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# Mephedrone use and associated adverse effects in school and college/university students before the UK legislation change

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## Summary

**Background:** Mephedrone is a synthetic cathinone that is commonly used as a recreational drug among those who attend nightclubs. There have been increasing reports of toxicity associated with its use and it was controlled as a Class B drug under the Misuse of Drugs Act (1971) in the UK on 16 April 2010. There has been a suggestion from media reports that mephedrone use is common in children/students but there is no data on the prevalence of its use among the general population. The aim of this study was to determine the prevalence and frequency of use of mephedrone among school and college/university aged individuals and to collect data on the sources of mephedrone and acute harm related to its use.

**Methods:** Data was collected using a questionnaire survey in schools, colleges and universities in the Tayside area of Scotland, UK in February 2010.

**Results:** A total of 1006 individuals completed the survey [501 (49.8%) males and 505 (50.2%) females], of whom 349 classified their educational institute as a school and 657 as a college/university. Among them 205 (20.3%) reported previous use of mephedrone; 23.4% reported using only using mephedrone on one occasion previously, although 4.4% reported daily use. A total of 56% of those who had used mephedrone, reported at least one unwanted effect associated with its use. A total of 17.6% of users reported 'addiction or dependence' symptoms associated with their mephedrone use. A total of 48.8% of users sourced mephedrone from street level dealers, 10.7% from the Internet.

**Conclusions:** We have shown in this study that the use of mephedrone among school and college/university students is common and that users found it easy to obtain. There was a high prevalence of unwanted effects associated with its use. Further work is needed to determine the impact of the recent changes in the UK legislation relating to mephedrone and other related cathinones and whether this has been effective in reducing the prevalence of mephedrone use.

## Background

Mephedrone (4-methylmethcathinone) is a synthetic cathinone which has been available as a recreational drug in Europe since 2008.[1] It is used for its stimulant properties and there has been increasing evidence of its use and acute toxicity associated with its use during 2009 and 2010.[2–8] It appears that the increase in use of mephedrone was in part

driven by poor availability and/or low purity of 'classical' stimulant recreational drugs such as cocaine and MDMA and in part related to the fact that it was legally and widely available from Internet suppliers.[3,7,8]

Mephedrone is generally used by nasal insufflation of powder or oral ingestion of powder, liquid, capsule or tablets.[3,5,8] It causes sympathomimetic toxicity with typical features seen in those presenting to the Emergency Department of agitation, tachycardia, hypertension, seizures and chest pain.[5,6,9] These features appear to be similar to the patterns of toxicity seen with 'classical' stimulant drugs such as ecstasy (MDMA) and cocaine. There has been one confirmed death related to lone mephedrone use from Sweden.[10] Although there have been numerous media reports where mephedrone has been implicated in deaths in the UK most of these are awaiting either toxicological analysis or coroner/procurator fiscal inquests to confirm whether or not mephedrone was actually involved in the cause of death.[9]

The UK Advisory Council on the Misuse of Drugs reviewed the evidence of acute harm associated with mephedrone use and as a result it was controlled along with other related cathinones as a class B drug under the UK Misuse of Drugs Act (1971) on 16 April 2010.[11]

A recent survey of over 2000 clubbers in the UK showed that 41.7% of individuals had used mephedrone on at least one occasion and 33.6% has used it within the last month. The last month use figures were similar to those for 'classical' recreational drugs such as cocaine (44.7%) and ketamine (32.4%) and MDMA powder (48.4%).[2] There has been a significant increase in the number of searches on the UK drug information website FRANK for mephedrone and other cathinones from 3.7% of all searches in September 2009 to 21.4% in February 2010.[9] There has been suggestion from coverage in the popular press that mephedrone use is widespread among school and college age adolescents, with reports of children as young as eight having the drug confiscated from them at school.[12]

However, mephedrone is not included in any published population-level surveys of drug use such as the British Crime Survey and other similar surveys in Europe. Therefore, there is limited information available on population use of mephedrone. The aim of this study was to determine the prevalence and frequency of use of mephedrone among school and college/university aged individuals and to collect data on the sources of mephedrone and acute harm related to its use.

