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Hair drug testing results and self-reported drug use among primary care patients with moderate-risk illicit drug use

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ABSTRACT

Background: This study sought to examine the utility of hair testing as a research measure of drug use among individuals with moderate-risk drug use based on the internationally validated Alcohol, Smoking, and Substance Involvement Screening Test (ASSIST).
Methods: This study is a secondary analysis using baseline data from a randomized trial of brief intervention for drug misuse, in which 360 adults with moderate-risk drug use were recruited from two community clinics in New Mexico, USA. The current study compared self-reported drug use on the ASSIST with laboratory analysis of hair samples using a standard commercially available 5-panel test with assay screening and gas chromatography/mass spectrometry (GC/MS) confirmation. Both self-report and hair testing covered a 3-month period.
Results: Overall concordance between hair testing and self-report was 57.5% (marijuana), 86.5% (cocaine), 85.8% (amphetamines), and 74.3% (opioids). Specificity of hair testing at standard laboratory cut-offs exceeded 90% for all drugs, but sensitivity of hair testing relative to self-report was low, identifying only 52.3% (127/243) of self-disclosed marijuana users, 65.2% (30/46) of cocaine users, 24.2% (8/33) of amphetamine users, and 2.9% (2/68) of opioid users. Among participants who disclosed using marijuana or cocaine in the past 3 months, participants with a negative hair test tended to report lower-frequency use of those drugs ($p < .001$ for marijuana and cocaine).
Conclusions: Hair testing can be useful in studies with moderate-risk drug users, but the potential for under-identification of low-frequency use suggests that researchers should consider employing low detection cut-offs and using hair testing in conjunction with self-report.

1. Introduction

Substance abuse treatment in the United States and many other countries is often delivered in a specialty sector, with programs serving patients whose problems have reached a critical threshold of severity. However, the last decade has seen growing integration of substance use services within the larger US healthcare system, with a corresponding shift toward addressing a wider spectrum of substance use problems to intervene before the onset of severe disorders. The screening, brief intervention, and referral to treatment (SBIRT) model promoted by the US federal government has broadened the provision of substance use services to individuals receiving care in mainstream medical settings such as hospitals, emergency departments, and primary care (Madras et al., 2009). Prioritization of behavioral health services within the context of healthcare reform is further expected to broaden eligibility for substance misuse services and encourage their delivery in outpatient and primary care venues (Buck, 2011; Mechanic, 2012). The World Health Organization likewise supports the integration of substance misuse services into primary care, and a multinational trial found that brief intervention led to reductions in illicit drug use risks (Humeniuk et al., 2012).

Within primary care settings, many patients who report illicit drug use may have risky but irregular use patterns, and may not require nor accept specialized drug abuse treatment. Individuals with drug use patterns that place them at a moderate level of risk can be very different from individuals in specialized drug abuse treatment settings, and pose unique challenges for research.

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Clinical trials of drug abuse interventions often gauge changes in drug consumption using self-report, and rigorous studies often include a biological measure. Use of self-report in addition to toxicology testing has been recommended (Donovan et al., 2012). Urine testing is the most common form of biological testing in drug abuse studies, due to its low cost and widespread clinical use in treatment (Moeller et al., 2008). Although urine testing provides a valuable measure of drug use among patients who use drugs regularly, it has limited utility for those exhibiting more moderate use patterns because of its short detection window (less than a few days for most drugs).

Hair testing is a promising alternative to urine testing, and has found use in a range of clinical, workplace drug testing, and forensic toxicology applications (Curtis and Greenberg, 2008; Klein et al., 2000). Although not without limitations (e.g., variable hair availability/length; participant concerns about cosmetic visibility of sample collection; and higher relative cost), hair testing has several properties that make it potentially well suited for moderate-risk populations. It has an extended detection window of approximately 1 month per half inch of hair. Thus, a 1.5-in. section of hair captures a 90-day window of drug use. This detection window makes hair testing particularly attractive for studies with individuals whose intermittent and lower frequency drug use patterns resist detection by urine testing. Specimen collection is straightforward, does not pose a biohazard risk or require special storage to avoid spoilage, and is less intrusive than observed urine specimen collection. Given these advantages, it is no surprise that some clinical trials of brief intervention for drug use have begun to use hair testing as an outcome measure (Bernstein et al., 2005; Ondersma et al., 2014; Schwartz et al., 2014).

