K38 Analysis of Cocaine Analytes in Human Hair II: Evaluation of Different Hair Color and Ethnicity Types Following Surface Contamination and Laboratory Decontamination

Jeri D. Ropero-Miller, PhD, and Cynthia Lewallen, MS, RTI International, 3040 Cornwallis Road, Building 3, 3040 Cornwallis Road, Research Triangle Park, NC 27709; Nichole D. Bynum, MS, Center for Forensic Sciences, RTI International, 3040 Cornwallis Road, Building 3, Research Triangle Park, NC 27709; Meredith Meaders, BS, RTI International, 3040 Cornwallis Road, Building 3, Research Triangle Park, NC 27709; Jordan N. Espenshade, MSFS, 1420 Centre Avenue, Apartment 103, Pittsburgh, PA 15282; and John M. Mitchell, PhD, Michael R. Baylor, PhD, and Peter R. Stout, PhD, Center for Forensic Sciences, RTI International, 3040 Cornwallis Road, Research Triangle Park, NC 27709*

After attending this presentation, attendees will understand: (1) the in vitro model of drug surface contamination used to investigate cocaine analyte concentrations and ratios in hair; (2) the permeability of hairs and potential variations in drug absorbance in different hair color and types; and (3) how processes and procedures used by hair drug testing laboratories may affect drug analyte concentrations in hair.

This presentation will impact the forensic science community by directly affecting policy implementation for forensic applications of hair testing, such as the investigation of drug facilitated crimes and workplace drug testing.

Introduction: The mechanism(s) of permeability of hair to drugs are not fully understood. Research data suggest that hair color may affect cocaine's incorporation into and retention in the hair matrix. The possibility that because of hair color one individual may be more likely to test positive for a drug than another, despite both having ingested or having been exposed to the same amount of a drug, greatly concerns policymakers and forensic practitioners. The potential for such bias must be understood to ensure the correct interpretation of results and the appropriate use of hair testing. If it is shown that hair color influences drug permeability, current drug testing methods may need to be improved in order to take these variations into account and remove any potential for bias and false-positive results. The goal of this study was to evaluate cocaine analytes in hair of different color (e.g., light, dark) and ethnic origin (e.g., Caucasian, African American) after the hair has been subjected to surface contamination with cocaine and subsequent laboratory decontamination.

Methods: The *in vitro* surface contamination study design was modified to a shorter collection time, but generally followed a previously published method by Stout et al. 2006. Briefly, verified drug-free head hair samples (Caucasian light and dark hair types, African American; n=12 each) were collected under IRB protocol, contaminated with cocaine HCl powder, shampooed daily for 8 weeks with aliquots removed weekly for decontamination (two washing protocols: methanol and extensive phosphate buffer) and cocaine analyte testing by LC/MS/MS. Quantitative analytical procedures for the determination of COC, BE, CE, and NCOC in hair were performed on an Agilent Technologies 1200 Series liquid chromatography system coupled to a 6410 triple quadrupole mass spectrometer, operated in positive ESI mode. For confirmation, two transitions were monitored and one ion

ratio was determined which was acceptable if within 20% of the ratio of known calibration standards. The limits of quantitation (LOQ) for COC was 25 pg/mg and BE, CE, and NCOC were 2.5 pg/mg. The upper limit of linearity was 55,000 pg/mg for cocaine and 1,000 pg/mg for all other analytes. Between run imprecision for COC at 150 pg/mg was less than 3% and at 15 pg/mg for all other analytes was less than 8%.

Results: While previous cocaine surface contamination studies were designed to provide an estimate of interindividual variation, this study included sufficient samples to determine differences between ethnic groups or hair color with statistical significance. The preliminary data suggests there was no apparent simple relationship between concentration and hair color by this *in vitro* cocaine surface contamination model.

Conclusion: The results of this study along with continued studies may influence how hair testing results are interpreted, and could have a significant impact on whether national agencies use hair testing.

Hair, Cocaine Analytes, LC/MS/MS

 ** Presenting Author*