## Materials and methods

A questionnaire was designed which collected data on basic demographics (age and sex), type of educational institution and previous use of mephedrone. In those individuals who reported previous use of mephedrone additional information was collected on the frequency of use of mephedrone, ease of obtaining it, where it was obtained from, form of mephedrone used and any adverse effects associated with its use. Data was collected in February 2010 from five secondary schools, three colleges and two universities in the Tayside area of Scotland by the Tayside Police Force Information and Intelligence Analyst Unit to establish how common mephedrone use was in students in their local area. All of the students in these educational institutions were given the opportunity to participate in the survey; participation was voluntary and anonymous.

## Results

### Study population

A total of 1006 individuals completed the survey, 501 (49.8%) males and 505 (50.2%) females. Three hundred and forty-nine classified their educational institute as a school (mean ± SD age 14.0 ± 1.1 years) and 657 as a college/university (mean ± SD age 20.50 ± 6.5 years).

### Mephedrone use

A total of 205 (20.3%) of those surveyed had used mephedrone on at least one occasion. The frequency of mephedrone use is shown in Figure 1. Overall, 23.4% reported using only using mephedrone on one occasion previously. A total of 4.4% of the study group reported using mephedrone on a daily basis, however, daily use of mephedrone was only reported in those 21 years or younger.

Mephedrone was used in five different forms (tablet, capsule, powder, liquid and crystal). Users reported use of mephedrone in numerous different combinations, these are summarized in Table 1. The most common forms of mephedrone used were powders and capsules; conversely there was little reported use of liquid or crystalline mephedrone.

### Source of mephedrone

The sources used to obtain mephedrone are shown in Table 2 which demonstrates that the most common source was a dealer in almost half of those surveyed. At the time of the survey mephedrone was legally available from Internet sites, but

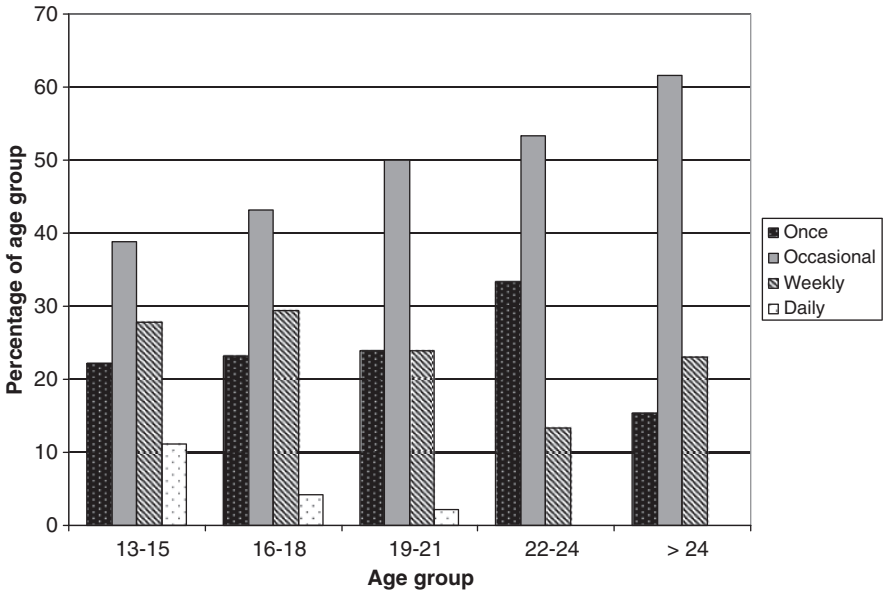


**Figure 1.** Frequency of mephedrone use among the 205 mephedrone users.

**Table 1** Form of mephedrone used by the 205 mephedrone users

| Form of mephedrone | Number of users | Percentage of users |
|---|---|---|
| Capsule/powder | 116 | 56.5 |
| Capsule | 49 | 23.9 |
| Powder | 17 | 8.3 |
| Tablet | 6 | 2.9 |
| Tablet/powder | 5 | 2.4 |
| Tablet/powder/capsule | 4 | 2.0 |
| Tablet/capsule/powder/crystalline | 2 | 1.0 |
| Liquid | 2 | 1.0 |
| Not available/not answered | 2 | 1.0 |
| Crystalline | 1 | 0.5 |
| Tablet/capsule | 1 | 0.5 |

