

# Determining the scale of designer drugs (DD) abuse and risk to public health in Poland through an epidemiological study in adolescents

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## Abstract

Since 2008, it has been recognised by most health authorities worldwide that the abuse of newly-emerging psychoactive drugs, ('designer drugs'/'legal highs'; DD), in youth is a rapidly increasing problem, especially in the EU, threatening to offset gains made in tackling established and illegal drugs which they are intended to mimic; DD diversity is continually increasing to circumvent laws. The aim of the study was to determine the scale of DD abuse/availability amongst Polish youth. The surveyed test population was randomly selected from a representative group of adolescents attending high schools, secondary schools and universities throughout Poland. Questionnaires were completed by 14,511 subjects (10,083 school pupils and 4,428 students). Few persons from each group admitted using DDs; 453 schoolpupils (4.49%) vs. 81 students (1.83%). More males (4.74%) took DDs than females (2.77%). The tendency to take DDs in the company of friends was high in both DD-taking groups (>80%). DDs were consumed mostly in open spaces (34.15%), discos/pubs (21.13%) and boarding school/friend's house (20.57). Most frequently, DDs came from shops (57.68%), friends (31.46%) or dealers (10.11%). Ensuing symptoms included; happy/euphoric mood (58.80%), talkativeness (42.51%) and hallucinations (22.85%). Over 74% of DD-takers in both groups experienced adverse reactions, and those requiring help sought it from: friends/colleagues (6.74%), doctors (5.06%), and hospitals (4.87%), but most rarely from parents/guardians (2.62%). Urgent action is being taken, especially in youth education, to prevent DDs becoming the serious menace seen with conventional drugs.

## Key words

designer drugs (DDs), legal highs, adolescent health

## INTRODUCTION

Since the 1980s, new psychoactive substances have been referred to as 'designer drugs' (DDs), although in recent years the term 'legal highs' (LHs) has become popular. They refer to a broad category of unregulated psychoactive compounds and/or products in which they are contained, marketed as legal alternatives to conventional controlled drugs, and usually sold via the Internet or in 'smart/head shops'. The term is applied to a wide range of synthetic and plant-derived substances and products, including 'herbal highs', 'party pills' and 'research chemicals', many of which may be specifically designed to circumvent existing drug controls. The term 'legal highs' in itself, though in common usage, remains problematic, but is used as an umbrella term for psychoactive substances not controlled by drug laws [1]. In many countries, these compounds present a serious social and health problem. Describing these substances as 'legal'

can be incorrect or misleading to customers, as many may already be covered by medicines or food safety laws. Under the European Product Safety Directive, producers are obliged to retail only safe products on the market. Under reasonably foreseeable conditions of use, a product should not 'present any risk or only the minimum risks compatible with the product's use, considered to be acceptable and consistent with a high level of protection for the safety and health of persons', taking into account its characteristics, labelling, and any warnings and instructions for usage [1].

One of the first most commonly found ingredients of LHs were either piperazine derivatives (BZP); TFMPP, mCPP, DBZP or cannabinoid receptor (C1) agonists. After becoming illegal, they were replaced by cathinone and its derivatives, as well as new cannabinoid receptor (C1) agonists [2]. The latest European Commission (EC) report shows nearly a two-fold increase in new psychoactive compounds. In 2009, 24 new substances appeared on the European market, whereas a year later 41 new ones appeared. Access to these compounds increases at an alarming pace. Most of the 41 new psychoactive substances were synthetic cathinones or synthetic cannabinoids, of which the latter (15 cases) have now become, after the phenethylamines, the second-largest

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drug family monitored by the early-warning system, (EWS). The list of newly-notified substances also contains a diverse group of chemicals, including a synthetic cocaine derivative, a natural precursor, and miscellaneous other synthetic psychoactive substances [1, 3].

Currently, it takes the EU about a year to place a suspect compound on the prohibited list by a 6-stage procedure; however, this is insufficient to keep pace with new DD development by producers. Efforts are therefore now underway to make this process more rapid and efficient [4]. Identification of newly-emerged DDs on the market and appropriate enforcement action taken, merely fuels producers to stay one step ahead by actively searching for and manufacturing new innovative and diverse DDs, coupled with developing novel marketing strategies [5].

The Polish DD trade really started in 2007, helped by the internet, and a year later the first 'head/smart shop' premises were opened in Lodz [6], after which the number rose dramatically throughout the country to 1,400 towards the end of 2010. In November of that year, following recent changes in legislation, the Chief Sanitary Inspectorate (CSI), was able to close all these shops. As a result, suppliers started using various other alternatives for selling, such as the internet, through illicit drug dealing, etc [7, 8, 9].

Until fairly recently, DDs masqueraded as camouflaged narcotics due to the then legal loopholes in the law which allowed them to remain outside existing anti-drug laws [10], as well as other regulations governing alcohol and tobacco. Subsequent amendments made to narcotic legislation have now included psychoactive chemicals which are now defined in a banned list by their systematic and common chemical names [11, 12, 13]. Possession or selling of DDs or potential DDs thereby became a criminal offence, and their marketing was covered by the same law as for conventional narcotics/illegal drugs.

