New Psychoactive Substances Prevalence in Samples Tested in the NDTC laboratory 2010-2015

Sinéad McNamara, Siobhan Stokes, Áine Shine, Ross Kilduff, Paul O’Byrne. HSE National Drug Treatment Centre, Dublin, Ireland

HSE National Drug Treatment Centre Laboratory

The HSE-NDTC laboratory is the largest specialist provider of drugs of abuse screening for drug treatment services providing a nationwide service to the HSE Addiction Services, hospitals, General Practitioners, voluntary organisations, Department of Education (Juvenile detention centres), the Probation Service, the Courts Service, the Medical Council, an Bord Altranais and various occupational health departments.

Introduction

In 2013 it was reported that Ireland had the highest use of new synthetic drugs in Europe, with consumption of these substances reaching a peak average, according to the UN Office on Drugs and Crime which said that new psychoactive substances (NPS) were “proliferating at an unprecedented rate” across the world and posed “unforeseen public health” effects.

The Report of the International Narcotics Control Board for 2014 states that in Europe, the availability and abuse of new psychoactive substances remain a major public health challenge, with a record number of such substances being newly identified.

The INCB 2014 Global Synthetic Drugs Assessment notes that the Eurobarometer survey conducted among 12,000 randomly selected youths aged 15-24 across the EU in 2011 recorded the lifetime prevalence of youths that had experimented with “legal substances that imitate the effects of illicit drugs”. The highest lifetime prevalence rates were reported by Ireland at 16.3 per cent.

According to a 2014 EMCCDA update, the data suggests that the growth of the market in new psychoactive substances will continue to pose a range of challenges for public health and drug policy over the next few years. Particular challenges relate to the speed at which new psychoactive substances appear, their open sale and the lack of information on their effects and harms.

Due to clinical demand for testing, since 2008 we have constantly redeveloped our LCMS capability to include several multi-residue testing methods in order to meet the challenge of testing for New Psychoactive Substances. We have reported on this in a number of publications.

This has involved on-going method development over this time as more drugs were added to the screen. Most recently to unambiguously identify all of the different compounds due to common MRMs and presence of multiple isomers, by separating the screened compounds into 7 groups and optimizing the chromatographic and mass spectrometer parameters utilizing MRMs we can now unambiguously identify over 80 compounds in one run.

Objective

The objective of the study is to report trends in New Psychoactive substances over the period 2010-2015 in samples tested in the NDTC laboratory. “Spice” drugs and related synthetic cannabinoids are not included in the study.

Materials and Methods

Analysis was carried out using our in-house screen for multiple compounds with 2 transitions for each separated in a 21 minute run with the following conditions:

Mobile Phase A: 100:100:800 Buffer: ACN: water Mobile Phase B: 100:900, buffer: ACN Buffer: 0.5% formic acid, 25mM ammonium formate

Targeted analysis included the following drugs: 2-methylamphetamine, 4-methylamphetamine, BZP, MDA, N-Methyl-5-APB, Pentedrone, Cametamfetamine, Ethylone/Butylone, Pentylene, Fluorotropacocaine, Benzoylcegonine, methamphetamine, p-methoxymethamphetamine, dimethylcathinone, p-methoxymethamphetamine, 3,4 DMMC, MDAT, Ketamine, 5-MeO Dalt, Cocaine, 2-Aminodindane, 4-fluoromethamphetamine, Benzoceona, MDAL, MDP, 4-EMC, Methedrone, MDEA, JTFMPP, Desoxypirradiol, MDPV, Amphetamine, Pseudoephedrine, Ethcathinone, 3-fluoromethamphetamine, MDMA, MPBP, Benzedrone, Dimethocaine, 3-methylamfetamine, methamphetamine, sympheine, Mephedron, 2-fluoromethamethcaine, 4-MEC, MPPP, PVP, 5-IAI, Naphyline, 4-methylamfetamine, methcathinone, 5-APB, Buphedron, 4-fluoromethamethcaine, N,N-t-itemethylcathinone, mCPP, MBDB, PCat, methoxetamine, MDPBP, 3,4 MD-N-benzylcathinone, 8k-2CB, nitracaine, methoxypiperadine, mephtemamine, 2S1-NBOMe, alpha-methylfentyltramine, 2CB, 2SB-NBOMe, 2CE, 2CI, ethylphenelafedine, 2SC-NBOMe.

