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BEHAVIORAL BIO-MEDICAL INTERFACE (JL BROWN AND RJ DICLEMENTE, SECTION EDITORS)

Substance Use and HIV Among Justice-Involved Youth: Intersecting Risks

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Abstract

Purpose of Review This review discusses recent advances in research on the intersection of HIV prevention and substance use among youth involved with the justice system. We discuss current themes of recent findings and provide guidance for researchers, policymakers, and clinicians on the next steps in advancing work in this nascent area.

Recent Findings Of the 46 studies that measured HIV risk and substance use among justice-involved youth, 56% were cross-sectional designs, 22% were intervention trials, and 22% were longitudinal designs. Cross-sectional studies suggested that substance use is highly associated with HIV risk behaviors. Longitudinal analyses underscored the importance of understanding contextual risk factors, such as trauma and violence. Intervention trials demonstrated improved scientific rigor of behavioral approaches.

Summary Despite recent advances, research in this field remains limited. Future directions include longer follow-up periods, consideration of biomedical HIV-prevention interventions, and a focus on dissemination and implementation science of efficacious interventions.

Keywords Juvenile justice · Youth · HIV · Substance use · Prevention

One-fifth of new HIV diagnoses in the United States (US) are in young people aged 13 to 24 years [1]. Youth are more likely than other age groups to engage in behaviors, such as unprotected sex, substance use, and having multiple sexual partners that place them at higher risk for infection with HIV [2]; however, youth are less likely than older Americans to receive HIV testing [3]. After infection, adolescents and young adults are also less likely than other age groups to be connected with HIV-related health care, and have low rates of viral suppression [3].

Risk of HIV transmission is greatly elevated for the many young people involved in the US justice system. In 2016, over 850,000 youth under age 18 were arrested [4]. At any given time, nearly 50,000 youth are incarcerated or detained in residential settings [5]. Prevalence of other sexually transmitted infections (STIs) among youth with justice involvement is significantly higher than what is observed in the general adolescent population, ranging from 9% and 13% chlamydia diagnosis among newly arrested males and females, respectively [6] to 20 to 42% infection rates in studies of detained females [7]. Yet prevalence rates of HIV among the juvenile justice population remain largely unknown and challenging to accurately measure, particularly since many youth are not screened for HIV when entering the juvenile justice system [8, 9]. However, behavioral risk data are clear. Nearly 90% of youth in juvenile detention are sexually active [10]. Thirty-five percent of boys and over 40% of girls report unprotected sex in the past month prior to detention, and 20% of boys and 10% of girls report ever having sex with a high-risk partner [10]. Substance use is often a catalyst for risky behavior: approximately a third of detained youth report having had unprotected sex while drunk or high [10]. As formerly detained youth age into young adulthood, HIV/STI risk behaviors [11] and substance use [12] remain substantially higher than those

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experienced by youth in the general population, pointing to the enduring influence of incarceration and criminal justice involvement in long-term public health outcomes. Young adults ages 20–29 years had the highest rates of new HIV infection in the US in 2014, accounting for 36% of new HIV diagnoses, with the vast majority occurring among racial/ethnic minorities [13]. The vast majority of juveniles involved in the justice system return to their communities following arrest, typically within 2 weeks, where they have opportunities to engage in risky substance use and sexual behaviors that increase HIV vulnerability [11, 14]. Individuals supervised by the justice system living in the community (i.e., those on probation or parole) may be at higher risk of HIV acquisition and have more difficulty accessing treatment than those incarcerated [15]. These populations often struggle with lack of health insurance, increased rates of sexually transmitted infections, and housing instability, all factors associated with increased risk of HIV acquisition [16]. This is critical to consider for youth involved in the justice system, as legal policies over the past decade have increasingly emphasized diverting justice-involved youth from detention to the community [17]. Diversion programs are an effective way to reduce recidivism. However, fewer youth may receive STI/HIV screening and treatment when not in supervised settings.

