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A 3-year review of new psychoactive substances in casework*



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ABSTRACT

Following the initial popularity of mephedrone (4-methylmethcathinone) there has been a stream of new "recreational drugs" entering the global market. The lack of clinical studies on the effects and toxicity of these drugs has made interpretation of toxicological findings difficult. In an attempt to assist in a better understanding of the extent of their use and the fatalities that have been linked to these compounds we present our collated findings in post-mortem and criminal casework where these have been detected and/or implicated. Between January 2010 and December 2012 we have detected new psychoactive substances (NPS) in 203 cases, with 120 cases in 2012 alone. The drugs detected in in life or post-mortem blood and urine are, in order of decreasing frequency; mephedrone, 4-methylethcathinone, BZP, MDPV, TFMPP, methoxetamine, 4-fluoromethcathinone, 4-methylamphetamine, PMA, methylone, PMMA, naphyrone, alpha-methyltryptamine, butylone, MDAI, desoxypipradrol, D2PM, MPA, synthetic cannabinoids, 2-AI, 5-IAI, 5-MeODALT, MDPBP, 5/6-APB, pentedrone and pentylone. Other drugs or alcohol were detected in 84% of the cases including other NPS and in fatalities it should be noted that alternative causes of death (including mechanical suicide, accidental death and non-psychoactive drug overdose) accounted for the majority. Related to this was that of all fatalities involving cathinones, 41% of these were hangings or other mechanical suicides, this was a higher proportion than seen with other drugs found in such cases. The presence of multiple NPS and/or other stimulants was a particular feature in various cases, however, of the drug deaths only 7% solely involved NPS. Across all case types and including some cases investigated in 2013, NPS concentrations showed a wide range but these and selected cases are presented to assist toxicological interpretation in future cases.

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1. Introduction

Whilst there has been an evolution in drugs of abuse over the last 30 years, of prime toxicological significance has been the more recent phenomenon of new psychoactive substances, also known as so-called "legal highs", "designer drugs" or "bath salts" [1]. This has been a global issue with the continual emergence of new compounds on the recreational and illicit drug market. In many countries, such compounds are rarely included in drug control legislation and may even fall outside of generic legislative systems. This is largely due to these drugs being predominantly synthetic derivatives and analogues of existing controlled drugs, analogues of pharmaceutical products, previously researched substances or

naturally occurring compounds [2]. Arguably the accessibility and information available through the Internet has promoted this evolution with various websites marketing these compounds as "research chemicals" or products purported to be "not for human consumption", being sold as "plant food" or "bath salts" [3]. Whilst there are hundreds of drugs based on the primary chemical frameworks of phenethylamine, cathinone, tryptamine, piperazine and aminoindan, there are additional drug families based on their action (e.g. synthetic cannabinoids) as well as distinct atypicals (e.g. methiopropamine, AH-7921 and aminopropylbenzofurans).

The variety and evolution of drug types has resulted in a continual analytical challenge for detection, identification and measurement. The challenge has been met in some regards through the complementary use of techniques such as HPLC-DAD, GC-MS, LC-MS and LC or GC coupled with accurate mass-spectrometry [4]. Each technique provides a particular advantage with the analytical toxicologist having to take account of the various analytical characteristics and pitfalls (e.g. isobaric nature of drugs including isomerisation) which have been discussed elsewhere [5]. However, the often initial absence of reference materials can hinder identification and measurement and even if

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available such compounds may be expensive and may not have corresponding deuterated standards for use in quantification by mass-spectrometry [6].

Aside from the analytical challenge, the lack of clinical studies on the effects of these drugs and their toxicity has made interpretation of toxicological findings difficult. In an attempt to assist in a better understanding of the extent of their use and particularly fatalities that have been linked to these compounds, findings during casework have been collated in respect to fatal and non-fatal cases submitted to our laboratory where new psychoactive substances have been detected and/or implicated.

2. Experimental

2.1. Analytical methods

Routine analysis involved the use of immunoassay, ultra/high performance liquid chromatography coupled with diode array detection (U/HPLC-DAD), liquid chromatography with hybrid linear ion trap tandem mass spectrometry (LC-MS/MS) coupled with DAD, and in some cases ultra-high performance liquid chromatography with high mass accuracy quadrupole time-of-flight mass spectrometry (UHPLC-QTOF-MS). The methods have been published elsewhere [7,8].

2.2. Casework

Analysis was undertaken as part of routine case investigations on behalf of HM Coroners or Police Forces using *in life* and/or postmortem specimens, further details of case types are described below. Drug screening involved a non-targeted approach for common drugs of abuse (including alcohol) and prescription drugs with more specific analysis where required.

3. Results and discussion

3.1. Drug frequency

Fig. 1 shows the frequency of new psychoactive drugs detected in casework between January 2010 and December 2012. Overall such drugs were detected in 203 cases, with 120 of those being solely from Jan to Dec 2012, showing an increase in frequency compared to 2010 and 2011. The drugs found were collated into the following drug classes (in decreasing order of frequency); cathinones, piperazines, "miscellaneous" compounds, tryptamines and aminoindans. Of the specific drugs detected, desoxypipradrol, 5-methoxy-DALT and 5-iodoaminoindan (5-IAI) were only found in 2010 casework, whereas pentylone, MDPBP and 2-aminoindane were only found in casework in 2011. 5- and

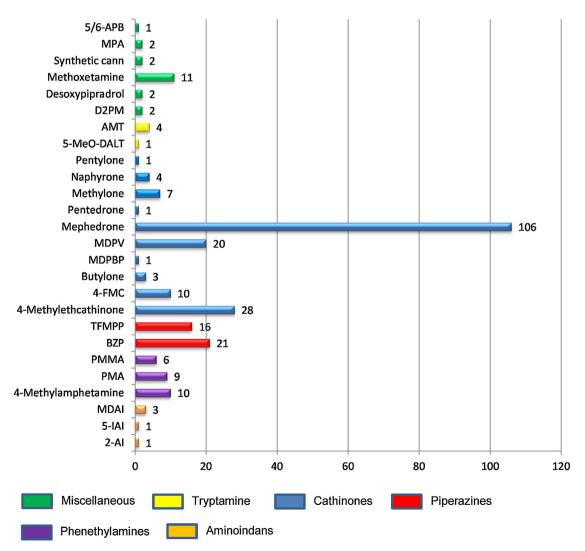


Fig. 1. The frequency of new psychoactive substances in cases between 2010 and 2012 (203 cases).

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