Y11 The Analysis of Fentanyl and Its Analogs and Metabolites in Postmortem Blood Using Biocompatible Solid-Phase Microextraction (BioSPME) and Liquid Chromatography-Tandem Mass Spectrometry (LC-MS/MS)

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Learning Overview: After attending this presentation, attendees will be informed on a new possible analysis method for fentanyl and its analogs using a BioSPME extraction and LC-MS/MS that decreases analysis time.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by providing a newly validated method for an efficient extraction and overall analysis of fentanyl and its analogs in the height of the opioid epidemic.

In 2016, approximately 13 people died of a drug-related overdose each day in Pennsylvania. In all, 4,642 drug-related overdose deaths were reported that year by Pennsylvania coroners and medical examiners. In 52% of these cases, fentanyl and fentanyl-related substances were identified in decedents, with heroin being the second most frequently identified substance. This is an increase of 27% from the previous year. Due to the ease with which these illicitly manufactured fentanyl and fentanyl analogs can be synthesized, it is essential that new validated methods be investigated. In addition, it is often difficult to synthesize standard reference materials for the increasing number of illicitly manufactured fentanyl analogs. It is also expensive for laboratories to purchase all the standards needed for developing methods and analyzing samples with these compounds included in the panel. Structural similarities among many of these analogs also present unique challenges for toxicology laboratories. For example, by adjusting the position of a single additional methyl group, a total of 15 different analogs can be synthesized. The presence of fentanyl analog isomers and isobaric compounds causes great difficulty in separation using LC. Additionally, the fentanyl epidemic is also causing an increase in casework. Therefore, the development of more efficient techniques for screening postmortem samples for fentanyl and its analogs would greatly benefit toxicology laboratories.

The purpose of this study is to compare a new *in vivo* BioSPME technique to an existing technique used in the toxicology department at Health Network Laboratories (HNL) located in Allentown, PA. The toxicology department at HNL is a full-service toxicology laboratory, providing therapeutic drug monitoring, compliance drug testing, workplace drug testing, Driving Under the Influence (DUI)/Driving Under the Influence of Drugs (DUID), and postmortem toxicological services. BioSPME was developed as an extraction method that could quickly extract drugs from biological fluids without the binding of macromolecules, which was a concern for previous SPME techniques. The use of BioSPME fibers allows for the direct analysis of a free analyte fraction on traditional Liquid Chromatography/Mass Spectroscopy (LC/MS) methods. These tips also open the door to the possibility of future direct MS analysis that could greatly impact the field by providing a rapid detection method for these fentanyl compounds, a capability that could drastically reduce sample preparation and analysis times.

In this study, a method to analyze 19 different fentanyl analogs in postmortem blood is being developed using both BioSPME and HNL's extraction method. The method will utilize both Time-Of-Flight/Mass Spectrometry (TOF/MS) as a screening method and LC-MS/MS as a quantitative method.

Fentanyl, Toxicology, LC-MS/MS