



### B146 Canine Detection of Organic and Inorganic Gunshot Residues (GSR) on the Suspected Shooters

Marcello Rendine, DBA\*, Department of Forensic Pathology, Foggia 71100, ITALY; Irene Riezzo, MD, PhD, University of Foggia, Osp D'Avanzo, Foggia 71100, ITALY; Carmela Fiore, MD, Ospedale "G. Tatarella", Cerignola, Foggia 71100, ITALY; Michela Ferrara, MD, Department of Forensic Pathology, Foggia 71122, ITALY; Francesco Sessa, MS, Department of Forensic Pathology, University of FOGGIA, Foggia 71100, ITALY; Gianfranco Guccia, Palermo 90145, ITALY; Pietrantonio Ricci, MD, PhD, Department of Clinical and Experimental Medicine, Foggia 71100, ITALY

**Learning Overview:** After attending this presentation, attendees will have a better understanding of how a well-trained scent-detection dog can be an alternative and rapid tool to facilitate the identification of a suspected shooter.

**Impact on the Forensic Science Community:** This presentation will impact the forensic science community by providing a variety of benefits to law enforcement regarding the need to improve the performance, reliability, and courtroom defensibility of detection dog teams and their optimized combination with forensic operators, showing their capability in detection and identification of gunshot residue.

The identification and the analysis of gunshot residue are important evidences in the field of forensic science and there is a need for the development of tools more rapid and sensitive than stubs or swabs, to obtain more conclusive results.

This study determined that trained detection dogs alert to organic compounds and inorganic components indicative of gunshot residues presence on the hands and the clothing of shooters and non-shooters, maximizing the finding of the shooter in an efficient, cost and time effective manner.

The identification of the suspected shooter may often be ambiguous during initial processing investigation, and the test may not always be obvious after some days if the suspect has not been apprehended immediately because GSR persistence decreases quickly with time.

Furthermore, in cases of foul play, a shooter may attempt to scrub and clean up gunshot residues from his own hands, from clothing, or from other surfaces.

For this reason, the investigation findings and the subsequent scientific evaluation of a suspected shooter require a relatively short response time to avoid contamination and to preserve any and all possible evidence of the shooting.

This study aimed to investigate the baseline detection limits of GSR-detection dogs and to latent gunshot residues evidence on washed hands, face, and clothing, to potentially generate an alert by a detection canine by a *positive predictive value* (PPV), and to compare the dogs' responses to current presumptive chemical and analytical techniques.

Field trials experiments to determine canine interest in the observed GSR samples were conducted.

The canine detection of GSR scent in low concentration is called "*sensitivity*".

In addition, this study reports the analysis of several potential interference odorant compounds (i.e., hands soap, household laundry detergent, perfume, etc.) at these GSR scent traces in minimum concentration, and the associated percentages of false positive alerts (false PPV).

The canine discrimination of GSR scent traces in minimum concentration is called "*specificity*".

After this training, a series of field trials are performed to test the canine's "*limit of detection*" (LOD) for the GSR, which is the lowest quantity of a substance that the dog can be distinguished from the absence of that substance (blank value). The limit of detection has been determined by performing scent line-ups in which various amounts of GSR have been exposed and the lowest concentration of GSR for which the canine can still alert have been recorded.

The study demonstrates that canines are generally not using the relatively low volatility parent substances, but instead use characteristics VOCs (volatile organic compounds) to accurately locate specimen of GSR, with the ability to distinguish between inorganic and organic residues of gunshot. The results of this study indicate that the well-trained gunshot detection dog is an outstanding tool for suspected shooter investigation, displaying excellent sensitivity (100), specificity (99), and having a positive predictive value (99), negative predictive value (99) as well as accuracy (99).

These recovery rates ranged between 99% and 100% indicate that properly trained GSR dogs can make significant contributions in the finding GSR traces and so in the identification the shooter.

#### Gunshot Residue (GSR), Canine Detection and Identification, Suspected Shooter