The viability of drugs in oral fluid as a proficiency testing scheme

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Introduction

Oral fluid is a quick and non-invasive matrix choice for drug testing and as a consequence there has been an increasing need for the provision of a proficiency testing scheme. We will look at the mechanism by which drugs get into oral fluid, the advantages and disadvantages of this as a matrix and the progress of the oral fluid proficiency testing (PT) scheme over the last five years.

How do drugs get into the oral fluid?

The salivary glands are highly perfused (rapid transference of drugs from the capillaries into the oral fluid). Since Oral Fluid is slightly acidic, basic drugs tend to partition more since they are more soluble than acidic drugs. There may also be residual drug present in the Oral Fluid from drugs taken (chewing, smoking, snorting etc).

Advantages and disadvantages of drug testing of oral fluid

The main advantages are that it is a completely non-invasive procedure of collection, unlike traditional matrices such as blood, and can be performed in almost any location. Sample collection is also easily directly observed, therefore adulteration and substitution that can often occur with urine samples is much more difficult. The main disadvantage is the low volume of the sample; potentially limiting the amount of additional analysis that can be performed. In addition, the reproducibility of oral fluid sample collection volumes and the recovery of drugs from the collection device may impact on analytical results.

Scheme

The LGC drugs in oral fluid scheme (DOF) covers the main drugs of abuse including screening groups and individual drugs. New psychoactive substances (NPS) e.g. Mephedrone are included to reflect current trends.

The number of laboratories that participate in the scheme has shown a steady increase since 2009. This reflects the increase in the use of oral fluid as a viable matrix for drug testing.

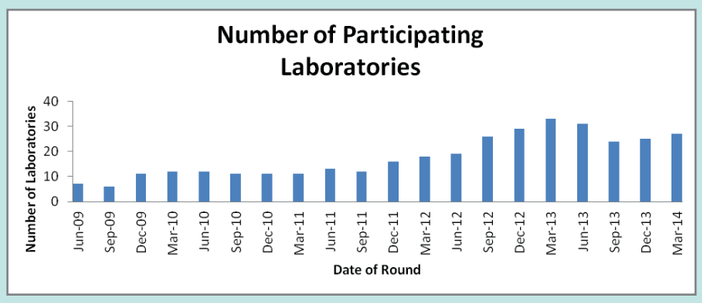

Figure 1: Numbers of participants labs since 2009

The Scheme is a qualitative scheme but quantitative information is collected and processed for information only. The assessment of Satisfactory/Unsatisfactory is based on the qualitative result submitted.

Natural, non-stimulated human oral fluid is spiked with a range of drugs; which enables the PT scheme to reflect those be obtained in routine testing. Oral Fluid from Drug Users is also used (thus incurred substances are present).

Results

The results in Figure 2 show the consistently satisfactory performance scores for four commonly analysed drugs; Morphine, Amfetamine, Methadone and Diazepam.

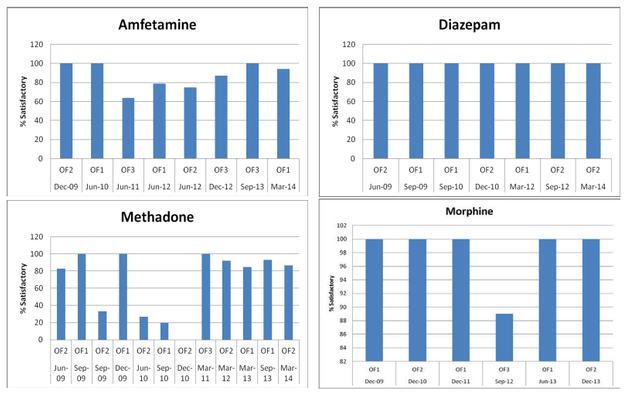

Figure 2: % Satisfactory results for Amfetamine, Diazepam, Methadone and Morphine

Diazepam: results are all satisfactory, regardless of concentration. Amfetamine and Methadone: in general, results that have a lower satisfactory performance are on or below the thresholds as defined by the European Workplace Drug Testing Society (EWDTS).

It is important for any PT scheme to remain relevant by including NPS and other current drugs in trend e.g. Ketamine.

Ketamine has shown consistently good results from the laboratories who analysed for it, the number of laboratories analysing for Ketamine has increased as shown in Table 1.

Round	Consensus Mean (Quantitative Data)	Satisfactory (%) (Qualitative Data)	Number of laboratories Analysing (Qualitative)
Sep-10	-	100	1
Jun-12	-	100	2
Jun-12	-	100	2
Dec-12	55	86	7
Sep-13	49.5	90	10

Table 1: Data for all PT samples containing Ketamine since its introduction in 2010

When the DOF Scheme first introduced Mephedrone in June 2010, no participants detected its presence (this may be due to laboratories not analyzing for it). It has since been in two further rounds and there has been an increase in the number of those who have successfully detected the drug, as shown in Table 2.

Round	Consensus Mean	Satisfactory (%) (Qualitative Data)	Number of laboratories Analysing (Qualitative)
Jun-10	-	-	-
Mar-13	85.8	100	5
Mar-14	32	87.5	8

Table 2: Date for all PT samples containing Mephedrone since its introduction in 2010

MDPV, Methylenedioxypyrovalerone, known as 'bath salts' is a psychoactive stimulant which has been seen more frequently as a drug of abuse. In December 2013, MDPV was added with a 75% satisfactory performance and four results submitted. As the DOF PT scheme continues, it will be interesting to see whether it follows the trends of Mephedrone and Ketamine.

Potential adulteration is always a concern. In June 2012 two identical test materials were distributed, both containing Amfetamine and Ketamine at 60ng/ml One was 100% Oral Fluid, the other 20% mouthwash (as adulterant). The mouthwash contained Chlorhexidine digluconate.

Table 3 shows that although both samples produced false negative results using CEDIA (Cloned Enzyme Donor Immunoassay) for Amfetamine, the adulterated sample showed significantly more false positive results. These findings suggest a substance in the mouthwash is cross-reacting with the CEDIA method leading to false-positive results

Table 3: Comparison of normal and adulterated sample

	Jun-12			
	CEDIA Method			
	OF1		OF2 (20% mouthwash)	
Drug/Group	Positive	Negative	Positive	Negative
Amfetamine Group	1	4	1	4
Amfetamine	0	2	0	3
Methylamfetamine	0	3	1	2
Cannabinoid Group	0	4	3	1
Benzodiazepine Group	1	4	3	2
Methadone	0	6	3	3
Buprenorphine	1	1	2	0
6-MAM	0	3	1	2
Ketamine	0	0	0	0

Summary / Conclusion

A drugs in oral fluid PT scheme is becoming increasingly more valuable as the prevalence of oral fluid as an alternative matrix increases. This is reflected in the increase in laboratories within the scheme and the increasing use for which this type of analysis can be undertaken. The use of natural non-stimulated human oral fluid, rather than synthetic or stimulated more accurately reflects real life samples. The results successfully show the need to reflect common drugs trends whilst still covering more 'traditional' drugs of abuse.