References


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(page number not for citation purposes)
New River Community and Technical College

STUDENT SCHEDULE/BILL
Spring Semester 2009

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E & G Fees - NRCTC 1167.00
System Capital Fees - NRCTC 175.00
Web-CT Web Class Fee-New River 120.00

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Mr Scott L. Porterfield
Student ID: 000073164
Campus: Greenbri
Residency: R
College: CC
Major: GNEC
Total Current Term Charges: 1494.00
Total Current Term Credits: 1494.00

Previous Balance: 0.00
Current Term Balance: 0.00
AMOUNT DUE: 0.00
Future Balance: 0.00

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What's going on with meth?

Experts reach different conclusions about the drug's impact on the nation

BY MARK HAGLAND

In the ongoing saga around drug abuse in the United States, a particularly curious debate has arisen around one drug in particular: methamphetamine. Is meth abuse, which has cut a swath among such social groups as rural youth and urban gay men, reaching crisis proportions? Or is it actually declining? And is meth significantly different from other drugs? Enough that it should be treated differently from a policy standpoint?

The debate swirling around meth reached a new point in June, when the Sentencing Project, a not-for-profit advocacy organization, released a report titled The Next Big Thing: Methamphetamine in the United States. The report, according to a release, "reveals that methamphetamine is actually one of the rarest of illegal drugs used, with its use declining among youth, stabilizing among adults and demonstrating no increase in first-time users." The report's findings include:

- Meth is among the least commonly used drugs.
- Meth remains a rare occurrence throughout most of the country and is not indicative of a nationwide problem.
- Meth use is declining among our nation's youth.
- Drug treatment programs are highly effective in combating meth addiction.

Asked why his organization undertook this study, Ryan S. King, the report's author and a Sentencing Project policy analyst, says, "The media have exaggerated the prevalence of the drug, as well as distorted its receptivity to treatment. We're saying it's not an epidemic, and the way the media has portrayed this on a national level is distorted. And media coverage has a direct consequence for national drug policy. We would like policy to be evidence-based rather than fueled by exaggeration and rhetoric."

In fact, recent statistical reports from Quest Diagnostics, a leading employer drug-testing firm, seem to indicate declining meth use among corporate employees, along with other drugs. "When we looked at the testing data overall, we found this spring that workplace drug use has fallen to its lowest level since we began testing in 1988," says company spokesperson Jennifer Somers. "If you look at the 2005 drug testing index, we can say that drug use has come to a 17-year low. That's quite significant."

Somers adds, "There have been significant declines in methamphetamine drug-test positives. Those positives declined from 0.33% in 2004 to 0.26% in 2005, and then to 0.18% in the first six months of 2006. That's a 31% decrease in the first six months of 2006 over 2005 levels, she notes.

Differing Points of View

Such statistics and claims of decreasing meth use seem to herald good news. Yet the federal government reported in February that the proportion of admissions to publicly funded substance abuse treatment facilities for primarily abuse of meth/amphetamines and other stimulants increased from 3 to 8% between 1994 and 2004. Thus, some experts and policy makers harbor serious doubts about claims of decreasing meth use. Some even contend that meth use patterns are different enough from those of other drugs that statistics might not reflect what is happening in society.

One expert who remains deeply concerned about meth is Nora Volkow, MD, director of the National Institute on Drug Abuse (NIDA). To begin with, says Dr. Volkow, "If you're addicted to methamphetamine, the likelihood that you're going to maintain employment is highly unlikely. It really erodes a person's overall health and mental health. The people we're seeing for methamphetamine are mostly jobless." As a result, she says, one could interpret statistics from commercial testing labs as indicating, in fact, that more individuals are dropping out of the workplace as they succumb to drug addiction.

More broadly, Dr. Volkow contends that "Our ability to impact methamphetamine is definitely not growing" and meth use might be intensifying among certain groups of users.

"It actually has been very difficult to pinpoint" precisely whether meth abuse is increasing, holding steady, or dropping, Dr. Volkow concedes, "because our usual surveys have not had the sensitivity to pick up change on methamphetamine use. There's no evidence from the surveys themselves that methamphetamine use is up. However, we've seen an increase in emergency room visits related to meth, and an increase in the number of people seeking treatment for meth. And there's some indication of an increase in the number of people being incarcerated for meth-related reasons."

