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Screening for substance use in pregnancy and the newborn

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ABSTRACT

Substance use during pregnancy is common, costly and associated with maternal and newborn health consequences. Assessment of substance use should be integrated into prenatal care. Substance use identification methods include patient interview, screening instruments, and biological testing. In this review, we critically evaluate screening and testing for substance use during pregnancy, highlighting the benefits and barriers of integrated assessment into prenatal care. We also discuss the limitations and negative consequences that should be considered when implementing screening and/or testing procedures. Lastly, we provide recommendations for the ethical implementation of screening and testing for substance use in the context of prenatal care.

1. Introduction

Substance use during pregnancy is common, costly and associated with maternal and newborn health consequences. According to the 2016 National Survey on Drug Use and Health, 8.3% of pregnant women drink alcohol, 6.3% use illicit drugs, and 10% smoke cigarettes [1]. Although the overall prevalence of illicit drug use during pregnancy has not changed, opioid use has increased five-fold and in parallel to the opioid crisis [2]. The prevalence of substance use, however, decreases by trimester, as most women quit or cut back [1]. Maternal motivation for behavioral change is a natural part of pregnancy [3]. Hence the perinatal period offers a unique opportunity to support behavioral health change due to increased access to women throughout their perinatal care and pregnancy serving as a “teachable moment” [4]. Consequently, providers are tasked with appropriately identifying and responding to perinatal substance use.

Clinically, substance use can be assessed via patient interview, utilization of instruments, or biological testing (Table 1) [5–8]. The present paper offers a critical evaluation of screening and testing for substance use during pregnancy, highlighting the benefits and barriers of integrated assessment into prenatal care.

2. Screening

Screening is the identification of unrecognized disease in what appears to be an otherwise healthy individual [9]. Conditions appropriate for screening should meet the following criteria: 1) the condition is an important health problem; 2) acceptable treatments or interventions are available; 3) facilities for diagnosis and treatment are available; 4) there is a recognizable latent or early symptomatic stage; 5) there is a suitable test or examination; 6) the test is acceptable to population; 7) natural history of the condition is understood; 8) consensus on whom to treat as patients; 9) it is of reasonable cost; and 10) the screening process should be ongoing [10]. Substance use during pregnancy meets many but not all the WHO criteria for screening. In particular, screening acceptability has been under-examined and the social consequences of a positive test result minimized [11].

The American College of Obstetricians and Gynecologists recommend screening for alcohol and drug use in pregnancy [12] to promote early identification and referral to treatment when indicated [13]. Further, it is recommended that screening be implemented universally across socioeconomic classes and racial and ethnic groups. Screening should occur at the first prenatal visit, and for those who screen positive, it should be repeated throughout pregnancy to monitor use over time [13].

A number of screening instruments are available for use in pregnant women. Screening instruments for alcohol have been well supported in the literature [14,15]. The TWEAK [16], T-ACE [17], and AUDIT-C are among the most popular measures of risky drinking and have demonstrated the highest sensitivity in this population (see Burns et al., 2010 for review) [14]. There are less, especially comparative data, on screening instruments for illicit drug use. The 4P's Plus is a measure of alcohol and other drugs developed specifically for pregnant women and has demonstrated good sensitivity and specificity [18]. The Substance

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Table 1
Definitions of relevant concepts.

Concept	Definition
Testing	Analysis of a biological specimen (urine, blood, hair saliva, sweat, nails and meconium) to determine if an individual has used a particular drug
Screening	Brief self-report instruments used to identify severity of substance use and appropriate level of intervention
Substance Use	Use of any type of substance, including both licit and illicit substances
Substance Misuse	The use of substances for non-medical purposes in a way in which it is harmful to health
Substance Use Disorder	Cognitive, behavioral and physiological symptoms that indicate an individual is continuing to use a substance despite experiencing significant substance-related problems (DSM-5)
Addiction	A “chronic, relapsing disorder characterized by compulsive drug seeking and use despite adverse consequences"

Use Risk Profile—Pregnancy (SURP-P) [19] is also a validated three-item scale used to identify overall level of risk for substance use in pregnant women. There are at least two ongoing trials comparing different screening instruments. More definitive comparative effectiveness data is therefore likely forthcoming.

Instrument-based screening practices can be subject to specific institutional barriers, such as lack of space, time and resources to support such procedures [20]. The NIDA Quick Screen [21] has been recommended as an alternative approach to screening that only requires asking 3 open-ended questions about patient use of alcohol, tobacco, and other drugs: “In the past year how many times have you drunk > 4 alcoholic drinks per day? Used tobacco products? Taken illegal drugs or prescription drugs for nonmedical reasons?” This approach is thought to demonstrate good sensitivity and specificity and require less time and administrative support than instrument-based screening. Further, the lengthened time window beyond pregnancy could minimize fears of disclosure due to the stigma and risks associated with substance use during pregnancy [13].

