

## Sweat Testing May Prove Useful in Drug-Use Surveillance

By Neil Swan, NIDA NOTES Contributing Writer

Chemical analysis of human sweat may become an effective method of monitoring drug use over extended periods, according to NIDA researchers. Sweat, collected over several days or weeks in patches worn on the skin, is a sensitive indicator of heroin and cocaine use, according to Division of Intramural Research investigators at NIDA's Addiction Research Center in Baltimore.

The current standard test for evidence of drug use is urinalysis. But most drugs of abuse are cleared from urine within 2 to 3 days, meaning that urine screening must be performed two to three times a week to effectively monitor drug use on a continuing basis.

Refinements in tests that use hair or sweat may provide a reliable drug-use monitoring procedure that could be performed less frequently and with less invasion of privacy than urine tests. Drugs and their chemical byproducts of metabolism, called metabolites, are excreted into sweat and then bind to hair, where they can remain detectable for months. Human hair is now being used for some drug-use testing, although far less commonly than urine. Sweat testing is now being performed for cocaine, amphetamines, and opiates.

"It appears that chemical analysis using sweat patches worn continually for a week could provide effective drug-use surveillance," says Dr. Edward J. Cone, principal investigator and a research chemist at the ARC. The patch might serve as a useful monitoring device for people in drug abuse treatment or under court supervision or probation, he says. To prevent tampering to conceal drug use, the patch is specially designed so that once removed, it cannot be reattached to the skin.

Previous research has determined that residues of a number of drugs can be detected in human sweat, including alcohol, amphetamine, cocaine, heroin, morphine, methadone, methamphetamine, and phencyclidine (PCP). In recent studies, researchers used a sweat patch, which resembles a common Band-Aid<sup>®</sup>, to collect sweat from test participants. The subjects were residents of the ARC's clinical ward with a history of cocaine or heroin abuse. The patch, which collects accumulating sweat on an absorbent cellulose pad, is designed to be worn for several days, although test participants said that the patches could be worn for up to 4 weeks with minimal discomfort.

Sweat patches were removed after varying lengths of time and frozen until the accumulated sweat residue was assayed by gas chromatography-mass spectrometry, a precise analytical process for separating and identifying chemical compounds. The sweat residues were analyzed for cocaine and heroin.

### Comparison of Urine, Sweat, and Hair Testing for Cocaine and Heroin

Issues	Urine	Sweat Patch	Hair
Type of Measure	Incremental	Cumulative	Cumulative
Invasiveness	High	Low	Low
Detection Period	2-3 days	Weeks	Months-Years
Risk of False Positives*	Low	High	High

Risk of False Negatives**	High	Undetermined	Undetermined
Risk of Adulteration	High	Undetermined	Low
Technological Development			
<i>Screening Assays</i>	Plentiful	Needed	Needed
<i>Confirmation Assays</i>	Plentiful	Needed	Needed
<i>Cutoffs</i>	Established	Needed	Needed
<i>Control Materials</i>	Plentiful	Needed	Needed
Cost Per Unit Test	Low	Undetermined	High

\* *False positives resulting from environmental contamination of the biological specimen during collection and handling and from passive drug exposure as a result of, for example, contact with skin or exposure to cocaine vapors*

\*\**False negatives resulting from the drug detection "window" of the biological specimen.*

After cocaine was administered to test participants, the drug was detectable in sweat within 1 to 2 hours and concentrations peaked within 24 hours. Cocaine was detectable in trace amounts following doses as small as 1 milligram. Concentrations of cocaine in sweat increased in apparent relation to the amount of the dose. The lowest dose of cocaine (1 to 5 milligrams) detectable in sweat was below the dose needed to produce drug-induced effects and euphoria, Dr. Cone says. In addition to cocaine, smaller amounts of cocaine metabolites were also detected.

Heroin traces in sweat were also studied. After administration of the drug, the heroin metabolite 6-acetylmorphine appeared rapidly in the sweat, and levels continued to increase while levels of heroin decreased over time. This suggests that heroin was undergoing hydrolysis (fragmentation from heroin to the metabolite) in the sweat patch, according to the ARC researchers.

The investigators compared characteristics of drug testing using specimens of human urine, sweat, and hair (see table on previous page). Costs of sweat testing have not yet been determined.

"Sweat testing is a relatively noninvasive way to obtain a cumulative estimate of drug use over several weeks," says Dr. Cone. But analyses of sweat and hair to detect drug use involve new technologies that require further research and development, he adds.

**Source:**

Cone, E.J.; Hillsgrove, M.J.; Jenkins, A.J.; Keenan, R.M.; and Darwin, W.D. Sweat testing for heroin, cocaine, and metabolites. *Journal of Analytical Toxicology* 18:298-305, 1994.

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