Congruent with juvenile justice policy changes (i.e., a movement away from incarceration and broader adoption of diversion programs), recent research examining the interrelationships among HIV/STI risk and substance use has expanded from focusing on *detained* youth (e.g., youth living in a detention facility or other secure setting) to *community-supervised* (e.g., those on probation). For example, in 2010, when our group published a comprehensive rigorous review of any published HIV-prevention interventions for justice-involved youth [18], 16 studies were identified and of these, four (25%) were conducted with non-detained or community-supervised justice-involved populations. Five years later, Hong and colleagues published a comprehensive review of HIV/STI-prevention interventions (from 2000 to 2013) among detained and delinquent youth, of which only 1 of 15 identified studies focused on non-detained youth [19]. To advance public health priorities in line with shifting juvenile justice policy changes [20], clinicians, researchers, and policymakers must gain a better understanding of justice-involved youths' intersecting HIV and substance use risks, particularly in their natural (i.e., community and home-based) environments. We summarize recent main themes of this area of research using data from published reports and provide future directions to guide the field as to requisite next clinical, research, and policy steps regarding HIV prevention and substance use for justice-involved youth.

Methods

Search Strategy

In order to capture all relevant, published studies addressing this broad topic, a comprehensive search strategy was employed, using multiple online search tools. A systematic search for articles involving substance use and HIV risk behaviors among justice-involved youth published from January 1, 2013, to March 2, 2018, was conducted in PubMed, PsycINFO, Embase, Web of Science, Sociological Abstracts, Social Services Abstracts, and Google Scholar. The search combined four concepts: (1) incarceration, (2) youth, (3) substance use, and (4) HIV risk behaviors. A search strategy was developed in collaboration with a clinical librarian (JBW) using an iterative process that involved testing search terms, keywords, and controlled vocabulary, including MeSH and Emtree terms, for each of the search concepts and examining the relevance of corresponding search results. The search strategy was peer reviewed by a second librarian using Peer Review of Electronic Search Strategy (PRESS) guidelines. Detailed search strategies for each database can be found in Appendix Table 1.

Study Selection

The literature search yielded 858 articles. After excluding duplicates, 532 articles were screened for inclusion based on title and abstract and 478 were eliminated because of their irrelevance to the topic. Additionally, eight publications from the search results that addressed the intersection of HIV, substance use, and juvenile justice were excluded because of the study design; this included one systematic review of HIV/STI-prevention interventions for detained and delinquent youth [19], three studies examining intersecting risks of HIV, substance use, and justice involvement among HIV-positive youth [21–23], two studies of large existing adolescent health databases [24, 25], and two retrospective studies of at-risk populations (a community-based sample of African American youth [26] and Black men recruited from STI clinics [27]) examining how a history of juvenile justice involvement and/or incarceration may increase HIV risk.

A total of 46 articles were therefore included in the final review. Inclusion criteria were as follows: (1) was a peer-reviewed article; (2) included a US-only population; (3) youth were in 10–18-year-old age range at time of study enrollment (i.e., longitudinal studies may have followed youth beyond 18 years of age); (4) participants were actively justice-involved at time of study enrollment (e.g., arrestees, court-involved truancy, community-supervised through probation, juvenile drug court, brief detention, and/or longer-term incarceration); (5) data were collected on HIV/STI (or sexual risk activity) *and* substance use, which included any illicit substances for minors, including nicotine. A team of three

reviewers (MTS, AH, and MH) assessed and summarized findings of the final 46 articles. One reviewer (ED) selected a random sample of articles to review for quality assurance. Any disagreements in the abstract review were resolved after a consultation and detailed examination of the study.

Results

Of the 46 studies that enrolled justice-involved youth (e.g., court-involved truancy, arrestees, probation, juvenile drug court, detention), a little over half of the studies (54%; $n = 25$) included youth who were community-supervised (e.g., truancy, juvenile drug court, or juvenile probation) and approximately 46% ($n = 21$) focused on detained or incarcerated youth. With respect to study design, 22% ($n = 10$) were intervention trials [28–37] of which nine were randomized controlled trials (RCTs); 56% ($n = 26$) were cross-sectional [6, 38–62] and 22% ($n = 10$) were longitudinal or prospective analysis designs [11, 63–71]. At time of enrollment, study participant ages ranged from 11 to 18 years with most studies including age range of 13–17 years and several studies extending into young adulthood (i.e., up to 30 years of age [11, 27, 59, 61]). Samples were disproportionately male, reflecting the overall higher representation of males in the juvenile justice system [4]. Supporting a growing body of gender-responsive research, 26% ($n = 12$) studies (yet, only one intervention) included only cisgender female justice-involved youth. No studies focused on sexual minority justice-involved youth. Racial and ethnic minority youth (particularly African American/Black and Latinx/non-White, Hispanic) were overrepresented in all studies consistent with statistics demonstrating continued disproportionate minority contact with the juvenile justice system [4]. Sample size study enrollment ranged from 15 to 2260 youth, depending on study design (e.g., qualitative versus quantitative cross-sectional) and stage (e.g., pilot randomized trial versus large-scale randomized controlled trial). Intervention studies' sample sizes ranged from 47 to 460 with a 6–12-month post-intervention follow-up window being most typical and two studies following participants up to 24 months or more post-intervention [29, 35]. Longitudinal assessment (non-intervention) studies included a variable number of assessments over time but most commonly included two to three post-baseline timepoints (range 1–11) over a period of 6–24 months with the two longest follow-up periods occurring 7 years post-baseline with high-risk girls in a trial of Multidimensional Treatment Foster Care [64] and 14 years post-baseline among a sample of youth initially detained during adolescence as part of the Northwestern Juvenile Project [11].