Although direct screening approaches demonstrate adequate psychometric properties, they are limited in that they are highly face-valid and thus susceptible to under-reporting [22,23]. Pregnant women often underreport substance use [24] and may misreport the timing of use as occurring earlier in the pregnancy [25]. Therefore, clinician-administered measures may result in patients feeling uncomfortable disclosing their use to a medical provider. In an effort to address such issues, the wording of screening items and mode of administration has been explored. Self-administered and computer-administered instruments have been found to be associated with more accurate reporting and greater self-disclosure than face-to-face interviews [26]. In addition, indirect approaches to screening (e.g., WIDUS [23]) that ask about correlates of substance use (e.g., mental health, demographics) have been found to predict toxicology results more accurately than direct screening items.

Screening tests are not diagnostic instruments. A positive test result does not confirm the presence or absence of a substance use disorder, rather it signifies that further assessment is warranted: diagnosis via DSM criteria by a provider knowledgeable in the topical area. Regardless of screening method utilized, conversations with patients regarding substance use should be held in a non-judgmental manner and the provider should serve as a source of support to positive behavior change.

3. Barriers to identification of substance use

Obstacles to identification of substance use in pregnancy are complicated and include overall barriers to care as well as stigma and legal ramifications associated with disclosure of substance use. Since screening of substance use depends on patient attendance, barriers to care are also obstacles to identification of use. Substance Use Disorders (SUDs) are linked with factors that inhibit ability to access care, including challenges related to availability of treatment services, housing, transportation, food, and employment [27]. Similarly, psychosocial issues, such as poverty, domestic violence, and comorbid mental health issues, are more prevalent among pregnant women who use drugs and have been associated with delays in receipt of care [27].

In addition to barriers to care, identification of substance use among pregnant women is hampered by the consequences of disclosing use. SUDs are associated with greater stigma than other mental health issues [28], with pregnant women representing a particularly stigmatized subgroup [11]. This stigma extends to the care system, with providers frequently having negative attitudes toward those with SUDs which contributes to suboptimal treatment [29]. Correspondingly, punitive approaches (e.g., incarceration, civil commitment, loss of parental rights/custody) are common, and consequently, pregnant women who use drugs often avoid accessing care for fear of these repercussions [11].

4. Drug testing

In contrast with screening, which is intended to promote identification of potential problematic substance use [13], biological drug testing allows for objective identification of substance use that is not subject to the biases associated with self-report measures (e.g., response bias). Drug testing captures metabolites of substances present in the biologic compartment at a specific point in time. Although drug testing is often utilized as a component of clinical practice, improper use of tests and test results can carry serious legal and social consequences.

4.1. Maternal drug testing

Maternal drug testing can be conducted using the following biological matrices: urine, hair, saliva, blood, sweat, and nails [8,30–37]. Each biological matrix has specific strengths and limitations in drug detection in both maternal and newborn compartments (Table 2). We will focus on maternal urine drug testing as it is the most common test because it is noninvasive, inexpensive and widely commercially available. However, despite being considered the “gold standard” of substance use identification, there are many factors to consider when interpreting urine drug test results [8,38].

Urine drug test are conducted using immunoassay technology, which detect drug metabolites or classes of drug metabolites present in the urine above or below a specific threshold for each analyte measured. Most initial urine drug tests include detection of amphetamines, cocaine, cannabis, opiates, phencyclidine, and benzodiazepines, but the substances assessed vary based on the specific kit used and detection times differ greatly by substance and frequency of individual use. While the goal of initial urine drug tests is to screen for potential substance use, results should be interpreted with caution based on an understanding of the many variables that can influence the validity of these results.

Urine drug test validity is impacted by multiple factors. The detection window varies based on individual substances (see Moeller et al., 2017 for a summary of drug detection duration approximations for urine drug testing) [8]. Urine drug tests are often unable to detect certain substances, such as synthetic cannabinoids which have continually changing formulations and often market themselves as being undetectable by standard urine drug tests [39]. Point of care drug testing is clinically convenient, however test results can be difficult to interpret, especially by non-laboratory personnel [34]. Finally, the test

Table 2
Strengths and weaknesses of biological matrices for drug testing.

