



### H126 Deaths in Denver With the Detection of Cannabinoid Metabolites: 2010-2016

Derek Bumgarner, MD\*, Denver Office of the Medical Examiner, 660 Bannock Street, Denver, CO 80204; Meredith A. Frank, MD, Denver Office of the Medical Examiner, 660 Bannock Street, Denver, CO 80204; Krista L. Timm, MD, Denver Office of the Medical Examiner, 660 Bannock Street, Denver, CO 80204; and James Louis Caruso, MD, Denver Office of the Medical Examiner, 660 Bannock Street, Denver, CO 80204

After attending this presentation, attendees will understand the timeline of legalization of marijuana in Colorado and the impact this has had on deaths in Denver, CO.

This presentation will impact the forensic science community by reporting on the incidence of detection of cannabinoid metabolites in forensic cases and discussing trends for deaths in Denver, CO, in relation to the legalization of marijuana in the state of Colorado, a previously unreported topic.

Federal law prohibits cannabis for medicinal and recreational purposes by its classification as a Schedule I Controlled Substance. Amendment 64 to the Colorado State Constitution legalized the personal possession of cannabis for medicinal and recreational consumption in November 2012; state-regulated commercial sales of cannabis products to the general public commenced on January 1, 2014.<sup>1</sup> This study explores the effects that cannabis legalization has had on mortality statistics in Denver, with examination of pre/post legalization trends regarding manner of death.

The Denver Office of the Medical Examiner (DOME) is responsible for medicolegal death investigation in the City and County of Denver, where three Board-certified forensic pathologists and one forensic pathology fellow oversee investigation of sudden or unexplained deaths. In this jurisdiction, deaths are categorized by manner, which consist of natural, accident, suicide, homicide, and undetermined. Samples of postmortem peripheral blood or antemortem specimens (if available) are retained and submitted for testing of commonly abused drugs, including cannabinoids (Tetrahydrocannabinol (THC), and metabolites of 11-hydroxy delta-9 THC, delta-9-THC, and delta-9 carboxy THC).<sup>2</sup> Toxicological testing was performed according to internal laboratory protocols with appropriate controls at National Medical Services, Inc, Willow Grove, PA, by means of High-Performance Liquid Chromatography/Tandem Mass Spectrometry (HPLC/MS/MS).

DOME employs a searchable database regarding cases within its jurisdiction, which includes a coding system that allows documentation of substances detected by toxicological testing. Query of the DOME database revealed a total of 3,075 postmortem examinations in which toxicology studies were ordered during 2010–2016. Of these postmortem examinations with toxicology, 688 (22%) were positive for cannabinoids. Given that the state legalization for commercial sales of marijuana commenced on January 1, 2014, it is determined that 1,682 cases occurred “pre-legalization” and 1,393 cases were “post-legalization.” Those cases that resulted positive for the detection of cannabinoids during these time periods, as well as the trends within various manners of death, will be discussed.

Of the total cases with toxicology, 1,185 were ruled with a manner of non-traffic accident (39%), natural 989 (32%), suicide 344 (11%), homicide 252 (8%), traffic-related accident 163 (5%), and undetermined (5%). Pre-legalization, there were 653 non-traffic accidental deaths, and of these, 82 (13%) resulted positive for cannabinoids. Post-legalization, there were 543 non-traffic accidental deaths, and of these, 88 (16%) resulted positive for cannabinoids. Pre-legalization, there were 615 natural deaths, and of these, 127 (21%) resulted positive for cannabinoids. Post-legalization, there were 374 natural deaths, and of these, 98 (26%) resulted positive for cannabinoids. Pre-legalization, there were 126 suicides, and of these, 16 (13%) resulted positive for cannabinoids. Post-legalization, there were 218 suicides, and of these, 75 (34%) resulted positive for cannabinoids. Pre-legalization, there were 128 homicides, and of these, 67 (52%) resulted positive for cannabinoids. Post-legalization, there were 124 homicides, and of these, 56 (45%) resulted positive for cannabinoids. Pre-legalization, there were 73 traffic-related accidental deaths, and of these, 23 (32%) resulted positive for cannabinoids. Post-legalization, there were 90 traffic-related accidental deaths, and of these, 40 (44%) resulted positive for cannabinoids. Pre-legalization, there were 98 deaths with an undetermined manner, and of these, 11 (11%) resulted positive for cannabinoids. Post-legalization, there were 44 deaths with an undetermined manner, and of these, 5 (11%) resulted positive for cannabinoids.

Frequent detection of cannabis metabolites was identified in all manners of death in Denver for the years 2010–2016, and the results of this study reveal an overall increase in the presence of cannabinoid metabolites in fatalities during the three years following the legalization of marijuana sales in Colorado. Furthermore, cannabis metabolite detection was increased post-legalization in manners of non-traffic accidents by 3%, suicide by 17%, traffic-related accidents by 12%, and natural by 5%. Homicides demonstrated a decrease in detection of cannabinoids by 7%. Deaths which remained undetermined in manner revealed no significant change.

#### Reference(s):

1. Source: Fort Collins Government. *Amendment 64: Use and Regulation of Marijuana*. <http://www.fcgov.com/mmj/pdf/amendment64.pdf> (accessed July 26, 2017).
2. Sharma P., Murthy P., Bharath M.M.S. Chemistry, Metabolism, and Toxicology of Cannabis: Clinical Implications. *Iranian Journal of Psychiatry*. 2012;7(4):149-156.

#### Marijuana, THC, Legalization