In 2009, the first amendments extended the list of banned substances to cover BZP, JWH-10 (Cannabinoid C1 receptor agonist) and 15 psychoactive herbal products suspected of being present in DD products, consisting of; *Argyrea nervosa*, *Banisteriopsis caapi*, *Calea zacatechichi*, *Catha edulis*, *Echinopsis pachanoi*, *Kava kava*, *Leonotis leonurum*, *Mimos tenuiflora*, *Mitragyna speciosa*, *Nymphaea caerulea*, *Peganum harmala*, *Rivea corymbosa*, *Salvia divinorum*, *Tabernanthe iboga*, *Trichocereus peruvuanus*) [11]. Further extensions made in 2010 included new synthetic cannabinoids and the newly-emerged mephedrone [12]. At the same time [14], new legal definitions of 'substitute substances' were introduced whereby if those compounds present in DD products were not covered by any other legislation on safety, then they automatically fall under the anti-drug law. In addition, the afore-mentioned amendments prohibit the manufacture and market placement of substitute substances; the penalties being heavy fines where the CSI is responsible for national surveillance. Not surprisingly, in 2011, further substantial additions were made to the list of banned substances [5, 13]. Despite the measures taken, the serious social and health problems of DDs remain which therefore a growing concern to national anti-narcotic institutes and those in the EU, as well as others further abroad.

As previously stated, the DD issue depends not only on diversity, but on developing new strategies for marketing, advertising, and ways of taking the DDs. Freshly-emerging DDs, if not covered by the above-mentioned legislation, can also be technically legal if they have not also been checked

for safety as consumer products. As a result, there are many internet sites selling DDs as decorations for Christmas and Halloween, or as joss-sticks and chemical reagents. DDs come in many guises, such as pills/tablets (46.6%), dried plants mixed with plant/synthetic extracts for smoking, e.g. 'spice' (29.7%), raw plant material with various extracts (18.1%), and powder (3.7%), or liquid (1.2%) forms of the latter. A very few can be in the form of aerosols or chewing gum. Within this assortment, the majority of products offered are of plant origin, sold separately (e.g. sage, kratom, red mushrooms), or as seeds (e.g. Hawaiian Baby Woodrose), or as dried plant mixtures containing C1-cannabinoid receptor agonists such as JWH-018 [15].

The effect of DDs on the body is of course paramount. In such a short space of time, invariably no formal scientific studies on the pharmacodynamics or pharmacokinetics are possible, nor can interactions with medicinal drugs or other medications be assessed. In addition side-effects, overdosing, presence of undetermined residues, addictive potential, long-term effects, not to mention psychological or social effects, can only be known through using animal models. The sole evidence is provided by the users themselves, (i.e. subjective), or from the limited number of clinical reports/case studies. Problems in gathering and systematically analysing this data, however, is compounded by the enormous diversity of compounds present in DD products.

## STUDY OBJECTIVES

These were formulated in response to the public health threats posed by emerging DDs and are as follows;

- discover the extent of DD use amongst pupils and students;
- determine DD availability and distribution channels;
- assess youngsters attitudes to DDs and awareness of the health risks/dangers arising, including social issue problems.

## MATERIAL AND METHODS

**Study population profile.** The surveyed test population was randomly selected from a representative group of adolescents attending high schools, secondary schools and universities throughout Poland. Questionnaires were completed between the first and second quarters of 2011 by 14,511 subjects of which 10,083 were from high/secondary schools and 4,428 came from universities. Altogether, 7,826 were female and 6,684 male (Tab. 1a, 1b).

**Sample selection – schoolchildren.** Samples were taken from the Ministry of National Education database particularly using the 'Identification Data concerning Schools and Educational Facilities' obtained from the Educational Information System of 30 September 2010 (No. 2010.09.30/01). Schools were sampled and then analysed using Statistica and SPSS software. Pupils attending high/secondary schools were sampled in two stages, i.e. first, an appropriate school was chosen by stratified sampling and then a suitable class was selected. The Cluster sampling method was used; all children from the selected classes were surveyed. The sampling covered 569 schools from 379 districts in Poland.