Cross-Sectional Studies

Across the 26 cross-sectional studies reviewed, 38% ($n = 10$) included community-supervised samples. Findings suggest that, among any justice-involved youth, substance use confers enhanced risk for engaging in HIV risk-related behaviors. Many studies used global measures of substance use, collapsing drug use into one broad category [38, 52, 57, 60, 61]. Studies have found that drug use (e.g., marijuana and other drugs) is associated with unprotected sex (e.g., inconsistent condom use), number of sexual partners, drug use during sexual activity, and increased rates of STIs [49, 51, 58]. Several studies focused specifically on the effects of marijuana [6, 54] or alcohol [39] alone. For example, one study found that attention-deficit-hyperactivity disorder (ADHD) was associated with sexual risk behavior for youth with conduct problems, but that cannabis use completely accounted for this association [54]. A cross-sectional brain fMRI imaging study focusing on alcohol detected activation of brain regions associated with risky decision-making, riskier peer norms, and number of days endorsing sex while using alcohol among a sample of community-supervised justice-involved youth [39]. Studies examining multiple substances find differential effects of these substances on HIV risk. One cross-sectional study by Gillman and colleagues [53] found that detained youth who reported frequently using only cannabis were *less* likely to engage in risky sexual behavior and reported *greater* intention to use condoms compared with those who frequently used alcohol and cannabis or just alcohol alone [53]. In this study, alcohol use alone appears to increase the likelihood of risky sexual behavior among juvenile detainees than either alcohol *and* cannabis or just cannabis alone.

Several cross-sectional studies identified critical social ecological factors associated with enhanced risk for substance use and HIV, such as gang violence (e.g., being gang-involved and/or having a dating partner who was gang-involved) [47, 60, 62, 65], dating violence victimization [61], and a history of child maltreatment [57]. Several studies also included psychiatric risk factors, such as depression [6]. The majority of cross-sectional studies focused on individual-level factors associated with HIV and substance use risk and, as stated above, several studies included an examination of larger socioecological factors [42, 46]. Notably, few studies incorporated interpersonal, parent or family-level factor associations with risk [41, 52].

Longitudinal (Assessment Only) Studies

Of the ten studies published, 80% ($n = 8$) centered on intersecting risk of HIV and substance use over time among community-supervised justice-involved youth, such as truant court-involved youth [63], youth presenting to a court intake center [6], youth on probation [71], and youth in the juvenile drug court [70]. These studies assessed and supported a wide variety of individual-level factors associated with substance use and HIV risk, including callous-unemotional traits [68], incidence of pregnancy [64], clustering of problem behaviors [63], and history of sexual coercion [69]. Several longitudinal

studies used global measures of any substance use [11, 63, 68] and others included measurement of single substances, such as alcohol [67, 69], marijuana [63, 66, 71], and cigarettes [65].

The three studies that focused on following detained youth highlighted contextual risk factors for substance use and HIV such as racial disparities, community trauma, and child welfare involvement. The Northwestern Juvenile Project [11] was a seminal study that followed detained youth ($N = 1789$) starting in 1998 for 14 years (through median age 30 and 11 timepoints). Abram and colleagues [11] found that multiple sexual partners and unprotected vaginal sex remain prevalent at the 14-year follow-up but that risk varied by sex and race, with African American and Hispanic males most at risk. Among females, non-Hispanic white youth were at greatest sexual risk; the authors attribute this to their higher rates of substance use disorder relative to African American and Hispanic women. Ramaswamy and colleagues [65] examined cigarette smoking among a 16–18-year-old re-entry population of Black and Latinx men to ascertain risk factors associated with nicotine use prior to detention and 1 year post re-entry; high rates of smoking were reported at follow-up (69%) and associated with foster care history and number of prior arrests; only use prior to detention was also related to a greater number of sexual partners [65]. Lastly, Puja Seth and colleagues (2017) followed 188 African American female detained adolescents over 6 months and found that community trauma at baseline was a significant risk factor for future unprotected sexual activity and marijuana use as well as post-traumatic stress disorder (PTSD) symptoms.

