Validation of a Model for Estimating Time of Last Cannabis Use from Known Concentrations of Tetrahydrocannabinol and the Major Metabolite

Edward Ogden*, Katherine Papafotiou, and Con Stough
Brain Sciences Institute, Swinburne University of Technology, John Street, Hawthorn, Victoria, Australia

BACKGROUND: The incidence of driving while affected by cannabis is rising in parallel with increased cannabis use in the community. As the impairing effect of cannabis on driving is better understood, knowing the time cannabis was last used becomes important for determining impairment in accident investigations and clinical evaluations. Two models for predicting time of last cannabis use from single plasma cannabinoid concentrations—model I, using $\Delta^9$-tetrahydrocannabinol (THC), and model II, using the concentration ratio of 11-nor-9-carboxy-THC (THCCOOH) to THC—were developed and validated from controlled drug administration studies by Huestis et al in 1992 and re-evaluated in 2005. The current study seeks to extend that validation by use of a large number of plasma samples collected after administration of single doses of THC to subjects in driving impairment studies and to examine the effectiveness of the models to predict time elapsed since administration of THC.

METHODS: The aggregated data of experiments involved administration of THC with and without alcohol. One data set comes from forty cannabis users who each smoked a cigarette containing either 1.74% THC or 2.93% THC. Blood samples were drawn at 25 minute intervals and THC was measured using gas chromatography-mass spectrometry. Allowing for missing data, 214 THC/time pairs were available for analysis. No measurement was made of THC-COOH. The second data set comes from another project in which subjects smoked cigarettes containing 0% THC, 1.8% THC or 3% THC with low dose alcohol (.03% BAC) or cannabis (0% THC, 1.8% THC and 3% THC) with high dose alcohol (.05% BAC). Each part was made up of six randomized, double-blind sessions. Blood was drawn at 20 minutes and 60 minutes for both THC and THC-COOH. Allowing for missing data and the placebo condition 814 data points were available. Predicted times of cannabis smoking, based on the Huestis models, were compared with actual smoking times.

RESULTS: The results validate the Huestis model for predicting time of last use of cannabis use, especially when both THC and THC-COOH levels are known.

Keywords: Marijuana, THC, Pharmacokinetics