Chromatographic separation of delta-8-carboxy-THC and delta-9-carboxy-THC to evaluate the false positive rate of urine THC immunoassay screens

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BACKGROUND

Immunoassays for drug screening measure analytes through antigen-antibody binding and can give a presumptive result quickly, though they may be prone to false positives and false negatives. Confirmation testing is typically performed by liquid chromatography (LC) coupled with tandem mass spectrometry (MS/MS). While mass spectrometry is the gold standard for sensitivity, specificity and selectivity in drug measurement, this test may not be readily available and is more time consuming than immunoassays. Automated urine drug screens targeting delta-9-carboxy-THC, the primary urinary metabolite of the psychoactive cannabinoid delta-9-THC, cannot differentiate this compound from delta-8-carboxy-THC due to similarity in molecular structure. Therefore, there is concern that a patient who uses products containing only delta-8-carboxy-THC could yield a positive urine screening result for delta-9-carboxy-THC.

RESEARCH QUESTION

What is the false positive rate for a commercially available urine delta-9-carboxy-THC immunoassay screen in the central Iowa veteran population?

METHODS

- Data was collected from the veteran population from 5/9/2024 until 11/18/2024 in central Iowa.
- Urine specimens were screened using a commercially available THC immunoassay on Abbott Alinity instrumentation. All presumptive positive results were confirmed using liquid chromatography tandem mass spectrometry (LC-MS/MS).
- The Abbott Alinity THC immunoassay has a cutoff value of 50 ng/mL.
- The analytical measurement range for the quantification of delta-9-carboxy-THC by LC-MS/MS is 20-2000 ng/mL.
- Each specimen's chromatography was manually reviewed for categorization into one of the following groups:
  - Delta-9-carboxy-THC
  - Delta-8-carboxy-THC
  - Both Present
  - Both Absent

RESULTS

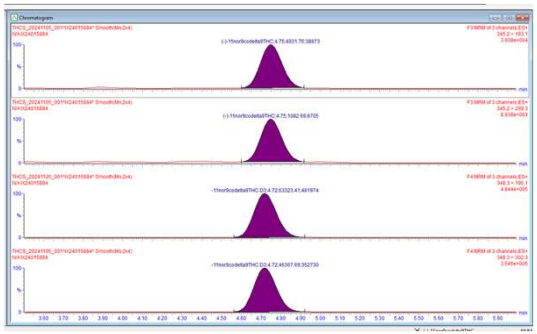


Figure 1: A true positive sample containing the internal control as well as the delta-9-carboxy-THC daughter ions can be determined by the retention time, ion ratio, and internal control peak's area. A concentration of 211 ng/mL is reported for delta-9-carboxy-THC.

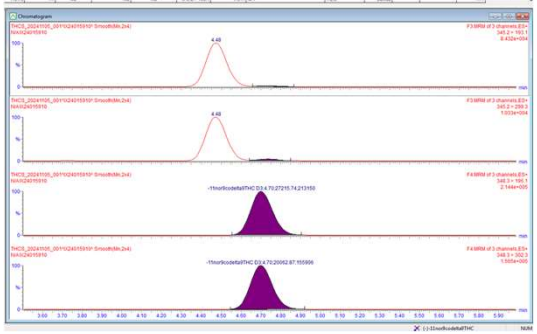


Figure 2: A peak (delta-8-carboxy-THC) precedes the deuterated internal standard. The amount of delta-9-carboxy-THC is below the quantification limit (20 ng/mL).

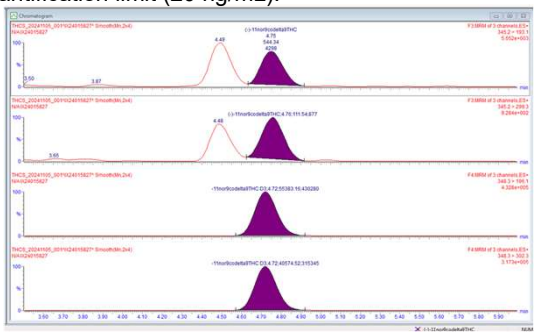
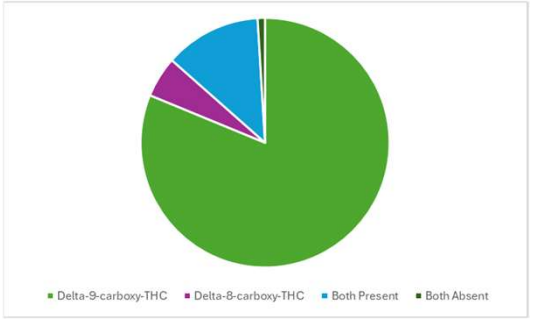


Figure 3: This sample contains both delta-8-carboxy-THC and delta-9-carboxy-THC. Delta-9-carboxy-THC is quantifiable at 27 ng/mL.

RESULTS

- 415 positive THC screens were confirmed by mass spectrometry in a 6-month timeframe.
- 94% contained a quantifiable amount of delta-9-carboxy-THC upon confirmation
- 81% had a singular chromatographic peak identified as delta-9-carboxy-THC
- 5% had a singular chromatographic peak identified as delta-8-carboxy-THC
- 13% had both compounds present
- 1% did not contain either delta-9-carboxy-THC or delta-8-carboxy-THC



CONCLUSIONS

In our population of patients with positive urine THC screens, approximately 18% used delta-8-THC-containing products. In 5% of samples with positive urine THC screens, delta-8-carboxy-THC was present without quantifiable delta-9-carboxy-THC. In another 1% of samples, neither delta-8-carboxy-THC nor delta-9-carboxy-THC were present. Our urine THC immunoassay screen demonstrated a positive predictive value (PPV) of 94% for true use of delta-9-THC. LC-MS/MS-based methods provide unparalleled specificity in distinguishing isobaric structures, such as delta-8-carboxy-THC and delta-9-carboxy-THC and can be used to evaluate the performance of routine automated immunoassays used for urine drug screening.

FURTHER QUESTIONS

Additional questions may be directed to Darcy Dochterman at Darcy.Dochterman@va.gov. The authors of this poster have indicated that they have no relevant conflicts of interest.