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Original communication

Concentrations of drugs determined in blood samples collected from suspected drugged drivers in England and Wales

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ABSTRACT

This communication reports the blood concentrations of alcohol and drugs from 376 cases of alleged driving under the influence of drugs analysed at the Forensic Science Service Chorley and London laboratories between February 2010 and March 2011. The samples were analysed for alcohol, amphetamine, benzodiazepines, cocaine, MDMA, opiates, γ-hydroxybutyrate (GHB), ketamine, methadone and methylmethcathinone (the 4-isomer of which is known as mephedrone). The results were interpreted with respect to the number and type of drugs of abuse detected and the concentrations measured. Alcohol was quantified in 113 cases (30%), and of these a level in excess of the prescribed UK limit for driving of 80 mg% was present in 90 cases. In 80 cases, only the concentration of alcohol was measured, the concentrations of both drugs and alcohol were measured in 33 cases. In the remaining 263 cases, only the concentrations of relevant drugs of abuse were measured. The most common drug of abuse quantified was cocaine which was detected in 92 cases, either as the active drug or as its major metabolite benzoylecgonine, followed by diazepam which was quantified in 76 cases. Concentrations of some new drugs, and drugs rarely reported in driving under the influence cases are also presented.

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1. Introduction

A number of cases of alleged driving under the influence of drugs were analysed by the Forensic Science Service (FSS) in the UK during the period February 2010 to March 2011. The legislation related to drug driving in the UK is defined in the Road Traffic Act 1988 where section 4 makes it an offence to drive, or attempt to drive, a mechanically propelled vehicle whilst unfit through drink or drugs.

A suspected drug-impaired driver normally commits a moving traffic offence (*e.g.* speeding, weaving, failing to stop at traffic lights *etc.*) or is involved in a road traffic collision before they are apprehended by police in England & Wales. Drivers are normally required to co-operate with a roadside screening test for alcohol. If the result of this test indicates the driver is below the breath alcohol limit for driving, but they are still displaying signs of intoxication (*e.g.* slurred speech, clumsiness), strange behaviour (*e.g.* agitation or hostility) or they have a history of criminal drug abuse, they may be asked to participate in a field impairment test (FIT).[1] Only specifically trained traffic police officers may conduct this test and if the driver performs poorly they may be arrested under suspicion of driving whilst impaired through drink or drugs. In the final stage of the process, the suspect is assessed by a Forensic Medical Examiner (FME) who will determine whether their condition is due to a drug, rather than an underlying medical condition or fatigue. A sample of blood or urine is then collected from the driver and sent for analysis. Whilst the presence of drugs is frequently confirmed in cases of suspected drug-driving, a conviction for this offence relies on the demonstration of impairment on the part of the driver at the time of the incident. The FIT and FME opinion may provide evidence of the driver being under the influence of drugs, however they do not necessarily demonstrate driving impairment.

While there has been a considerable amount of research into the prevalence of drink driving in the UK, very little research has focused on driving under the influence of drugs.[2] A small number of studies have looked at the prevalence of drug driving,[3,4] and the contribution of drugs to road traffic fatalities,[5,6] with the most relevant research originating from Scotland.[2,6–9] However, there is very little published data on the actual concentrations of drugs found in drivers apprehended in the UK. Some data has been gathered for drivers under the influence of benzodiazepines and opiates,[10] and amphetamine and methylenedioxymethylamphetamine (MDMA),[11] but this has not been published. Two studies reporting blood

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concentrations in drug-impaired drivers in Scotland were published in 1999,[7,12] but there is currently no corresponding published data for drug-impaired drivers in England & Wales. Knowledge of the concentration of a psychoactive drug in blood is necessary to enable valid conclusions to be drawn about any pharmacological effects produced. A more detailed analysis which goes beyond prevalence would enable the identification of cases where the drugs detected were above therapeutic concentrations. This is important as it is currently unclear from the existing UK drug-driving data what proportion of the opiates and benzodiazepines detected have been prescribed and what proportion are being used illicitly.[2]

Internationally, publication of the concentrations of drugs found in drivers is much more widespread. In Sweden, concentrations of cocaine and its metabolite benzoylecgonine (BZE),[13] amphetamine,[14,15] benzodiazepines,[16] opiates[17] and γ-hydroxybutyrate (GHB)[18,19] in drug-impaired drivers have been reported. There is also information in the literature concerning concentrations of benzodiazepines[20,21] and methadone[22] found in drivers in Norway, GHB found in drug-driving cases in the USA,[23] and of amphetamine in drivers in Finland.[24] Concentrations of amphetamine[25] and various other drugs found in drivers in the Netherlands[26] and Switzerland[27] have also been published.