Intervention Studies

Of the ten published intervention studies, with the exception of one within-subject (pre/post) design [31], all were RCTs. All interventions were conducted with community-supervised justice-involved youth; however, two interventions began in detention and then continued with youth post-release [30, 35]. Two intervention trials published two sets of papers with the same intervention just at different stages (i.e., pilot stage and then full trial) [31–33, 37]. Interventions ranged with respect to format (e.g., individual, group, or family-based) and intensity, ranging from brief [28, 29] to more intensive [34, 35]. For example, Bryan and colleagues (2018) recently demonstrated the efficacy of a single 3-h substance use (alcohol and marijuana) and sexual risk-reduction intervention session for detained youth in reducing STI incidence at 12-month follow-up [28]. In a pilot study of adolescents recruited from a juvenile drug court ($N = 81$), participants were randomized to either a 6-month-long, sexual risk-reduction protocol with an emphasis on contingency management and family involvement or a treatment-as-usual arm; preliminary results demonstrated that adolescents randomized to the intervention exhibited slower increases in sexual behavior over the study period [33]. Likewise, Donenberg and colleagues (2018) randomized youth on probation (ages 13–17 years) to a 6-month sexual risk-reduction program (PHAT Life; $n = 163$) or a time-matched health promotion program ($N = 147$); in a moderator analysis, high-risk adolescents (e.g., those with multiple partners, inconsistent condom use, and early sexual debut) reported significantly lower risk behaviors than controls at the end of the trial (e.g., no sex or a single sex partner with consistent condom use, fewer overall partners) [32].

Five interventions incorporated parent training or family-based approaches [29, 33–37]. Efficacy of the interventions was variable. For instance, Perrino and colleagues (2016) randomized community-dwelling, Hispanic youth (ages 12–17 years; $N = 242$) with a history of delinquency to either a multifaceted, family-based intervention (Familias Unidas) or a community-practice control; youth in the intervention arm were significantly less likely to endorse internalizing symptoms at 6 to 12 months following initial assessment. This effect was especially pronounced among youth with worse caregiver-youth communication at baseline, which suggests that the internalizing-reducing effect of the intervention may have been mediated by improved communication. Another study that focused on drug court-involved youth, randomized to either a family-focused intervention for substance use disorders (Risk Reduction Therapy for Adolescents [RRTA]; $n = 45$) or usual services ($n = 60$) for 1 year; no clinically significant treatment-attributable effects were detected for substance use, sexual risk behaviors, and HIV risk behaviors [37]. The authors posited that treatment effects may have been obscured by interventions that were implemented to all study participants by the juvenile drug court. In a study from our group, juvenile drug court-involved adolescents and an involved caregiver ($N = 47$ dyads) were randomized to either a five-session, family-based substance use and HIV/STI risk-reduction arm or a psychoeducation-only arm. At 3 months, results suggested that the intervention was associated with increased motivation to change marijuana use, decreased marijuana use and decreased risky sex over time [36]. Dembo and colleagues (2016) tested a brief intervention (BI) for truant youth and families ($N = 300$) that found a two-session youth-only intervention (BI-Y) to be superior to that which added a parent-only session (BI-YP) in robustly decreasing recidivism at 12 and 24 months; increased rates of recidivism were noted among youth with more substance use and sexual risk behaviors at baseline.