**Table 1a.** Test population profile according to gender

|          |   | Girls/Women | Boys/Men | Total  |
|----------|---|-------------|----------|--------|
| Pupils   | n | 5,154       | 4,928    | 10,082 |
|          | % | 65.86       | 73.73    | 69.48  |
| Students | n | 2,672       | 1,756    | 4,428  |
|          | % | 34.14       | 26.27    | 30.52  |
| Total    | n | 7,826       | 6,684    | 14,510 |
|          | % | 53.94       | 46.06    | 100.00 |

**Table 1b.** Test population profile according to age\*

|          |   | <16 yrs | 16-20 yrs | 21-25 yrs | >25 yrs | Total  |
|----------|---|---------|-----------|-----------|---------|--------|
| Pupils   | n | 3,543   | 6,113     | 110       | 7       | 9,773  |
|          | % | 99.86   | 88.84     | 3.50      | 1.50    | 69.61  |
| Students | n | 5       | 768       | 3,035     | 459     | 4,267  |
|          | % | 0.14    | 11.16     | 96.50     | 98.50   | 30.39  |
| Total    | n | 3,548   | 6,881     | 3,145     | 466     | 14,040 |
|          | % | 25.27   | 49.01     | 22.40     | 3.32    | 100.00 |

\*There were 471 incorrect replies received to the questionnaires concerning date of birth, of these, 310 were pupils and 161 students. Only one reply on gender was ambiguous. The data shown above have therefore been adjusted accordingly.

**Sample selection – students.** A questionnaire in electronic form was used to sample students available on a specified university website. The survey was anonymous. However, additional data was collected concerning the university and place of respondents' residence; this served to stratify samples and allowed corrections to be made to the detailed composition of single student groups within a group. Corrections were made in two ways: 1) by randomly removing any excessively analysed subjects and rejecting answered questionnaires containing mistakes or repetitions, i.e. a 'structural sampling correction'; 2) by using the all-Polish additional data which enabled individual questionnaires to be ranked and samples to be standardised according to additional variables.

## STATISTICAL ANALYSIS

Performed using the Statistica 8.1 PL software package. Results were presented in the form of frequency tables, descriptive statistics and contingency tables. Constructing contingency tables and using the Pearson chi-squared test allowed nominal scale data to be analysed.

## RESULTS

Only a small proportion in total pupil and student numbers admitted to taking DDs, of which the former was higher at 4.49% (n=453) compared to the latter at 1.83% (n=81) (Tab. 2). Of these, pupils aged 15 years or over took DDs more frequently (3.99%) than those who were younger (2.57%). It is suggested that low general public awareness of DD harm is responsible for these findings. About 60% more males were found to take DDs than females (4.74% vs. 2.77%, respectively) (Tab. 2). Furthermore in total, there were more subjects who admitted taking DDs who lived in towns/cities <100,000 inhabitants, (4.48%) compared to those with >100,000. The fewest lived in villages/countryside (2.99%) (Tab. 2).

**Table 2.** Breakdown of subjects according to admission of DD use

| GROUP             |   | No to taking DDs | Yes to taking DDs | p; (chi <sup>2</sup> ) |
|-------------------|---|------------------|-------------------|------------------------|
| Pupils            | n | 9,626            | 453               | <0.000                 |
|                   | % | 95.51            | 4.49              |                        |
| Students          | n | 4,347            | 81                |                        |
|                   | % | 98.17            | 1.83              |                        |
| GROUP             |   | No to taking DDs | Yes to taking DDs | p; (chi <sup>2</sup> ) |
| Up to 15 yrs      | n | 3,456            | 91                | <0.000                 |
|                   | % | 97.43            | 2.57              |                        |
| Older than 15 yrs | n | 10,071           | 418               |                        |
|                   | % | 96.01            | 3.99              |                        |
| GENDER            |   | No to taking DDs | Yes to taking DDs | p; (chi <sup>2</sup> ) |
| Females           | n | 7,607            | 217               | <0.000                 |
|                   | % | 97.23            | 2.77              |                        |
| Males             | n | 6,365            | 317               |                        |
|                   | % | 95.26            | 4.74              |                        |
| RESIDENCE         |   | No to taking DDs | Yes to taking DDs | p; (chi <sup>2</sup> ) |
| Rural             | n | 6,223            | 192               | <0.000                 |
|                   | % | 97.01            | 2.99              |                        |
| Urban < 100,000   | n | 4,651            | 218               |                        |
|                   | % | 95.52            | 4.48              |                        |
| Urban > 100,000   | n | 3,097            | 124               |                        |
|                   | % | 96.15            | 3.85              |                        |
| Total             | n | 13,973           | 534               |                        |
|                   | % | 96.32            | 3.68              |                        |

The most popularly taken DDs were found to be 'Tajfun/Typhoon', (n=45, 23.08%), energy drinks, (n=31, 15.9%), 'Konkret/Concrete', (n=22, 11.28%), and 'Shiva' (n=17, 8.72%). The least favoured were 'Melange', 'Baka', 'Armagedon', 'Turbo blast', 'Bonsai' and 'Jamajka/Jamaica'; all at n=2, 1.03% (Tab. 3).