Biological Matrix	Strengths	Weakness
Maternal		
Urine	• Noninvasive collection • Inexpensive • Initial test = point-of-care testing (POCT) • Higher concentrations and longer detection times of metabolites compared to blood or serum	• Often unable to detect certain substances • Interpretation can be subjective when results are unclear • Multiple cross reactivities with common substances • Immunoassay sensitivity varies based on specific drug/class of drug • Adulterations possible • Window of detection varies based on substance
Hair	• Long window of detection • Noninvasive collection • Adulteration is difficult	• Requires sensitive laboratory analysis
Saliva	• Noninvasive collection • Adulteration is difficult • Association between drug concentrations in saliva is more predictable than urine	• Results vary between devices • Window of detection shorter than urine • Estimating drug concentrations is problematic • Requires sensitive laboratory analysis
Blood	• Adulteration is difficult	• Invasive collection • Lower concentrations and shorter detection times of metabolites compared to urine • Requires sensitive laboratory analysis
Sweat	• Noninvasive collection • Adulteration difficult • Prospective/continuous testing: o Longer testing window (7–14 days) than urine or saliva	• Requires sensitive laboratory analysis • Retrospective testing: o Detection window < 24 h o Primarily useful for identifying those under the influence of drugs • Prospective/continuous testing: o Drug concentrations lower than urine o Environmental contamination possible o Removal of the patch during monitoring period possible o Systematic collection challenging because of variation in locations of sweat glands
Nails	• Long window of detection • No hair-color bias • Most drugs present at higher concentration than metabolites	• Requires sensitive laboratory analysis
Neonatal		
Urine	• Same as those listed in Maternal section	• Short window of detection - varies based on substance • Initial sample often missed • Often unable to detect certain substances • Interpretation can be subjective when results are unclear • Multiple cross reactivities with common substances • Immunoassay sensitivity varies based on specific drug/class of drug • Skin irritation can occur • Collection methods can lead to adulterated samples
Meconium	• Noninvasive collection • Long window of detection	• Time intensive collection • Contamination with urine and/or stool can occur • Results take significant time; often not before discharge
Umbilical cord	• Noninvasive collection • Considered waste material • Easy and immediate collection • No challenges associated with contamination or collection • Long window of detection	• Might be discarded unless maternal drug use suspected
Hair	• Available immediately • Remains positive ≤ 3 months old	• Possibly limited amount • Potentially invasive • Short window of detection compared to meconium and umbilical cord • Expensive • Often not widely available

results are influenced by the time testing is performed, with higher drug concentrations occurring earlier in the morning [40].

Urine drug tests can result in both false-positive (due to error or cross-reactivities with other substances including prescribed medications) and false-negative results. Immunoassay sensitivity varies based on specific drug or class of drug [35]. For example, most initial urine drug tests use morphine as the calibrating drug which determines a positive result for all opioids. However, there is a low cross-reactivity between morphine and certain other opioids (e.g., oxycodone) [41]. Similarly, cutoffs for a “positive” result vary based on specific brand of drug test used [8]. Adulterations, either intentionally added to the urine by a patient or added to the substance as part of the process of creating street drugs [42], can influence test results and potentially mask substance use [43].

Because of these limitations, all initial urine drug tests should be considered presumptive, and clinicians conducting and/or interpreting initial urine drug tests must familiarize themselves with the metabolite cutoff limits and immunoassay capabilities of the specific kits being used. Additionally, routine specimen integrity measures (temperature, pH level, specific gravity, and urinary creatinine concentrations) should be incorporated to mitigate the influence of sample adulteration [8].

A positive initial test can be followed by a confirmatory test via either gas chromatography mass spectrometry or liquid chromatography tandem mass spectrometry [38]. Confirmatory Testing is more sensitive and specific than the initial urine drug test and thus ensures a more valid test result [38]. Confirmatory testing is recommended when results test results differ from self-report, when quantitative levels are clinically indicated, and, especially, when the course of clinical action will differ because of the test result [38]. It often takes days to a week for the results of a confirmatory test to be reported and is costlier than point of care testing. It should be stressed that both point of care and confirmatory urine drug tests capture substances and their metabolites within biological compartments at specific point in time. These tests do not assess behaviors associated with use, whether the individual

misused a substance or whether they have a substance use disorder. As discussed below, maternal drug testing required informed consent, especially when performed on labor and delivery.

4.2. Newborn drug testing

Drug testing can be performed on the newborn to assess prenatal drug exposure. Common biological matrices include breastmilk, urine, meconium, umbilical cord blood and hair with urine and meconium being the most commonly used [44–48]. There are advantages and disadvantages associated with each biological matrix, with no specific specimen choice clearly recommended (Table 2) [30]. It is important to note that no test captures exposures across the entire gestational period and few assess the magnitude of exposure [44]. Newborn testing is, in essence, maternal testing, and although parental consent is not legally necessary for newborn testing, the ethical principle of parsimony should apply.

