



K22 Cocaine Testing of Drug Treatment Patients - Comparison of Urine, Sweat, Oral Fluid, Skin Wipes, and Hair

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After this presentation, attendees will understand some benefits and limitations of urine, sweat, oral fluid, skin wipes, and hair as forensic drug testing matrices; some characteristic patterns observed in daily urinalysis; an improved sweat collection procedure; examples of false positives; and recommendations for prudent interpretations of drug test results.

This presentation will impact the forensic community by introducing ways to improve the reliability of drug testing and its interpretation/reporting.

This study compared the matrices of urine, skin swabs, sweat, and hair for monitoring cocaine use, with urinalysis being the gold standard, or arbitrator of use. Possible environmental contamination was measured through skin swabs. Unique aspects included *daily urine monitoring* (Monday-Saturday) of 35 participants for up to four weeks, simultaneous monitoring methods of all matrices, CI-GC/MS analysis to the limit of detection (LOD), and the potential for ongoing illicit drug use by participants in cocaine dependence treatment. This report expands an earlier pilot study. In the current cohort of participants, twenty showed virtually no cocaine use by urinalysis, four tested positive continuously, and eleven displayed infrequent use. Proposed new cut-off levels for the various matrices are based on receiver operating characteristic (ROC) curves widely used in clinical chemistry for cost/benefit analyses for a matrix assay using false positive and false negative rates to determine statistically how well it correctly identifies a positive result (defined as sensitivity) and how well it identifies a negative result (defined as specificity).

Identification of cocaine use was based on the intensity and shape of the urine BE excretion curve over several days and acceptable creatinine levels. Urine specimens exhibited a sensitivity of 0.86 at 100 ng/mL BE (n=934) and a specificity of 0.99. At 300 ng/mL BE, the sensitivity was 0.76 and the specificity was 0.998. The few false positives in urine were attributed to inadvertent ingestion of trace amounts of cocaine by the participants.

Skin swabs showed contamination on either hands or forehead, even with urine-negative participants. Generally, the skin contamination paralleled the drug use pattern detected by urinalysis. The amounts of cocaine on skin in some cases far exceeded the amounts attributable to drug use alone, with the excess caused by skin contact with drug residues.

Sweat was collected using PharmChek™ sweat patches applied on alternating arms at approximately four-day intervals. False positives (defined as the presence of drug or metabolite without intentional drug use) occurred at a 1.8% rate at the proposed cutoff concentrations, 75 ng cocaine/patch in this research. Using the ROC curves, the diagnostic test sensitivity was 0.60 (n=301). At the SAMHSA cutoff of 25 ng cocaine/patch a 10.6% false positive rate was observed. Pretreatment of selected patches with glycerol resulted in enhanced drug transfer from the skin to the patch when compared with non-treated patches.

Oral fluid was collected with Sarstedt Salivettes™. Oral fluid cocaine levels generally paralleled urine BE at substantially lower concentrations. For oral fluid cocaine or BE levels >15 ng/mL of extract, the diagnostic test sensitivity was 0.68 among chronic users (n=103) and 0.34 for occasional users (n=243). The specificity was 1.00 for chronic users and 0.97 among occasional users.

Hair was collected at the beginning and end of the 4-week study period. Although prior use patterns were unknown, the median cocaine concentration for African-American hair at the beginning of the study was 6.1 ng/mg hair vs. 1.2 ng/mg of Caucasian hair. African-American hair tended to retain cocaine longer so that at the end of the study the median level was 4.9 ng/mg compared to 0.24 ng/mg for Caucasian hair. The concentrations of cocaine in the hair of individuals who were abstinent during the study period did not fall to zero even though no drug use was identified. ROC curves were not generated for hair due to limitations of the sampling interval and related hair growth.

These results indicate that, while each drug testing method has its strengths and limitations, urine appears to be less susceptible to environmental contamination than other matrices.

Cocaine, Drug Testing, Contamination