Previous research comparing hair testing to self-report has documented substantial under-reporting of drug use in both youth and adults (Delaney-Black et al., 2010; Fendrich et al., 1999; Grekin et al., 2010; Magura and Kang, 1996). A large epidemiological study with middle-aged men found that hair testing identified more cocaine users, but fewer marijuana users, compared to self-report (Ledgerwood et al., 2008). Other studies have examined the validity of hair testing in controlled settings. For example, a study with ten volunteers in a secure research ward found that concentration of cocaine and its metabolites in hair was correlated with dose level, but affected by melanin content (Scheidweiler et al., 2005). A controlled methamphetamine administration study found good evidence of dose-related detection levels for hair, but noted substantial inter-individual differences (Polettini et al., 2012). Another study with nine methamphetamine-dependent volunteers concluded that concentrations in hair generally reflect self-reported patterns of usage well, although the authors cautioned against extrapolating findings to light or occasional methamphetamine users (Han et al., 2011). A study with marijuana users found that only 7 of 13 participants who smoked cannabis in a controlled administration setting had a positive hair test (Huestis et al., 2007). Few studies, however, have examined hair testing among out-of-treatment individuals who access the broader healthcare system. A notable exception is a series of studies that examined patterns and predictors of non-disclosure of cocaine use among individuals who disclosed heroin use during an outpatient medical visit (Tassiopoulos et al., 2004, 2006).

The current study extends the literature on hair testing and self-reported drug use by examining their agreement in a sample of adult primary care patients who reported moderate-risk drug use on an internationally validated screening instrument. The overarching aim of the study is to examine the utility of hair testing as a research measure in this population. Individuals who use drugs at a moderate-risk level have distinct service needs from those with severe substance use problems, and are poised to receive increased attention from clinical researchers given the emphasis on behavioral health integration and adoption of brief intervention services across healthcare settings. Researchers designing clinical services studies are faced with a number of commercially available options for biological detection of drug use. Potentially important differences can exist in sample processing, analytical procedures, and coverage of different substances between laboratories, and even within the same laboratory across different testing products. In the current study, we examined a standard, commercially available 5-panel hair test.

2. Methods

2.1. Parent study

This study is a secondary analysis using baseline (pre-randomization) data collected for a clinical trial comparing computerized vs. in-person brief intervention for risky drug use. The study was approved by the Institutional Review Boards of Friends Research Institute and Christus Health. All participants provided written informed consent. Additional details about the parent study have been described elsewhere (Schwartz et al., 2014).

2.2. Setting

The study was conducted at two rural health centers in New Mexico, USA.

2.3. Screening and enrollment

Research assistants approached patients in the clinic waiting rooms and invited them to be screened for a health study. Patients were screened using the Alcohol, Smoking, and Substance Involvement Screening Test (ASSIST), an instrument developed and widely disseminated by the World Health Organization. The ASSIST can be used to triage patients into low-, moderate-, and high-risk categories for tobacco, alcohol, cannabis, cocaine, amphetamine-type stimulants, inhalants, sedatives, hallucinogens, and opioids (Humeniuk et al., 2008; Newcombe et al., 2005).

Inclusion criteria were age 18 or older and illicit drug use (including non-medical use of prescription drugs) at a "moderate-risk" level as defined by the ASSIST (i.e., a score of 4-26 for any substance other than tobacco or alcohol). Exclusion criteria were: "high risk" ASSIST score for alcohol or any drug other than tobacco, drug abstinence in the past 3 months, enrollment in substance abuse treatment within the past year, recent receipt of a brief intervention for drug use at the clinic, and plans to move out of state within a year. Among patients eligible for the parent study, 25% declined to participate. Three hundred and sixty participants were enrolled, one of whom was subsequently withdrawn due to current enrollment in substance abuse treatment (an exclusion criterion).

Several steps were taken to improve accuracy of self-report. The screening interview with the ASSIST was conducted anonymously, without recording names or identifying information. Screening information was linked with study data only after determining eligibility and obtaining written informed consent. Confidentiality protections were emphasized during the screening introduction, and participants were assured that their responses would not be shared with clinic staff or become part of their medical record.

2.4. Participants

The parent study included 359 participants with moderate-risk drug use, of whom 46% were female, 47% were Hispanic ethnicity, and 90% were White. The mean age was 36.1 years (SD = 14.6).

2.5. Measures

2.5.1. ASSIST. The ASSIST was administered during eligibility screening as described above. The ASSIST has established validity for identifying substance use risks (Humeniuk et al., 2008; Newcombe et al., 2005). Past 3 month frequency of use is gauged for each substance, on a response scale of Never, Once or Twice, Monthly, Weekly, and Daily or Almost Daily. Other items tap indicators of problem use (e.g., failed attempts to quit/cut down).

2.5.2. Hair testing. Hair samples were collected using laboratory-recommended procedures, whereby samples were measured to 1.5 in. from the scalp, corresponding to the 3-month time frame of self-report on the ASSIST (participants with insufficient head hair were asked to provide body hair). Hair samples were sent to a commercial laboratory (Confirm Biosciences/Omega Laboratories, Mogadore, OH) and analyzed for presence and quantity of marijuana, cocaine, amphetamines, and opioids (and phencyclidine, for which there were no positives). Although it did not test for all possible drugs, the standard 5-panel test was selected for the parent study because it was readily commercially available and was thought to cover the