Both interventions that began in detention and continued post-release included a first, single session while in detention and then delivered the remainder of the intervention while community-supervised. DiClemente and colleagues (2014) tested a gender-responsive intervention uniquely tailored for African American detained girls (Imara; 13–17 years, $n = 188$) and designed to reduce new STIs, increase safe-sex practices, and improve psychosocial markers. Participants were

randomized to Imara, which included three individual and four phone-based sessions, or a time-matched psychosocial intervention; 3 months post-intervention, participants in the intervention arm reported more frequent condom use self-efficacy, HIV/STI knowledge, and condom-use skills. However, groups did not differ on new STI cases, condom use, or number of sexual partners [30]. Similarly, Rowe and colleagues (2016) randomized drug-involved, detained youth (13–17 years; $N = 154$) in two sites to either Multidimensional Family Therapy (MDFT) or enhanced treatment as usual; both groups demonstrated reduced rates of unprotected sex acts and STI incidence from intake to 9 months [35]. Of note, youth in both conditions received structured HIV/STI prevention but only those in MDFT received family-based HIV/STI prevention after release. Only in one of the two sites, the MDFT group demonstrated a lower frequency of sex acts and unprotected sex compared to the usual-care group at 9-month follow-up.

Discussion

Our review illustrates recent advances in our understanding of how substance use is interrelated with HIV risk behaviors for justice-involved youth. Over the past 5 years, the number and scope of studies examining and addressing intersecting risks among this population have increased. Necessarily, the field has expanded its focus to include juvenile justice populations outside of youth in detention settings. Specifically, there have been a proliferation of studies focused on one particular subset of this at-risk population: community-supervised justice-involved youth (i.e., youth supervised by the court while in the community, such as those in juvenile drug court or monitored through probation). By including community-based juvenile justice samples, the field is beginning to identify distinct risks, expanded juvenile justice settings, and new frameworks to develop, test, and implement critical substance use and HIV-prevention intervention programs [72].

The field has observed an increase in the proportion of longitudinal studies examining risk in this population, yet the majority of studies continue to be cross-sectional. The lack of longitudinal studies limits the field's ability to ascertain how risk develops over time; a critical component of HIV-prevention efforts among a subset of youth that are at great risk for future substance use and adult criminal justice involvement (behaviors that put them at significant risk for HIV seroconversion). There has also been a marked increase in the number of published interventions, but overall there is still a dearth of available evidence-based behavioral treatments. Programs that target substance use and HIV risk behaviors in tandem are sorely needed; as are interventions that tailor HIV-prevention content to substance-using youth in the justice system. In addition, intervention effects remain short-term and thus effects of interventions into emerging adulthood remain unknown. The Northwestern Juvenile Project [11] and Leve and colleagues [64] conducted studies following justice-involved youth from adolescence into critical adult HIV risk windows. Leve and colleagues' (2013) study followed justice-involved girls post-intervention, but intervention effects were not the focus of the longer-term follow-up study. As such, we are very limited in understanding how interventions developed and delivered in adolescence impact HIV risk into adulthood.

Evidence examined as part of this review suggests that substance use promotes HIV risk behaviors for justice-involved youth populations. With one exception [53], the cross-sectional literature underscores that substance use is associated with engaging in a variety of sexual risk behaviors including inconsistent condom use, number of sexual partners, and history of STIs. Both the cross-sectional and longitudinal studies highlight individual (e.g., history of sexual victimization, experiences of childhood trauma) and sociocontextual factors (e.g., community trauma) that may shape HIV risk. Of note is in the emergence of brain imaging data to this body of literature [39, 67]. Thayer et al. (2014) found that network connectivity strength of the dorsal default mode network was associated with initial and longitudinal trajectories of alcohol use and that alcohol use was associated with sexual risk behaviors among court-involved youth. Although these data are rare, they point to novel approaches for future research exploring associations between the experiences of alcohol use (e.g., mindfulness of body sensations) and interventions attempting to reduce alcohol use and associated sexual risk behaviors in adolescence.

It is encouraging that over the past 5 years, there has been an increase in rigorous substance use and HIV-prevention intervention study designs, particularly with community-supervised justice-involved youth who have the opportunity to engage in risk and practice prevention skills during the intervention period. Our own work demonstrates the many challenges to rigorously testing HIV-prevention interventions in court-based and other non-detention justice settings [73]; thus, these recent studies that have enrolled larger samples and conducted rigorous randomized controlled trials show promise for bringing evidence-based substance use and HIV-prevention interventions to other juvenile justice populations and settings outside of detention. Despite these advances, however, dissemination and implementation of the few existing interventions has been limited. The field is also in need of development and testing of gender-responsive interventions as the unique risk profiles, and needs of cisgender girls are supported by cross-sectional studies.

