



## Pathology/Biology - 2017

### H134 Deaths From Combined Methamphetamine and Heroin Use in Denver: 2005-2016

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After attending this presentation, attendees will better understand trends of methamphetamine and heroin use in Denver, CO, some of the possible reasons thereof, and the interpretation of applicable toxicology results.

This presentation will impact the forensic science community by describing emerging trends of methamphetamine and heroin abuse in Denver, a previously unreported subject in the Rocky Mountain region.

Methamphetamine and its metabolite, amphetamine, are strong sympathomimetic and dopaminergic stimulants whose overall overdose mortality in the United States increased nearly two-fold from 1999 to 2009.<sup>1,2</sup> Likewise, there has been an increase in methamphetamine use during the past several years in Denver.<sup>3</sup> Since 1999, deaths from heroin, an opioid with analgesic and sedative properties, increased five-fold nationally.<sup>4</sup> While much is known about the effects of either methamphetamine or heroin alone, comparatively little is known about the two drugs when they are taken concomitantly or in succession.<sup>5,6</sup> Some studies have found a synergistic effect between the two drugs and postulated that one may ameliorate the unwanted side effects of the other.<sup>7</sup> Readiness of availability is another factor.<sup>8</sup> Informal clinical observations in Denver reveal that approximately half of known local injection drug abusers use a combination of methamphetamine taken simultaneously or in succession with heroin, and that this trend is increasing. This study reports mortality data from combined methamphetamine and heroin toxicity using records of the Denver Office of the Medical Examiner (DOME) from 2005-2016.

The DOME maintains a searchable database of all deaths reported to the office using modified Systematized Nomenclature of Medicine-Clinical Terms. The database was queried for deaths in which toxicology results were positive for a combination of methamphetamine and heroin or one or more of its metabolites, 6-monoacetylmorphine (6-MAM) and morphine. Toxicological testing was performed according to internal laboratory protocols with appropriate controls at National Medical Services, Inc., Willow Grove, PA, by means of Gas Chromatography/Mass Spectrometry (GC/MS) and/or Liquid Chromatography/Mass Spectrometry (LC/-MS) on blood samples, and enzyme immunoassay on urine samples. At autopsy, peripheral blood was selected for analysis preferentially, with occasional substitution of heart or cavity blood and the addition of urine, depending upon the circumstances and specimen availability for a given case. Each autopsy report was reviewed by forensic pathologists to ensure that the toxicology results and circumstances surrounding the death were consistent with the use of both methamphetamine and heroin by the decedent. Cases in which drugs were detected but did not cause death directly (e.g., trauma) were excluded.

Sixty-seven total deaths resulting from combined methamphetamine and heroin use were identified since 2005. Deaths from this combination remained stable from 2005 to 2010, and increased steadily from 2010 onward. The absolute increase from 2010 to 2016 was greater than five-fold; the increase was nearly five-fold when corrected for population growth. Methamphetamine was found together with 6-MAM in 46/67 cases (69%). Methamphetamine was found with morphine in the absence of 6-MAM in 21/67 cases (31%).

Frequent detection of methamphetamine with 6-MAM indicates a substantial portion of cases in which methamphetamine and heroin are taken together and cause death rapidly, before either drug can be further metabolized.

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Detection of methamphetamine with morphine alone suggests acute use of methamphetamine and subacute use of heroin preceding death (i.e., alternating injections). The data are in agreement with clinical observations of drug use behaviors in Denver.

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### Methamphetamine, Heroin, Overdose