Of those admitting taking DDs, there were more pupils who took 1-2 DDs than students; 48.78% vs 41.98% and interestingly, this trend was also seen in those taking DDs more frequently, 3-9 times, at 25.39% vs. 24.69%, respectively. In contrast, there were more students (33.33%) than pupils (25.83%) who took more than 9 DDs (Tab. 4). According to gender, there were more females than males who took 1-2 DDs, (58.07% vs. 40.69%); however, the reverse was seen in those taking DDs 3-9 and >9 times, respectively (26.50% vs. 23.50% and 32.81% vs. 18.43%) (Tab. 4). The number of subjects that took 1-2 DDs decreased in order of increasing number of inhabitants of the locality, i.e. for the countryside, cities <100,000 and cities >100,000 this was, respectively, 52.08%, 47.71% and 41.13%. The opposite, however, was seen in those who took more than 9 DDs, i.e. 22.92%, 28.44% and 30.64%, respectively (Tab. 4).

By far the most popular way of taking DDs by all the studied subjects was with their friends, (82.67% for pupils and 81.48% students). Other occasions included, respectively, on one's own (8.67% and 11.11%), with family (6.22% and 6.17%), and with incidental company (2.44% and 1.24%) (Tab. 5). A large majority of females preferred to take DDs with their friends (86.58%) than alone (11.57%); the respective proportions for males being 79.68% and 7.30%. In terms of taking DDs in the presence of the family or with persons met incidentally, males took more than females, respectively, 9.21% vs. 1.85% and 3.81 vs. 0.00%. The greatest consumption of DDs in the presence of friends took place among those living in cities with <100,000 inhabitants (Tab. 5).

**Table 3.** Types of DDs consumed<sup>1</sup>,\*\*

| DD NAME             | n  | %*    | %**  |
|---------------------|----|-------|------|
| 'Tajfun'            | 45 | 23.08 | 8.43 |
| Energy drinks       | 31 | 15.90 | 5.81 |
| 'Konkret'           | 22 | 11.28 | 4.12 |
| 'Shiva'             | 17 | 8.72  | 3.18 |
| 'Czeszący Grzebień' | 13 | 6.67  | 2.43 |
| 'Mefedron'          | 10 | 5.13  | 1.87 |
| 'Spice'             | 9  | 4.62  | 1.69 |
| 'Buszek'            | 7  | 3.59  | 1.31 |
| 'Czarna Wdowa'      | 5  | 2.56  | 0.94 |
| 'Rasta'             | 5  | 2.56  | 0.94 |
| 'Bobi'              | 5  | 2.56  | 0.94 |
| 'Sztynny Misza'     | 5  | 2.56  | 0.94 |
| 'Gumijagody'        | 5  | 2.56  | 0.94 |
| 'Amfibia'           | 4  | 2.05  | 0.75 |
| 'Mr Grzmot'         | 4  | 2.05  | 0.75 |
| 'Tabaka'            | 3  | 1.54  | 0.56 |
| 'Git Roman'         | 3  | 1.54  | 0.56 |
| 'Speedo'            | 3  | 1.54  | 0.56 |
| 'Kosior'            | 3  | 1.54  | 0.56 |
| 'Woodo'             | 3  | 1.54  | 0.56 |
| 'Magic'             | 3  | 1.54  | 0.56 |
| 'Jamajka'           | 2  | 1.03  | 0.37 |
| 'Bonsai'            | 2  | 1.03  | 0.37 |
| 'Turbo Blast'       | 2  | 1.03  | 0.37 |
| 'Armagedon'         | 2  | 1.03  | 0.37 |
| 'Baka'              | 2  | 1.03  | 0.37 |
| 'Melange'           | 2  | 1.03  | 0.37 |

\*percentage of those providing DD names (n=234);

\*\*percentage of those admitting taking DDs (n=534).

**Table 4.** Incidence (x) of DD taking\*

| GROUP           | 1-2X    | 3-9X  | >9X   | p; (chi <sup>2</sup> ) |
|-----------------|---------|-------|-------|------------------------|
| Pupils          | n 221   | 115   | 117   | 0.358                  |
|                 | % 48.78 | 25.39 | 25.83 |                        |
| Students        | n 34    | 20    | 27    |                        |
|                 | % 41.98 | 24.69 | 33.33 |                        |
| GENDER          | 1-2X    | 3-9X  | >9X   | p; (chi <sup>2</sup> ) |
| Females         | n 126   | 51    | 40    | <0.000                 |
|                 | % 58.07 | 23.50 | 18.43 |                        |
| Males           | n 129   | 84    | 104   |                        |
|                 | % 40.69 | 26.50 | 32.81 |                        |
| RESIDENCE       | 1-2X    | 3-9X  | >9X   | p; (chi <sup>2</sup> ) |
| Rural           | n 100   | 48    | 44    | 0.339                  |
|                 | % 52.08 | 25.00 | 22.92 |                        |
| Urban < 100,000 | n 104   | 52    | 62    |                        |
|                 | % 47.71 | 23.85 | 28.44 |                        |
| Urban > 100,000 | n 51    | 35    | 38    |                        |
|                 | % 41.13 | 28.23 | 30.64 |                        |
| Total           | 1-2X    | 3-9X  | >9X   |                        |
| Total           | n 255   | 135   | 144   |                        |
|                 | % 47.75 | 25.28 | 26.97 |                        |

\* percentage of those admitting to whenever taking DDs (n=534), i.e. in total.