Limitations

Several limitations to the present review warrant mention. First, the findings are limited to what authors reported in each manuscript. Additional study or intervention details (e.g., intervention content, data collection procedures) that were unpublished were not requested by the authors or investigators. Second, our review intentionally did not include the few studies of substance use and justice involvement among HIV-positive youth [21–23]; this is a growing and important area of future research that can inform the field in different ways about the intersection of substance use, HIV, and justice involvement.

Future Directions

This review highlights numerous gaps in the literature and suggests many important areas for future research on the intersecting risks of HIV and substance use for justice-involved youth populations. First, in order to develop effective HIV-prevention strategies for this high-risk population, it is necessary to identify optimal opportunities within the juvenile justice continuum to assess and intervene upon HIV risk behaviors. Identifying at-risk youth and developing and implementing HIV-prevention interventions at a youth's earliest point of contact with the juvenile justice system could shift both their HIV risk trajectories and stem the progression of illness and spread of disease; for example by screening youth for sexual and substance use risk behaviors at their first point of contact with the system, such as arrest or court intake appointments. Second, although the current body of literature reflects an expanded focus to include youth in a diverse array of juvenile justice settings, there remain several underrepresented juvenile justice populations. The field remains nascent with respect to efficacious prevention interventions for high-risk subgroups such as cisgender girls and sexual minority youth. There is a desperate need to develop and test interventions that are responsive to gender, sexual orientation, and gender identity in order to address the unique behavioral risks of these subgroups. Third, emerging biomedical HIV-prevention interventions are notably absent from the reviewed literature. Questions examining pre-exposure prophylaxis (PrEP) awareness, acceptability, uptake and adherence that are being asked with increasing regularity among other high-risk populations have yet to be studied among this at-risk group of youth. PrEP, a fixed-dose combination of two antiretroviral drugs, is efficacious in preventing the transmission of HIV [74]. Clinical trials among HIV-negative individuals from high-risk groups (e.g., injection drug users) suggests that when used correctly, PrEP can significantly reduce the risk of HIV acquisition [75–78]. Given the high levels of engagement in sexual and substance use risk behaviors among justice-involved youth, PrEP and other emerging biomedical HIV-prevention technologies are a critical component of HIV-prevention efforts. Future research and intervention studies could, for example, examine justice-involved youth and emerging adults' awareness and acceptability of, and access, uptake, and adherence to PrEP. Fourth, given the strong association between HIV risk behaviors and substance use among justice-involved youth, future research should focus on development, testing, and implementation of interventions that simultaneously reduce HIV risk and substance use. Fifth, the field must start to take advantage of developing and testing digital health risk-reduction interventions (e.g., internet, text messaging, apps, social media) for this population to expand scale and impact. To date, there are no published digital health substance use and HIV/STI risk-reduction interventions for justice-involved youth. Lastly, the field is witnessing an increase in efficacious substance use and HIV-prevention interventions that now calls for novel implementation science trials with multiple different justice settings, such as the courts and probation, to understand how to effectively implement and sustain these interventions.

Conclusions

Justice-involved youth, whether detained or monitored in the community, are at significantly higher risk than their non-justice-involved peers for HIV/STI risk behaviors and infection largely owing to the intersection of substance use and sexual risk behaviors. It is encouraging to see a substantial increase in the number of studies aiming to disentangle the complex interaction of justice involvement, sexual risk behaviors, and substance use, particularly for community-supervised youth. Given that intersecting risks appear well documented, but evidence for intervention to reduce risk is much less available, this review is a call to action for the field to focus on the development, testing, and implementation of efficacious substance use and HIV/STI risk-reduction interventions that address the multifaceted needs of this diverse and vulnerable population.

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Compliance with Ethics Guidelines

Conflict of Interest The authors declare that they have no conflict of interest.

Human and Animal Rights and Informed Consent This article does not contain any studies with human or animal subjects performed by any of the authors.