In this communication, we report the concentrations of alcohol and illicit and certain prescription drugs found in whole blood samples taken from 376 alleged drug-impaired drivers in England & Wales. Our study also includes concentrations of less common drugs of abuse, such as alprazolam, GHB and ketamine, and the previously termed 'legal' high mephedrone, as well as phenazepam, found in drivers in England & Wales. We believe that this is an important area of research as there is very little data on the prevalence or concentrations of these drugs in drivers, despite recent surveys and anecdotal evidence suggesting there has been a surge in their use.[2]

2. Study protocol

All alleged drug-driving samples submitted to the FSS undergo an initial screening for five classes of abused drugs: amphetamines/methylamphetamines, benzodiazepines, cocaine and/or cocaine metabolites, opiates and cannabinoids, which comprise the so-called 'standard panel' of drugs. Samples are also specifically screened for methadone (and morphine in the case of positive opiates screening result). If requested, alcohol analysis is also carried out. Where the results of the screening test are positive for more than one drug type, normally only one drug is chosen for confirmation, as permitted by police contracts. This decision is based on a number of factors including the approximate concentration of each positive drug type, the time delay between driving and sampling, the behaviour of the driver if recorded by the police, the legislative class of the drugs indicated and any additional intelligence (*e.g.* drugs found in the car or in the driver's possession). If the alcohol concentration is in excess of the prescribed limit for driving in the UK (80 mg of alcohol in 100 mL blood) positive drug screening results are not usually confirmed, unless a fatality has occurred.

Of the 1100 samples received by the FSS in alleged drug-driving cases from February 2010 to March 2011, only 376 cases met the criteria for this study. Our criteria stated that eligible cases must:

(a) be standard drug-driving cases only (*i.e.* no fatalities linked to the case).
(b) be accompanied by a blood sample.
(c) contain a measured level of drug(s).

For this subset of cases we have recorded the concentrations of amphetamine, MDMA, cocaine, BZE, diazepam, nordiazepam, oxazepam, temazepam, morphine, codeine, dihydrocodeine, methadone, mephedrone, GHB, phenazepam and ketamine confirmed to be present. The concentrations of cannabinoids found in whole blood samples are not measured, so these cases do not form part of our study. All of the samples in this study were analysed at either the London or Chorley laboratories of the FSS, having been submitted in cases of alleged drug driving by 26 of the 34 police forces in England & Wales.

3. Methods

3.1. Blood sampling

A variety of sample vials is used in the United Kingdom. Samples taken at hospital will frequently be unpreserved; those in police stations will mostly be preserved with sodium fluoride and would typically be of volume 3–6 mL.

3.2. Sample storage

Once received at the laboratory all samples were kept refrigerated. Ideally, all submitted samples should have been preserved with a fluoride concentration of at least 1.5% weight/volume, because it is well documented that the presence of micro-organisms can result in an unreliable alcohol result.[28] Cocaine[29] and mephedrone[30] also break down in whole blood, although the presence of fluoride somewhat inhibits the process. If it was unclear whether or not fluoride was present in the sample, the fluoride concentration was determined by means of a fluoride-sensitive electrode.

3.3. Alcohol analysis

Alcohol was analysed using gas chromatography with flame ionisation detection (GC-FID) using c. 300 μL of sample. The analysis was carried out in duplicate on two different GC columns to rule out the presence of any interfering volatile substances. The average of the two results was calculated, and a deduction of 6 mg/100 mL (mg%) for results <100 mg%, or 6% for results >100 mg% was taken from the average measured value. This allows for any uncertainty in the measurements and the result is reported as the 'not less than' value rather than the actual measured value.[31]

3.4. Initial screening

Initial screening, using 150 μL of sample with subsequent dilution as per kit insert, was conducted by means of enzymeimmunoassay (EIA) using kits supplied by Concateno® (formally Cozart®) and Orasure® Technologies Inc. The drugs of abuse covered by this screen and the positive cut-off concentrations for each type in whole blood are outlined in Table 1.

3.5. Confirmation

Where we elected to confirm a positive EIA result, this was done using an extraction and derivatisation method followed by either

Table 1
The EIA screening tests and cut-off concentrations for drugs of abuse used in this study.

Drug type	Specific drug antibody used	Cut-off (ng/mL)
Amphetamine	Amphetamine	25
Benzodiazepines	Oxazepam	50
Cocaine/BZE	BZE	50
Methadone	Methadone	25
Methylamphetamines	Methylamphetamine	50
Opiates	Morphine	25

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