5. Ethical considerations

While prenatal screening of substance use is often necessary in order to provide interventions that benefit both the mother and fetus, several ethical issues must be considered. Biological drug tests have multiple limitations and positive results can have significant ramifications. For these reasons, screening instruments are the preferred and recommended modality of substance use assessment. Across all biological matrices, drug testing should only be conducted with patient informed consent (including understanding of consequences of positive results) and in compliance with state laws [12]. Furthermore, newborn drug testing is ultimately maternal drug testing, and while consent is not required for newborn testing, ethical principles for maternal testing still apply. Providers are also ethically obligated to establish procedures for patient care following a positive screen or test result, including patient education, motivational interviewing-informed discussion to explore change, brief intervention, and referral for SUD treatment [12].

Obligations to screen for drug use and report differ globally. Australian guidelines emphasize “harm minimization” principles in the care of women but recommend infant screening [49]. European countries all have guidelines focused on treatment both during pregnancy and postpartum [50]. Reporting is restricted to instances of “risk of serious harm” only [50]. In the US, all states have policies and procedures in place regarding the notification of child protective services in the event of positive neonatal drug screens under the Child Abuse Prevention and Treatment Act [51]. However, the specific laws regarding newborn screening and procedures following a positive drug screen vary among states (see the Child Welfare Information Gateway for a complete list of state laws) [52]. These laws, while purporting to ensure safety and necessary care for neonates, are often punitive, unconstructive, and create a significant barrier to care [27]. Facilities should create policies that both comply with applicable laws and avoid discriminatory practices [45].

6. Summary and recommendations

Screening during pregnancy promotes early identification of substance use and provides the opportunity for appropriate counseling, education, and referral to treatment when indicated. A number of validated screening instruments are available using a range of different of approaches (e.g., direct, indirect) and administration modalities (e.g., self-report, computer-based). Taken together, screening provides the opportunity to stratify women into varying levels of risk and identify the appropriate level of intervention. Biological testing offers a potentially useful adjunct to screening instruments that is not subject to the biases associated with self-report measures. However, the information gained from either screening or biological testing is only useful if coupled to the clinical care of a specific individual. Screening or testing without patient engagement is potentially harmful and neither should be used in place of a comprehensive history.

Despite the benefits associated with screening during pregnancy, it is also associated with a number of limitations and negative consequences that should be considered when implementing any screening procedures. First, the stigma and punitive response associated with substance use during pregnancy results in women underreporting their use and often avoiding prenatal care altogether [11,28]. Second, positive screens and toxicology tests provide evidence of use, but they do not provide a comprehensive assessment of substance use and are not to be used as diagnostic instruments. Similarly, a negative test or screener does not rule out the presence of substance use due to under-reporting or the test providing a false negative. Finally, implementing screening procedures in clinic is associated with a number of barriers, including space, time, and clinic resources [20] that limit the dissemination of screening procedures.

7. Recommendations

Screening for substance misuse and addiction should be integrated into all domains of healthcare. Participation in such procedures should be voluntary and refusal to participate should not be clinically interpreted as evidence of substance use. Screening tools should be used as the primary identification approach, with biological testing only conducted with patient informed consent and in compliance with state laws [12]. When using biological testing, providers should be aware of the limitations of this approach, including the detection windows across substances, factors leading to false-negative and false positive results, as well as the importance of confirmatory testing. The selection of a particular screening tool should be based on the evidence supporting the instrument and the ease with which it can be successfully integrated into clinic flow.

Providers should be aware of the ethical and legal implications of screening during pregnancy. Newborn testing to avoid maternal consent is unethical and should not be used in practice. Across all screening approaches, providers are responsible to ensure adequate procedures following a positive substance use screen, including patient education, motivational interviewing around behavior change, brief intervention, and referral to treatment as needed [12]. Conversations surrounding such behavior change should be held in a non-judgmental manner and the provider should serve as a source of support to behavior change.

8. Practice points

- Screening for substance use should be integrated into all domains of healthcare.
- Screening tools should be used as the primary identification approach.
- Positive screens do not confirm the presence of substance use disorders, but signify that further assessment is warranted.
- Biological testing must be conducted with patient informed consent, in compliance with state laws, and with an understanding of the limitations of this approach.
- Providers should be aware of the ethical and legal implications of substance use identification during pregnancy.
- Newborn testing to avoid maternal consent is unethical.
- Providers are responsible for ensuring adequate procedures following a positive substance use screen.

9. Research directions

- Future research studies should focus on interventions designed to empower mothers and reduce barriers to substance misuse identification and treatment.
- The development and implementation of provider education interventions, which emphasize a compassionate and informed

approach.

- The implementation and dissemination of screening and testing procedures with linkage to evidence-based interventions.

Conflicts of interest

None.

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