**Table 5.** Environments in which subjects took DDs\*

| GROUP           | Friends | Family | Incidental company | Alone | p; (chi <sup>2</sup> ) |
|-----------------|---------|--------|--------------------|-------|------------------------|
| Pupils          | n 372   | 28     | 11                 | 39    | 0.811                  |
|                 | % 82.67 | 6.22   | 2.44               | 8.67  |                        |
| Students        | n 66    | 5      | 1                  | 9     |                        |
|                 | % 81.48 | 6.17   | 1.24               | 11.11 |                        |
| GENDER          | Friends | Family | Incidental company | Alone | p; (chi <sup>2</sup> ) |
| Females         | n 187   | 4      | 0                  | 25    | <0.000                 |
|                 | % 86.58 | 1.85   | 0.00               | 11.57 |                        |
| Males           | n 251   | 29     | 12                 | 23    |                        |
|                 | % 79.68 | 9.21   | 3.81               | 7.30  |                        |
| RESIDENCE       | Friends | Family | Incidental company | Alone | p; (chi <sup>2</sup> ) |
| Rural           | n 155   | 13     | 5                  | 18    | 0.635                  |
|                 | % 81.15 | 6.81   | 2.62               | 9.42  |                        |
| Urban < 100,000 | n 183   | 13     | 2                  | 18    |                        |
|                 | % 84.72 | 6.02   | 0.93               | 8.33  |                        |
| Urban > 100,000 | n 100   | 7      | 5                  | 12    |                        |
|                 | % 80.64 | 5.65   | 4.03               | 9.68  |                        |
| Total           | Friends | Family | Incidental company | Alone |                        |
| Total           | n 438   | 33     | 12                 | 48    |                        |
|                 | % 82.49 | 6.21   | 2.26               | 9.04  |                        |

\* percentage of those admitting to whenever taking DDs (n=534), i.e. in total.

More pupils than students preferred to take DDs in open spaces (36.97% vs. 18.52%), discos/pubs (22.27% vs. 14.81%), school/college premises (5.34% vs. 4.94%), or other unspecified places (6.68% vs. 6.17%). Compared to pupils, students preferred taking more DDs when using the internet in the company of friends (40.74% vs. 16.93%), or just at home (12.35% vs. 9.58%) – Table 6.

Females showed higher DD consumption than males in the following areas: discos/pubs (24.06% vs. 19.11%), home (12.04% vs. 8.60%) and school/college (5.56% vs. 5.09%), whereas males preferred open spaces (37.26% vs. 29.63%) and unspecified places (8.28% vs. 4.17%). Subjects living in villages/countryside most frequently preferred taking DDs in discos/pubs (27.89%) and open spaces (32.10%). Most of those who liked taking DDs in open spaces lived in cities <100,000 inhabitants (36.11%) (Tab. 6).

The most common ways that pupils obtained DDs were from friends (32.45%), dealers (11.26%), or other means not specified (10.82%) compared, respectively, to students at 25.93%, 3.70% and 9.88%. More students, however, preferred their DDs from shops (66.67%) and the internet (14.81%), compared to pupils at 56.07% and 5.96%, respectively (Table 6). Many more females than males obtained their DDs from friends (41.47% vs. 24.61%), whereas more males preferred buying DDs from shops than females (62.15% vs. 51.15%) (Tab. 7).

A large proportion of both pupil and student DD users experienced unusual symptoms after taking DDs (73.73% and 77.78%, respectively): however, more students than pupils reported side-effects (Tab. 8). Greater numbers of males than females declared feeling unusual symptoms (78.23 vs. 68.66%), and those dwelling in cities reported more negative symptoms after taking DDs (Tab. 8).

The most unusual effects commonly experienced after taking DDs were feelings of bliss, happy mood, euphoria, (58.80%) and being more talkative (22.85%), while the rarest were those of excessive sweating (11.42%), unspecified