**Table 2** Source of mephedrone among the 205 mephedrone users

| Source | Percentage of those who had used mephedrone |
|---|---|
| 'Dealer' | 48.8 |
| Internet | 10.7 |
| Friend/family member | 8.7 |
| 'Free at a party' | 5.4 |
| Self-manufactured | 0.5 |
| Unknown/not answered | 25.9 |

only 10.7% of users reported sourcing mephedrone over the Internet. However there was a trend to increasing sourcing of mephedrone from the Internet with increasing age (8.3% in those aged 13–15 years compared to 30.8% in those aged over 24 years).

The vast majority of individuals found mephedrone very easy (66.6%) or easy (31.3%) to obtain, with only 2.1% reporting it was difficult to obtain mephedrone. A number of respondents gave further explanation of their reasons for using mephedrone; responses included: 'as I was told it was legal and I thought I would give it a bash'; 'legal, accessible, and feel good factor'; 'because it was legal and potent'; and 'thought it was OK because it was legal then got dependant on the feeling'. A 16-year old within the school group described mephedrone as 'being cheaper than alcohol'.

## Adverse effects associated with mephedrone use

Of the 205 respondents who reported previous mephedrone use, 56% reported at least one adverse effect associated with its use. The adverse effects reported by users are summarized in Table 3. A significant number of these were local effects related to the irritant properties of mephedrone (sore nasal passages 24.4%, sore mouth/throat 22.9%, nose bleeds 22.4%). Of note, 17.6% of users reported 'addiction or dependence' symptoms associated with their mephedrone use.

**Table 3** Adverse effects reported among the 205 users of mephedrone

| Adverse effect | Number of users | Percentage of users |
|---|---|---|
| Bruxism | 58 | 28.3 |
| Paranoia | 51 | 24.9 |
| Sore nasal passages | 50 | 24.4 |
| Hot flushes | 48 | 23.4 |
| Sore mouth/throat | 47 | 22.9 |
| Nose bleeds | 46 | 22.4 |
| Suppressed appetite | 44 | 21.5 |
| Blurred vision | 43 | 21.0 |
| Palpitations | 42 | 20.5 |
| Insomnia | 40 | 19.5 |
| Hallucinations | 37 | 18.0 |
| Addiction/dependence | 36 | 17.6 |
| Nausea/vomiting | 35 | 17.1 |
| Burns | 35 | 17.1 |
| Blue/cold extremities | 30 | 14.6 |

## Discussion

We have shown that, at the time of the study, mephedrone use was common among school and college/university students in Scotland. The overall prevalence of use in our study population (20.3% life-time use) was however not as high as that reported in surveys of UK clubbers (41.7% life-time use).[2] Although overall there appears to be greater prevalence of use of mephedrone among clubbers, a greater proportion of mephedrone users in our study were using it on an at least weekly basis (30.7% compared to 14.5% in the UK clubbers survey). In addition, daily use of mephedrone was only seen in users aged <21 years of age and the highest daily use of 11.1% was among the 13–15 year age group. The students who reported use of mephedrone generally reported that it was easy or very easy to source. Interestingly, although a large proportion of the popular media coverage of mephedrone suggested widespread purchase of mephedrone from the Internet prior to its classification in the UK, only 10.7% of users in our survey reported souring mephedrone from the Internet. The majority of users sourced mephedrone from street level dealers. There was a trend to increasing sourcing of mephedrone from the Internet with increasing age; this may have been because the younger (<18 years of age) users are less likely to have credit/debit cards that would allow them to independently purchase from the Internet.