Compounds were optimised on the mass spectrometer by using the automated compound optimization wizard in Analyst software.

Samples were diluted 1/10 in water (dilute n’ shoot) before injecting into the LCMS for analysis.

Figure 1: Examples of NPS packaging found in Headshops in Ireland

Instrumentation

LCMS

The ABSciex 3200 QTrap method uses Electrospray positive ionisation with multi-reaction monitoring - 2 MRM transitions for each compound tested coupled with Enhanced Product ion monitoring (EPI) giving full scan data. This is coupled to an Agilent 1100 series HPLC. The column used was an Agilent Poroshell SB 120 C18 coupled with an Agilent Poroshell SB120 UHPLC Guard column.

Samples

Urine samples were obtained from participants in a methadone maintenance program screened on a regular basis for drug and alcohol use by immunoassay. Samples are tested for NPS on request where use of these drugs is suspected. We have also carried out a number of random “sweeps”.

Table 1: Top NPS drugs detected by year

<table>
<thead>
<tr>
<th>Year</th>
<th>Mephedrone (3.3%)</th>
<th>Methylone (5%)</th>
<th>PVP (7.9%)</th>
<th>MDPBP (8.16%)</th>
<th>MDA (12.24%)</th>
<th>Pentedrone (10.24%)</th>
<th>3-TFMPP (1.95%)</th>
<th>4-methyl ethcathinone (11.75%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>2.8%</td>
<td>2.3%</td>
<td>3.0%</td>
<td>2.2%</td>
<td>2.6%</td>
<td>2.7%</td>
<td>3.5%</td>
<td>1.8%</td>
</tr>
<tr>
<td>2011</td>
<td>2.7%</td>
<td>2.4%</td>
<td>3.1%</td>
<td>2.1%</td>
<td>2.5%</td>
<td>2.6%</td>
<td>3.6%</td>
<td>1.7%</td>
</tr>
<tr>
<td>2012</td>
<td>2.6%</td>
<td>2.3%</td>
<td>3.0%</td>
<td>2.2%</td>
<td>2.4%</td>
<td>2.5%</td>
<td>3.5%</td>
<td>1.8%</td>
</tr>
<tr>
<td>2013</td>
<td>2.5%</td>
<td>2.2%</td>
<td>2.9%</td>
<td>2.1%</td>
<td>2.3%</td>
<td>2.4%</td>
<td>3.4%</td>
<td>1.7%</td>
</tr>
<tr>
<td>2014</td>
<td>2.4%</td>
<td>2.1%</td>
<td>2.8%</td>
<td>2.0%</td>
<td>2.2%</td>
<td>2.3%</td>
<td>3.3%</td>
<td>1.6%</td>
</tr>
<tr>
<td>2015</td>
<td>2.3%</td>
<td>2.0%</td>
<td>2.7%</td>
<td>1.9%</td>
<td>2.1%</td>
<td>2.2%</td>
<td>3.2%</td>
<td>1.5%</td>
</tr>
</tbody>
</table>

Acknowledgements

L.Lawlor, M.Kehoe, A.Shine, S.Philbin, J.Hannon, E.Burke, G.Gaynor, G.Smith, S.Corry.

References

4. http://www.cndc.org.uk/report-database/2015-06 Sawan: DAMA, PVP, and BzP were the most popular in 2013. Pentedrone arrived in 2013, and by 2014 was the most popular at 9.1%.
5. PVP was a close second at 8.1%. So far in 2015 PVP and Pentedrone are the NPS's of choice.

The profile of drugs has changed greatly over the years as various legislative measures were introduced and this is reflected in the drugs detected by us in patient samples 1, 2.

In terms of the main cathinones seized in 2013 in Europe 3-MMC (341 kg), 4-MEC (210 kg), pentedrone (157 kg) and alpha-PVP (115 kg) accounted for almost 80% of the total amount seized. Between 2008 and 2013 there has been a 60-fold increase in the number of seizures of synthetic cathinones.

In Ireland in 2013, the main NPS drugs (excluding synthetic cannabinoids) seized in Ireland were PVP, 4-MEC, Mephedrone, MDPBP and Fluoromethcaine. This correlates with our findings. The data demonstrates the on-going challenges in monitoring the use of these dangerous new substances and keeping up with the new drugs as they emerge.

A serious problem for testing laboratories is the long time it takes to get certified reference standards for new drugs which emerge.