**Table 6.** Places in which subjects took DDs\*

| GROUP           |   | At home | Internet/riends | Disco/Pub | Restaurant | Open spaces | School/college | Other | p; (chi <sup>2</sup> ) |                        |
|-----------------|---|---------|-----------------|-----------|------------|-------------|----------------|-------|------------------------|------------------------|
| Pupils          | n | 43      | 76              | 100       | 10         | 166         | 24             | 30    | <0.000                 |                        |
|                 | % | 9.58    | 16.93           | 22.27     | 2.23       | 36.97       | 5.34           | 6.68  |                        |                        |
| Students        | n | 10      | 33              | 12        | 2          | 15          | 4              | 5     |                        |                        |
|                 | % | 12.35   | 40.74           | 14.81     | 2.47       | 18.52       | 4.94           | 6.17  |                        |                        |
| GENDER          |   | At home | Internet/riends | Disco/Pub | Restaurant | Open spaces | School/college | Other |                        | p; (chi <sup>2</sup> ) |
| Females         | n | 26      | 50              | 52        | 3          | 64          | 12             | 9     |                        | 0.083                  |
|                 | % | 12.04   | 23.15           | 24.06     | 1.39       | 29.63       | 5.56           | 4.17  |                        |                        |
| Males           | n | 27      | 59              | 60        | 9          | 117         | 16             | 26    |                        |                        |
|                 | % | 8.60    | 18.79           | 19.11     | 2.87       | 37.26       | 5.09           | 8.28  |                        |                        |
| RESIDENCE       |   | At home | Internet/riends | Disco/pub | Restaurant | Open spaces | School/college | Other |                        |                        |
| Rural           | n | 12      | 33              | 53        | 5          | 61          | 17             | 9     | 0.003                  |                        |
|                 | % | 6.32    | 17.37           | 27.89     | 2.63       | 32.10       | 8.95           | 4.74  |                        |                        |
| Urban < 100,000 | n | 25      | 41              | 39        | 5          | 78          | 10             | 18    |                        |                        |
|                 | % | 11.57   | 18.98           | 18.06     | 2.32       | 36.11       | 4.63           | 8.33  |                        |                        |
| Urban > 100,000 | n | 16      | 35              | 20        | 2          | 42          | 1              | 8     |                        |                        |
|                 | % | 12.90   | 28.23           | 16.13     | 1.61       | 33.87       | 0.81           | 6.45  |                        |                        |
| Total           | n | 53      | 109             | 112       | 12         | 181         | 28             | 35    |                        |                        |
|                 | % | 10.00   | 20.57           | 21.13     | 2.26       | 34.15       | 5.28           | 6.61  |                        |                        |

\* percentage of those admitting to whenever taking DDs (n=534), i.e. in total.

**Table 7.** Profile on how and where DDs are purchased\*;\*\*

| GROUP           |   | Shops | Friends | Internet | Dealers | Other ways |
|-----------------|---|-------|---------|----------|---------|------------|
| Pupils          | n | 254   | 147     | 27       | 51      | 49         |
|                 | % | 56.07 | 32.45   | 5.96     | 11.26   | 10.82      |
| Students        | n | 54    | 21      | 12       | 3       | 8          |
|                 | % | 66.67 | 25.93   | 14.81    | 3.70    | 9.88       |
| GENDER          |   | Shops | Friends | Internet | Dealers | Other ways |
| Females         | n | 111   | 90      | 13       | 13      | 16         |
|                 | % | 51.15 | 41.47   | 5.99     | 5.99    | 7.37       |
| Males           | n | 197   | 78      | 26       | 41      | 41         |
|                 | % | 62.15 | 24.61   | 8.20     | 12.93   | 12.93      |
| RESIDENCE       |   | Shops | Friends | Internet | Dealers | Other ways |
| Rural           | n | 128   | 61      | 15       | 24      | 20         |
|                 | % | 58.72 | 27.98   | 6.88     | 11.01   | 9.17       |
| Urban < 100,000 | n | 100   | 67      | 15       | 19      | 25         |
|                 | % | 52.08 | 34.90   | 7.81     | 9.90    | 13.02      |
| Urban > 100,000 | n | 80    | 40      | 9        | 11      | 12         |
|                 | % | 64.52 | 32.26   | 7.26     | 8.87    | 9.68       |
| Total           | n | 308   | 168     | 39       | 54      | 57         |
|                 | % | 57.68 | 31.46   | 7.30     | 10.11   | 10.67      |

\* percentage of those admitting to whenever taking DDs (n=534) ie. in total; \*\*this question allowed respondents to select more than one answer.

**Table 8.** Occurrence of negative symptoms after taking DDs

| GROUP           |   | Occured | Did not occur | p; (chi <sup>2</sup> ) |                        |
|-----------------|---|---------|---------------|------------------------|------------------------|
| Pupils          | n | 334     | 119           | 0.437                  |                        |
|                 | % | 73.73   | 26.27         |                        |                        |
| Students        | n | 63      | 18            |                        |                        |
|                 | % | 77.78   | 22.22         |                        |                        |
| GENDER          |   | Occured | Did not occur |                        | p; (chi <sup>2</sup> ) |
| Females         | n | 149     | 68            |                        | 0.134                  |
|                 | % | 68.66   | 31.34         |                        |                        |
| Males           | n | 248     | 69            |                        |                        |
|                 | % | 78.23   | 21.77         |                        |                        |
| RESIDENCE       |   | Occured | Did not occur | p; (chi <sup>2</sup> ) |                        |
| Rural           | n | 132     | 60            | 0.063                  |                        |
|                 | % | 68.75   | 31.25         |                        |                        |
| Urban < 100,000 | n | 172     | 46            |                        |                        |
|                 | % | 78.90   | 21.10         |                        |                        |
| Urban > 100,000 | n | 93      | 31            |                        |                        |
|                 | % | 75.00   | 25.00         |                        |                        |
| Total           | n | 397     | 137           |                        |                        |
|                 | % | 74.34   | 25.66         |                        |                        |

\*percentage of those admitting taking DDs.

