
Project title: Investigation of the association between the use of delta 9 tetrahydrocannabinol (Δ9THC) and neurobehavioural performance in a working prison population.

Organization: Institute of Occupational Health
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Project Duration: 18 months

Approximate Cost: £xxxxxx

Summary:
There is much concern about the potential effects of illegal drug use upon performance at work, especially after some high profile cases of transportation accidents and an association with the use of cannabis. The nature and magnitude of the effects of the active component delta 9 tetrahydrocannabinol (Δ9THC), are generally unknown, as studies in the area are methodologically difficult due to the obvious problems of gathering reliable data concerning illegal drug use in working populations. The object of this study is to utilize an alternative population of working prisoners, of whom it may be methodologically easier to collect reliable biological data concerning drug use than in conventional working populations. By the use of computerized neurobehavioural testing of workers in a prison population and the collection of blood samples, the proposed study aims to establish (i) the blood plasma concentration of Δ9THC at which level effects on neurobehavioural performance may reliably be expected to occur, and (ii) to document the time course of cognitive effects and the relationship between time, blood plasma concentrations of Δ9THC, the degree of impairment, and ultimately to estimate the impact this may have for working populations. The
use of a prison population is made in this proposal for two reasons (i) as a methodological solution to the problem of trying to establish accurate portrayals of drug use in conventional working populations, and (ii) as a way of targeting a potentially sizable number of drug users who also “hold down” jobs.

**Introduction:**

Recent surveys have shown that in certain age and social groups the use of recreational drugs such as ($\Delta^9$ THC) is widespread on both a regular and casual basis (Kosviner et al\(^1\)). Several studies have shown the presence of cannabis, class A drugs, and therapeutic medication in body fluids of traffic and workplace accident victims Brookoff\(^2\). Other studies have shown the presence of cannabis in drivers arrested for motoring offences, including Sutton & Paegle\(^3\) who found $\Delta^9$ THC in 39% of sampled offenders, and Brookoff et al\(^4\) who found the same in 33% of offending motorists. There is a concern that such a presence has either caused or contributed to the accidents (Bates & Blakely\(^5\)).

Many of the studies demonstrating the presence of cannabis or it’s metabolites have depended on semi-quantitative assays using urine as the most easily accessible body fluid. Unfortunately, there is little relationship between the concentration of cannabis or it’s metabolites in urine, and hence there is no single surrogate.

The existent literature does not facilitate one to answer whether it is possible to define the concentrations in blood above which (workplace) impairment is inevitable, and below which there would be no detectable effect. However, developments in neurobehavioural testing batteries and increased analytical sophistication of blood measurement indicate that investigation of this question is now possible. Definition of time concentration profiles of $\Delta^9$ THC in blood and their relation to impaired performance would be of great use to accident epidemiologists, forensic scientists and those involved in regulating workplace and transport safety.
**Objectives:**

1. To identify a suitable cohort of cannabis using prisoners.
2. To obtain Home Office permission to further the study.
3. To establish the blood plasma concentration of $\Delta 9$THC at which effects on neurobehavioural performance may reliably be expected to occur.
4. To document the time course of cognitive effects and the relationship between time, blood plasma concentrations of $\Delta 9$THC and degrees of impairment.

**Methodology:**

Recruitment of approximately 300 members of low category prison populations who perform regular prison employment duties will be conducted, and an appropriate screening method (for example to exclude participants with known mental illness or personality disorders) will be applied. The study would require individual prisoners volunteering to complete a neurobehavioural test battery to measure cognitive performance on a variety of cognitive domains associated with typical working demands. Because of the lack of reliability of both questionnaire and interview methods of collecting illicit drug-use data in other studies, a series of blood samples would be taken from participants immediately prior to completion of the test battery in the proposed study.

Because of the time delay between taking blood samples and results of any analysis, it would not be possible to identify (and screen) drug users from non-drug users immediately prior to neurobehavioural testing. Therefore, a methodology is proposed where all volunteers (after passing the screening outlined above) participate in the neurobehavioural testing and offer a blood sample, with the aim of significant numbers of drug users identifying positively to blood tests “post neurobehavioural testing”. Time of day of neurobehavioural testing would preferably be kept constant (although statistical measures could account for such data if testing-times were not kept constant). Bloods will be securely transported to an appropriate laboratory service for anonymous analysis, and neurobehavioural performance data will be electronically stored and encrypted before transit to a place of secure storage and further analyses.
Statistical analyses will be conducted:

(i) to compare neurobehavioural performance between those participants who test positive for Δ9THC use and those who do not.

(ii) to examine the association between Δ9THC concentrations in blood plasma and levels of declination in neurobehavioural performance.

(iii) to establish a lowest quantifiable level of Δ9THC concentration in blood that is equated with detrimental neurobehavioral performance.

**Costs:**

Research Fellow, 18 months approx. £40,000

Secretarial assistance, 6 months approx. £9,000

**Consumable costs:**

- 2 Portable computers approx. £2,000
- Neurobehavioural testing software approx. £500
- Blood collection and analysis approx. £3,000
- Travel and subsistence during data collection approx. £15,000
- Overheads and salary costs at 40% approx. £19,600

**TOTAL** £89,100

**Relevant experience:**

The Institute of Occupational Health has extensive experience in carrying out large scale epidemiological studies related to neurotoxicant exposure. Researchers in the department have carried out previous neurobehavioural investigations associated with other occupational factors, and are currently investigating other neurobehavioural effects. Previous neurobehavioural and neurological studies have been funded by HSE.
References:


