

Patterns in drug use in the United Kingdom as revealed through analysis of hair in a large population sample.



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Leaders in drug testing

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Introduction

Hair analysis provides a retrospective window of detection able to show changes in use over time and identify what drugs were used. It facilitates detection of drug use by random testing because it is able to detect intermittent use by individuals and as a result is particularly appropriate for monitoring the success of treatment in a clinical setting. Since 1993 TrichoTech has provided hair analysis screening service for a wide variety of agencies including drug dependency clinics, hospitals, Police investigations, sports clubs, Social Services, Probation Services, Institutions and the legal profession. In the last few years, hair analysis has been increasingly used in the workplace, in pre-employment or in-employment settings. The aim of this paper is to provide an overview of the most common sectors that make use of hair analysis, as well look at the patterns and results for the different drug groups in samples of hair samples analysed at TrichoTech between 2001 and 2005.

Methods

A total of 34,626 hair samples were analysed for the common drugs. Samples were washed, extracted then screened using ELISA coated-plates for each drug group using an automated analyser. Samples above the cut-off were extracted using solid-phase extraction methods and analysed by GC-MS, GC-MS/CI or GC-MS/MS.

Results

A total of 186,084 tests were performed on 34,626 samples of hair: amphetamines (74.1%), barbiturates (42.2%), benzodiazepines (57.6%), cannabinoids (66.5%), cocaine (84.0%), methamphetamines (74.1%), methadone (57.8%) and opiates (81.1%). The positive ELISA screens corresponded to 18,236 samples, which tested positive for at least one drug group, with the following number of confirmations by GC-MS performed for each drug group: amphetamines and methamphetamine (N=4561), cocaine (N=7,155), opiates (N=7,061), cannabinoids (N=6,838), benzodiazepines (N=3,116) and methadone (N=3,428).

Table 1. Sectioning patterns

Sections Analysed	Samples (N)	Percentage of Total
0 to 3 cm	15,342	44%
3 cm to 6 cm	4,604	13%
6 cm to 9 cm	1,036	3%
0 cm to 1 cm	5,072	15%
1 cm to 2 cm	2,455	7%
2 cm to 3 cm	1,971	6%
Other combination of lengths	1,958	6%
Body hair (various lengths)	2,188	6%

A variety of sectioning windows was requested for analysis (Table 1). These were associated with the need to correlate the detection of drugs and specific events on different time windows. A time window of three-month as a single section was most common.

Multiple monthly sections was usually requested for the evaluation of drug pattern habits or abstinence which was particularly relevant in certain Medico-Legal cases. Samples collected from other areas of the body such as axilla, pubic, chest, beard and leg were analysed whole because of its biology.

Table 2. Number of samples tested by sector with number of samples tested positive for at least one drug

Sector	Tested N (%)	Positive for at least one drug N (%)
Medico-Legal	22584 (65.2%)	14087 (62%)
Workplace	6751 (19.5%)	696 (10%)
Clinical	3408 (9.8%)	1849 (54%)
Research	1120 (3.2%)	409 (37%)
Police	524 (1.5%)	408 (78%)
Schools	121 (0.3%)	22 (18%)
Insurance	118 (0.3%)	30 (25%)

Whilst the Medical-Legal sector was the sector with the highest number of samples, the hair samples from Police investigations produced the highest positive rates (Table 2).

For all sectors combined, the common drugs detected were Cannabinol (27%), Cocaine (25%), Morphine (17%), Amphetamine (13%) and Diazepam (15%), (Table 2). In hair samples from the Workplace sector the most commonly detected drugs were: Cannabinol and THC (4%), Codeine (2%), Cocaine (2%), MDMA (0.5%) and Diazepam (0.1%). All positive samples from Schools were positive for at least one Cannabinol.

In 29% of the 839 wash residues analysed, the ratio of wash residue levels to hair levels was above 1/10. Predominant were MDMA (40%), Morphine (42%), Acetylcodeine (45%), Cocaine (48%), Heroin (53%) and THC (54%).

Table 3. Levels detected in hair in ng/mg

	N	Percentile 50	Percentile 99	Maximum
Opiate Group				
6-monoacetyl Morphine	3,558	1.1	63.8	220.8
Acetylcodeine	1,126	0.4	16.7	40.3
Codeine	4,520	0.8	12.7	68.4
Dihydrocodeine	2,415	1.3	61.3	182.7
Heroin	1,103	1.0	62.2	146.4
Morphine	4,798	2.1	41.1	291.3
Cocaine Group				
Anhydroecgonine methyl ester	635	0.8	13.1	80.9
Benzoylcegonine	5,458	1.0	36.1	163.7
Cocaeethylene	1,191	0.4	7.9	13.9
Cocaine	7,146	2.5	159.9	1093.8
Amphetamine Group				
Amphetamine	3,279	3.2	210.7	818.7
MBDB	9	0.1	0.4	0.4
MDA	565	0.3	6.0	14.6
MDEA	53	0.5	7.2	7.2
MDMA	2,213	1.2	43.0	206.9
Methamphetamine	97	0.6	128.1	128.1
Cannabinoid Group				
Cannabidiol	5,213	0.068	4.441	64.611
Cannabinol	6,060	0.053	2.336	54.270
Delta-9-tetrahydrocannabinol (THC)	6,194	0.119	5.090	66.649
11-Nor-delta9-THC-9-Carboxylic Acid	2,303	0.003	0.052	0.589
11-hydroxy-delta9-THC	2,016	0.002	0.018	0.132
Benzodiazepine Group				
Diazepam	2,926	0.200	2.650	14.020
Lorazepam	54	0.140	11.920	11.920
Nordiazepam	2,621	0.290	4.370	18.210
Oxazepam	802	0.030	0.590	5.210
Temazepam	641	0.080	2.380	37.010
Methadone Group				
EDDP	2,112	1.1	14.3	43.9
Methadone	3,427	9.1	98.2	322.0

Because of the wide range of levels routinely detected in hair samples of drug users, the results are presented as percentiles 50% (median), 99% and maximum levels detected (Table 3).

The data was analysed on a year by year basis to check for any drug use trends but no remarkable changes in the levels detected for the common drugs tested and different drugs used over time at TrichoTech since 2001 was noted.

The maximum levels detected in hair samples from the Workplace sector was on average 7% the levels detected in all sectors combined.

The geographical patterns of drugs detected revealed that in Wales the prevalence of detection of amphetamines is twice the cocaine's, whilst in most of England, the reverse was the case.

Conclusions

- The analysis of one section measuring 3-centimetre to cover an approximate period of three month is most common to verify drug use or abstinence.
- Analysis of monthly sections is important in the evaluation and interpretation of drug use, particularly when a drug use pattern is relevant.
- The Medico-Legal sector is the prevalent sector using hair analysis but the Workplace sector use of hair testing is increasing in the UK, largely for pre-employment, in-employment or for cause.
- One in 10 workplace hair samples analysed showed the presence of at least one drug, which is twice the rate of detection using urine, which is 1 in 20 urine samples (source: Medscreen). This means that the chances of identifying people on drugs in the Workplace by testing hair samples are twice more likely than urine samples. However, the levels detected in the workplace were much lower, indicating use of drugs by people in the Workplace sector in lower quantities.
- The wide range of levels detected for the different drug groups reflected very heterogeneous group of samples TrichoTech receive for testing on a routine basis.