What is clear, Dr. Volkow says, is that "The impact in terms of medical interventions and incarcerations is greater" than in the past for meth. "Also, the way people are taking methamphetamine is more dangerous than ten years ago. Initially, it was mostly consumed in tablet form orally, or they were snorting it. Now they're smoking it, which makes it much more potent. It's more potent in terms of the speed at which it can induce addiction as well as in terms of its neurotoxic effects."

Dr. Volkow testified on herviews in recent public hearings held by the U.S. House's Subcommittee on Criminal Justice, Drug Policy and Human Resources, chaired by Rep. Mark Souder (R-Ind.). Marc Wheat, staff director and chief counsel to the sub-
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METHAMPHETAMINE

committee, cites Dr. Volkow's testimony as being the kind of articulate, knowledgeable analysis most needed at a time when, he says, meth use is rocking regions such as Indiana's Third District, which Souder represents. Wheat strongly disputes some of the fundamental assumptions and conclusions of the Sentencing Project's report, and states forcefully that he believes meth is a serious and growing crisis.

"Right now, methamphetamine is still somewhat new to many drug abusers," he says. "But the interesting thing is that it releases three times the level of dopamine that cocaine releases. So this is a very powerful drug. We'd like to keep this out of the regular mix of illegal drugs. And I don't think it seems like a very smart strategy to just let methamphetamine run its course while we dither on old issues." In that regard, Wheat says, it's not true that the meth crisis has been oversimplified. Indeed, he says, "We do know that it is overwhelming rural law enforcement and child protection services in rural areas."

Wheat notes that some of the resources to stop meth are coming from the Combat Methamphetamine Epidemic Act, which was Title VII of the Patriot Act. As Wheat sees it, recent developments, which seem to indicate a strong shift toward the purchase of meth manufactured in Mexico and distributed by Mexican meth cartels, point to some level of effectiveness in the part of local law enforcement, who have put a great deal of effort into shutting down home-based meth labs that until recently provided most of the meth to users nationwide.

A report on MSNBC.com last month, however, suggests that the success in shutting down U.S.-based meth labs has led international drug cartels to fill the void with a purer form of meth, and that meth is more abundant than ever.

Meth's Treatment Needs

Meanwhile, behavioral healthcare professionals who treat meth abuse continue to try to determine what aspects of meth abuse make meth addiction different, and continue to refine treatment approaches. "One of the distinguishing features of methamphetamine use is that the effects of meth are significantly
more long-term than the effects of most other drugs," says Ronald J. Hansicker, DMinn, president and CEO of the National Association of Addiction Treatment Providers.

"The traditional Minnesota model, used initially for alcoholism, involved 28 to 30 days of inpatient treatment and admission to a 12-Step program with a sponsor," Dr. Hansicker explains. "With meth, it's pretty clear that this stuff doesn't even get out of one's system for six to eight months." Meanwhile, "The time that meth has a physiological impact is much longer. The psychological impact seems to vary by individual. But clearly meth just doesn't want to get out of your system," he says. Thus, Dr. Hansicker believes that meth addicts need long-term treatment, monitoring, and help involving a comprehensive focus on recovery.

That's a point that most wouldn't disagree with—no matter how they see the history of meth evolving in the United States.

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For More Information

To read the Sentencing Project's view of meth use, go to www.sentencingproject.org/pdfs/methamphetamine_report.pdf.

MSNBC.com's report on "Crystal cartels alter face of U.S. meth epidemic" is available at www.msnbc.msn.com/id/14817971.

SAMHSA's report on "Methamphetamine/Amphetamine Treatment Admissions in Urban and Rural Areas: 2004" can be found at www.streetdrugs.org/pdf/methRuralTX.pdf.

For details on how the state of Illinois is reacting to meth, see the July issue of Behavioral Healthcare, page 32.

For an overview of meth's history, manufacture, abuse, and treatment, see the September/October 2005 issue of Behavioral Health Management, page 38.

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