**Table 9.** Symptom profiles after taking DDs<sup>\*,\*\*</sup>

| NEGATIVE SYMPTOMS REPORTED    | n   | %*    | %**   |
|-------------------------------|-----|-------|-------|
| Happy/blissful mood, euphoria | 314 | 79.09 | 58.80 |
| Talkativeness                 | 227 | 57.18 | 42.51 |
| Hallucinations                | 122 | 30.73 | 22.85 |
| Irritability                  | 119 | 29.97 | 22.28 |
| Excitability                  | 116 | 29.22 | 21.72 |
| Headache                      | 91  | 22.92 | 17.04 |
| Anxiety                       | 89  | 22.42 | 16.67 |
| Bad mood                      | 79  | 19.90 | 14.79 |
| Aggressiveness                | 65  | 16.37 | 12.17 |
| Excessive sweating            | 61  | 15.37 | 11.42 |
| Others                        | 47  | 11.84 | 8.80  |
| Losing consciousness/fainting | 42  | 10.58 | 7.87  |

\*percentage of those reporting symptoms (n=234); \*\*percentage of those admitting taking DDs (n=534).

symptoms (8.80%), and losing consciousness/fainting (7.87%) (Tab. 9). When seeking help in dealing with the untoward symptoms, DD users most frequently turned to friends/acquaintances (6.74%), doctors (5.06%) and hospitals (4.87%), but most rarely to parents/guardians (2.62%) (Tab. 10).

**Table 10.** Type of help sought after taking DDs<sup>\*,\*\*</sup>

| TYPE OF HELP SOUGHT   | n  | %*    | %**  |
|-----------------------|----|-------|------|
| Friends/acquaintances | 36 | 48.00 | 6.74 |
| Doctors               | 27 | 36.00 | 5.06 |
| Hospital              | 26 | 34.67 | 4.87 |
| Parents/guardians     | 14 | 18.67 | 2.62 |

\*percentage of those reporting untoward symptoms (n=75); \*\*percentage of those admitting taking DDs (n=534).

## DISCUSSION

Despite DDs becoming illegal, the presented study shows that they still constitute a serious public health problem that should not be underestimated. Even though low numbers of subjects admitted taking DDs at least once, (3.68% in total), it is worrying that many more younger pupils did so than students who are older. It could be expected that the latter group would be more susceptible to taking DDs/drugs as they are more independent (e.g. financially, in decision making, etc.), and live away from home; however, this was clearly not the case. It is also important that education and other preventative measures should be taken into account when analysing the reasons for the study findings [2]. Moreover, age can be a factor, as the moment when pupils first take DDs might be when they finish their schooling, prior to continuing to further education.

The total numbers of DD users within this age group was found to be very similar with the EU mean of around 5%. In Poland, a previous 2008 study on 1,400 18 year-olds found that 3.5% had taken DDs at least once, whereas a follow-up study on 1,260 students showed an increase to 11.4% [1]. A further study from 2011 demonstrated even larger numbers (14.0%), despite most DDs becoming illegal around this time. Nevertheless, direct comparisons should be treated with caution as DDs are a very heterogeneous and loosely defined group and therefore liable to over-interpretation [16]. On the

other hand, some studies indicate that DDs are taken at the earlier ages of 12-14 years [17], which are not included in the 'Flash-Eurobarometer' data, therefore DD use may in fact be underestimated. The presented study also shows similar numbers of DD users compared to the 2008 study, despite the recent legally enforced ban on these substances, especially seen in the younger group of subjects, (i.e. pupils) [18].

Regardless, overall data of surveyed DD use in Poland prior to and after delegalisation show that in 2008 there were 14% of those who at least once tried DDs, and a year later this rose to 24% with numbers peaking at 35% in the first half of 2010. Numbers fell, however, to 11% in the second half of 2010 and further decreased to 7% at the beginning of 2011. It would seem that this decrease coincided with the time when DDs were made illegal, and the closure of 'smart/head-shops' in October 2010 [12, 14]. An anonymous 2009 internet survey conducted in the UK by Winstock et al [19] on black youth, (n=2,700, mean age 25yrs), before the mephedrone ban, demonstrated that 41.3% had taken this substance of which 38.7% had done so within the last year and 33.2% within the last month. Mephedrone, in fact, occupied 6th place in used stimulants after alcohol, tobacco, cannabinoids, MDMA, (ecstasy), and cocaine [7]. This was roughly in keeping with the European Monitoring Centre for Drugs and Drug Addiction (EMCDDA) report from 2010 where mephedrone occupied 4th place, after cannabinoids, ecstasy and cocaine [20]. Surveys in Poland, however, did not show this same level of popularity for mephedrone; even so, 5.13% admitted taking it amongst DD users.