Appendix 1

Table 1 Search strategies for databases. All searches were completed on 3/2/2018. A date limit from 2013 to 2018 was used; no other limits were used in the searches

Database	Search strategy	Number of results
PubMed	((incarcerat* OR probation[tiab] OR "community supervised"[tiab] OR arrest[tiab] OR arrested[tiab] OR detention[tiab] OR detained[tiab] OR prison[tiab] OR prisoner[tiab] OR prisoners[tiab] OR jail[tiab] OR jailed[tiab] OR jails[tiab] OR "prisons"[MeSH Terms] OR corrections[tiab] OR correctional[tiab] OR offender[tiab] OR offenders[tiab] OR justice[tiab] OR diversion[tiab] OR diverted[tiab] OR imprisoned[tiab] OR "Prisoners"[Mesh] OR court[tiab] OR courts[tiab]) AND (teen[tiab] OR teens[tiab] OR teenager[tiab] OR teenage[tiab] OR teenaged[tiab] OR teenagers[tiab] OR adolescent[tiab] OR adolescence[tiab] OR adolescents[tiab] OR "young adult"[tiab]OR children[tiab] OR child[tiab] OR youth[tiab] OR youthful[tiab] OR juvenile[tiab] OR youths[tiab] OR juveniles[tiab] OR "young people"[tiab]) AND ("substance use"[tiab] OR "substance abuse"[tiab] OR drugs[tiab] OR "drug use"[tiab] OR alcohol[tiab] OR opioid[tiab] OR opioids[tiab] OR cocaine[tiab] OR marijuana[tiab]) AND ("risk behavior"[tiab] OR "risk behaviors"[tiab] OR "sexual risk"[tiab] OR "sex work"[tiab] OR risky[tiab] OR tattoo* OR needles[tiab] OR needle[tiab] OR "unprotected sex"[tiab] OR "oral sex"[tiab] OR "anal sex"[tiab] OR "unprotected vaginal sex"[tiab]OR "sexually transmitted infections"[tiab] OR "sexually transmitted diseases"[tiab] OR "sexually transmitted infection"[tiab] OR "sexually transmitted disease"[tiab] OR std[tiab] OR condom[tiab] OR condoms[tiab] OR condomless[tiab] OR hiv[tiab] OR aids[tiab] OR "unsafe sex"[tiab] OR "high risk sex"[tiab] OR "sex work"[tiab]))	134
Embase	(incarcerat* OR probation:ab,ti OR "community supervised":ab,ti OR arrest:ab,ti OR arrested:ab,ti OR detention:ab,ti OR detained:ab,ti OR prison:ab,ti OR prisoner:ab,ti OR prisoners:ab,ti OR jail:ab,ti OR jailed:ab,ti OR jails:ab,ti OR "prison"/exp OR corrections:ab,ti OR correctional:ab,ti OR offender:ab,ti OR offenders:ab,ti OR justice:ab,ti OR diversion:ab,ti OR diverted:ab,ti OR imprisoned:ab,ti OR "prisoner"/exp OR court:ab,ti OR courts:ab,ti) AND (teen:ab,ti OR teens:ab,ti OR teenager:ab,ti OR teenage:ab,ti OR teenaged:ab,ti OR teenagers:ab,ti OR adolescent:ab,ti OR adolescence:ab,ti OR adolescents:ab,ti OR "young adult":ab,ti OR "adolescent"/exp OR children:ab,ti OR child:ab,ti OR youth:ab,ti OR youthful:ab,ti OR juvenile:ab,ti OR youths:ab,ti OR juveniles:ab,ti OR "young people":ab,ti) AND ('drug dependence'/exp. OR 'substance use'/exp. OR 'substance abuse'/exp. OR "substance use":ab,ti OR "substance abuse":ab,ti OR drugs:ab,ti OR "drug use":ab,ti OR alcohol:ab,ti OR opioid:ab,ti OR opioids:ab,ti OR cocaine:ab,ti OR marijuana:ab,ti OR 'street drug'/exp) AND ("risk behavior":ab,ti OR "risk behavior"/exp OR "high risk behavior"/exp OR "sexual risk":ab,ti OR "sex work":ab,ti OR risky:ab,ti OR tattoo* OR needles:ab,ti OR needle:ab,ti OR "unprotected sex":ab,ti OR "oral sex":ab,ti OR "anal sex":ab,ti OR "unprotected vaginal sex":ab,ti OR "sexually transmitted disease"/exp OR "sexually transmitted infections":ab,ti OR condom:ab,ti OR condoms:ab,ti OR condomless:ab,ti OR hiv:ab,ti OR aids:ab,ti OR "unsafe sex"/exp OR "unsafe sex":ab,ti OR "high risk sex":ab,ti OR "sex work":ab,ti)	274
PsycINFO	((MAINSUBJECT.EXACT("Prisons") OR MAINSUBJECT.EXACT("Prisoners")) OR ab(incarcerat* OR probation OR "community supervised" OR arrest OR arrested OR detention OR detained OR prison OR prisoner OR prisoners OR jail OR jailed OR jails OR "prisons" [MeSH Terms] OR corrections OR correctional OR offender OR offenders OR justice OR diversion OR diverted OR imprisoned OR court OR courts)) AND ab((teen OR teens OR teenager OR teenage OR teenaged OR teenagers OR adolescent OR adolescence OR adolescents OR "young adult" OR children OR child OR youth OR youthful OR juvenile OR youths OR juveniles OR "young people")) AND ((MAINSUBJECT.EXACT("Drug Abuse") OR MAINSUBJECT.EXACT("Alcohol Abuse") OR MAINSUBJECT.EXACT("Drug Usage") OR MAINSUBJECT.EXACT("Drug Dependency") OR MAINSUBJECT.EXACT("Polydrug Abuse")) OR ab("substance use" OR "substance abuse" OR drugs OR "drug use" OR alcohol OR opioid OR opioids OR cocaine OR marijuana)) AND ((MAINSUBJECT.EXACT("Sexual Risk Taking") OR MAINSUBJECT.EXACT("Sexually Transmitted Diseases")) OR ab("risk behavior" OR "sexual risk" OR "sex work" OR risky OR tattoo* OR needles OR needle OR "unprotected sex" OR "oral sex" OR "anal sex" OR	128