This study was carried out prior to the classification of mephedrone as a Class B Drug under the Misuse of Drugs Act (1971) in the UK in April 2010. The classification of mephedrone in the UK has resulted in 'legal high' Internet suppliers temporarily closing for business, no longer offering mephedrone for sale and/or selling alternative novel legal highs such as NRG-1 (which potentially contains naphylpyrovalerone).[13] Therefore, users are less able to easily source mephedrone over the Internet which will potentially lead to changes in the supply of mephedrone with a further increase in supply from street level dealers and/or a switch to either other classified recreational drugs or to other novel drugs that are still legally available.[7]

In our survey, 56% of mephedrone users reported at least one adverse effect associated with its use. In addition to the sympathomimetic features discussed in previous reports, a significant proportion of users noted local irritant effects. These included 'sore nasal passages' (24.4%) and nose bleeds (22.4%) from nasal insufflation of mephedrone. There have been few previous reports describing the acute harm associated with the use of mephedrone. Initial information was from Internet user discussion forums which suggested that mephedrone had stimulant effects.[14] The first report in the scientific literature of acute toxicity associated with mephedrone described a patient who developed agitation and sympathomimetic features following oral and subsequently intramuscular use of mephedrone.[4] Subsequently, larger case series of acute toxicity associated with mephedrone have been reported.[5,6] These have confirmed that mephedrone causes sympathomimetic features with the most common feature being agitation in >50% of patients. Other common features include palpitations (25.8%), significant hypertension (16.1%), significant tachycardia (12.9%) and self-limiting seizures (9.7%).[6] A total of 14.6% of users reported 'blue extremities' in the current survey, this is very similar to the 15% reported in the recently reported clubber survey;[2] this phenomenon has also been reported in Internet forum user discussion forums.[14] However, none of the clinical reports of acute mephedrone toxicity describe peripheral vasospasm or cool/blue extremities in individuals with acute mephedrone toxicity. There are reported cases of peripheral vasospasm with some novel sympathomimetics such as Bromo-DragonFLY,[15] however these reports are limited by the use of high doses of norepinephrine and/or other vasoconstricting agents. Although there is the potential that mephedrone, as a sympathomimetic agent, could cause vasospasm through alpha-1 effects, this is not a feature that is seen with drugs with a similar mechanism of action such as MDMA or cocaine.[16,17] We feel, therefore, that it is possible that the potential for

this phenomenon has become a widespread 'urban myth' among users.

A number of previous reports, prior to the classification of mephedrone, have suggested that users first became aware of mephedrone through media reports and that widespread media coverage of mephedrone also led to increasing knowledge of its availability and legal status.[3,7] There has also been the suggestion, from Internet mephedrone suppliers, of increases in sales of mephedrone following media coverage in the UK.[18] A number of users in our study stated that they had first become aware of mephedrone and starting using it as a result of media coverage. For instance, one of the college/university students commented: 'I think the recent press coverage has just made people more likely to try it. I'm a 20 year old uni student, not a druggie, and I'm ashamed to say I enjoyed it'. In addition media coverage of the potential harm associated with mephedrone does not appear to deter users, another college/university student in our survey stated that they: 'would probably do it *[mephedrone]* again despite all the scare stories'

This study has shown that mephedrone was widely used among school and college/university students prior to its classification in the UK. We have also demonstrated that surveys such as these, can provide useful information on the patterns of use, source and acute harm associated with recreational drug use among school and college/university students. Further work is required to investigate the impact of the classification of mephedrone and related cathinones and in particular whether this has resulted in a change in the prevalence of use of these drugs, changes in their routes of supply and/or whether other drugs have taken their place.

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*Conflict of interest:* P.I.D. and D.M.W. have acted as expert advisers to the UK Advisory Council on the Misuse of Drugs and the European Monitoring Centre for Drugs and Drug Addiction on mephedrone and other recreational drugs.

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