K31 Application of Models for the Prediction of Time of Marijuana Exposure From Blood of Drivers Arrested for DUI

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After attending this presentation, attendees will learn how clinically derived models for time of prediction of marijuana use in DUID cases was applied to data from actual driving under the influence cases. The model based upon THC concentrations, alone, was not predictive but the model based upon THC>carboxy-THC ratios had some predictive value.

This presentation will impact the forensic community and/or humanity by demonstrating how driving under the influence of marijuana is a major concern in traffic safety and forensic toxicologists are frequently asked to render opinions as to the subject's impairment. Since time of use is one of the determining factors used to evaluate impairment, the ability to predict the time of use from blood levels would be helpful. This paper discusses the use of a model presented by Huestis et al from clinical data and its application to DUI casework.

Forensic toxicologists are often asked to interpret THC and carboxyTHC levels detected in the blood of subjects arrested for driving under the influence of drugs (DUID). Marijuana has been shown to impair driving performance for up to 3 hours. Providing a reliable estimate for the time of use would help in the interpretation of such cases. In 1992, Huestis et al presented two mathematical models for the time prediction of marijuana exposure from plasma concentrations of THC and carboxy-THC based upon data obtained from participants in clinical studies. Model I utilized plasma THC concentrations and model II utilized carboxy-THC:THC ratios in plasma.

This study applied these models to blood data derived from DUI arrestees. Unlike the controlled clinical data, there are additional limitations to arrestee data. Blood, not plasma is the sample collected in DUI arrests; plasma:blood correlations are approximately 2:1. Second, validation of when THC was used and over what period of time in the driving population is not possible. Many of the arrested drivers admitted repeated use of marijuana over an extended periods of time. Since, both THC and carboxy-THC accumulate in chronic or repeat users, the variability of predicted time from the models would increase.

Driving under the influence of drugs is a major concern in traffic safety. Washington State had 2787 drivers arrested for DUID in 2004. The most frequent drug finding is THC and/or its major metabolite, carboxyTHC (28 % DUID cases). In 2004, 1135 drivers tested positive for THC and/ carboxy-THC; 668 (59%) had reportable levels of the pharmacologically active parent drug, THC (limit of quantitation is 1 ng/mL). From 1997 to 2004, the mean THC concentration decreased from 9.7 to 5 ng/mL, median 4 ng/mL, mode 2 ng/mL and the carboxy-THC levels were 54 ng/mL, median 40 ng/mL.

For this study, positive THC cases were selected in which a Drug Recognition Evaluation (DRE) was performed. DRE cases were selected because the reports are more complete. Of the 323 THC positive DRE reports obtained, the time blood draw on the blood vials was available in 191 cases. These cases were reviewed for a reliable source as to the time of last smoking, (n= 91). The criteria used included cases where the arresting officer visually saw the driver smoking marijuana, found a warm marijuana cigarette in the stopped vehicle, or cases in which the subject admitted to smoking within one hour of the stop. Cases were excluded when the subject cited an actual time of smoking as they were often confused actual time of day frequently stating use was after the stop. Admissions such as "thirty minutes before I was stopped" were included. In the 91 cases, the THC levels averaged 5.2 ng/mL, median 4 ng/mL, carboxy-THC levels 57.6 ng/mL, median 40 ng/mL.

Model I proved not to be useful. There was little correlation between the time of the stop and the predicted time of use the predicted time was always considerably less than the actual time. Model II proved more predictive for the time of use. The time of stated or observed use ranged from 50 to 233 minutes, average 131 minutes and median 127 minutes. The ranges were limited by the time required to stop and arrest, perform the DRE exam and obtain the blood draw. The average absolute time difference between the time of stated or observed smoking and time of blood draw was 43 minutes, median 30 minutes, standard deviation, 37 minutes. Further, Model II predicted the time of smoking to be within 30 minutes of the actual time in 50.5% of the cases, within 1 hour 73.6% of the time and within 2 hours 94.3% of the time. In 69% of the cases, the predicted value exceeded the actual time of use.

The data presented here is very promising for the usefulness of Model II in predicting the time of marijuana use but some caution must be used due to the limitations to this data. First, cases were pre-selected for short intervals between the time of smoking and the time of the stop. Second, the manner in which the cases were selected may have excluded more chronic smokers as these subjects may be less likely to

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answer the questions as to time of use or may purposefully misstate time of use. However, even in light of these limitations, it does appear that the time of use predicted by Model II may be useful when considered along with the context of the overall case, including the observed driving of the subject, the observed impairment of the subject during the physical exams and subject's statements when rendering an opinion as to the impairment of a subject arrested for DUID, marijuana.

46	0.505495	42.5736
21	0.230769	30.3341
19	0.208791	37.28421
4	0.043956	
1	0.010989	

Marijuana, Driving Under the Influence, Time of Driving

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