Table 1 (continued)

Database	Search strategy	Number of results
	"unprotected vaginal sex" OR "sexually transmitted infections" OR condom OR condoms OR condomless OR hiv OR aids OR "unsafe sex" OR "high risk sex" OR "sex work"))	
Web of Science	(incarcerat* OR probation OR "community supervised" OR arrest OR arrested OR detention OR detained OR prison OR prisons OR prisoner OR prisoners OR jail OR jailed OR jails OR corrections OR correctional OR offender OR offenders OR justice OR diversion OR diverted OR imprisoned OR court OR courts) AND (teen OR teens OR teenager OR teenage OR teenaged OR teenagers OR adolescent OR adolescence OR adolescents OR "young adult" OR youth OR youthful OR juvenile OR youths OR juveniles OR "young people") AND ("substance use" OR "substance abuse" OR drugs OR "drug use" OR "drug abuse" OR alcohol OR opioid OR opioids OR cocaine OR marijuana) AND ("risk behavior" OR "sexual risk" OR "sex work" OR risky OR tattoo* OR needles OR needle OR "unprotected sex" OR "oral sex" OR "anal sex" OR "unprotected vaginal sex" OR "sexually transmitted infections" OR "sexually transmitted infection" OR "sexually transmitted disease" OR "sexually transmitted diseases" OR condom OR condoms OR condomless OR hiv OR aids OR "unsafe sex" OR "high risk sex")	226
Sociological Abstracts & Social Services Abstracts	ab (incarcerat* OR probation OR "community supervised" OR arrest OR arrested OR detention OR detained OR prison OR prisons OR prisoner OR prisoners OR jail OR jailed OR jails OR corrections OR correctional OR offender OR offenders OR justice OR diversion OR diverted OR imprisoned OR court OR courts) AND (teen OR teens OR teenager OR teenage OR teenaged OR teenagers OR adolescent OR adolescence OR adolescents OR "young adult" OR children OR child OR youth OR youthful OR juvenile OR youths OR juveniles OR "young people") AND ("substance use" OR "substance abuse" OR drugs OR "drug use" OR "drug abuse" OR alcohol OR opioid OR opioids OR cocaine OR marijuana) AND ("risk behavior" OR "sexual risk" OR "sex work" OR risky OR tattoo* OR needles OR needle OR "unprotected sex" OR "oral sex" OR "anal sex" OR "unprotected vaginal sex" OR "sexually transmitted infections" OR "sexually transmitted infection" OR "sexually transmitted disease" OR "sexually transmitted diseases" OR condom OR condoms OR condomless OR hiv OR aids OR "unsafe sex" OR "high risk sex")	46
Google Scholar	(incarcerat* OR prison* OR justice OR arrest* OR detain*) AND (teen* OR adolescen* OR youth OR juvenile*) AND (drug OR drugs OR substance OR alcohol) AND ("sexual risk" OR "unsafe sex" OR "unprotected sex" OR risky OR tatoo* OR needle* OR condom*)	50
Total number of results		858
Total number of duplicates		326
Total number after de-duplication		532

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