The EMCDDA report characterised a typical DD user as living in a large city and who visits clubs, discos and popular music concerts [20]. This was confirmed by the 'Flash Eurobarometer' study from 2011 where popularity of using DDs decreased in order of those living in large cities, then towns, and last, the countryside [16]; both data showed a high male predominance. In contrast to the UK data, typical DD users in Poland live in towns, (<100,000), which may, however, simply reflect that the Polish population is spread over much fewer large cities. Upon analysing why DDs are taken by Polish youths, a picture emerges of low awareness of the risk posed by regular or occasional DD use, whether legal or not. There is, however, no scientifically rigorous data available on the actual real risk of using DDs. For this reason, DD producers often do not provide a list of ingredients on labels nor the names of active substances, or even side-effects or interactions with medications and alcohol [8]. Studies show that only 52% of vendors inform about the likely harm of taking their DD products in conjunction with alcohol, medication, driving, or using mechanical equipment.

Up to 63% of DD suppliers that provide ingredient information, however, give neither the chemical names of active substances nor their quantity. Only 48% of shops issue advice on dosage, but 40% do not provide any warning information on interactions or side-effects [21]. A study survey performed on students in the Polish city of Rzeszow showed that 60% of DD users had no idea of the active substances present in taken DDs and, which is even more alarming, 22% of them did not actually care to know [22].

Social networks and the internet are known to play a large role in the marketing, selling and distribution of DDs, but at the present time it is difficult to precisely verify and define their extent; some products are easy to buy over the internet but not all are readily available [17]. Due to the increased

exposure of youngsters to DDs through the internet, the dangers of addiction and health problems thus increase and result in having to consult a doctor or be admitted to hospital by 10% of the DD users surveyed in another study [17]. Despite this, the role of the internet for DD distribution should not be over-rated; the 'Flash Eurobarometer' study on the 27 EU countries showed that over half, (54%) were offered their DDs from friends/acquaintances, and secondly 36% obtained them at parties/clubs. Also 33% bought them in specialist shops while only 7% through the internet [16].

In Poland, most DDs were bought in shops, (although 'smart/head-shops' or internet ones were not differentiated), but in second place were friends/acquaintances, (37.5%), followed by 29.4% at parties/clubs; 4.5% were from the internet and 1.8% from other sources [16]. These results are fairly consistent with a survey study carried out on students from the Podkarpacie region of southern Poland where DDs were principally obtained from friends/acquaintances (38.7%), followed by specialist shops (21.6%), dealers (17%), and only 5.4% via the internet [22].

The presented study shows some similar trends. Over half the DD users surveyed bought them in 'head/smart-shops' (66.67% students and 56.07% pupils), whereas around 25% received them from friends/acquaintances (25.93% students and 32.45% pupils). Decidedly more students bought DDs over the internet than pupils (14.81% vs. 5.96%). The most popular locations where pupils consumed DDs were open spaces (36.97%) and discos/pubs (22.27%), while students took DDs mostly with fellow students in college (40.74%) or 18.52% in open spaces. It should, however, be stressed that irrespective of wherever taken, 82.49% did so in the company of friends/acquaintances.

Another study showed that more DD users living in the countrywide or small cities/towns obtained their DDs via the Internet (10.5% and 7.9%, respectively), compared to those living in large cities (2.3%). What is more surprising is that the former also bought their DDs from specialist shops much more often than large city dwellers [16]. Different results shown by other studies where, until recently, using the internet for obtaining DDs was quite low, reflected that at the time 'smart/head-shops' had been still operating in most EU countries where the studies were performed.

The internet forms the main source of knowledge on a huge number of topic areas including DDs and illegal drugs, whereby trends in their use and abuse are thus developed/established. As well as facilitating sales of psychoactive substances, the internet also provides important information on their actions and effects. This poses a major challenge to regulatory authorities and those institutions responsible for drug prevention together with parents and teachers. Searching the internet for narcotics information is very easy and one can buy them from any place in the world. A survey of 15-24 year-olds living in the EU, confirmed that the internet is a very popular place for obtaining drug information (61%). The remaining sources of information were divided as follows; from friends (35%), medical personnel (34%), family (27%) and teachers (25%) [23]. These trends changed with age as the older youngsters surveyed less frequently sought the advice of parents or friends, but more so from medical personnel. Irrespective of age, some also went to the police and social workers for advice or consulted help lines [16]. A very recent Polish survey conducted on students in 2010/11 confirmed the internet as being the main information of source [22];

however, only 13% of students, irrespective of where they lived, actually sought out any information on DDs – the rest were simply not interested in the subject.

A study by Hillebrand et al [21] demonstrated that the main reasons why the DD mephedrone was preferred were due to market considerations, i.e. the drug was cheap and easily available compared to conventional illegal drugs. The majority of those surveyed who had taken mephedrone within the last 2 months stated that they intended to continue despite the introduction of the mephedrone ban. It was found that in the opinion of those surveyed, legal drugs are not necessarily safe for health just because they are legal [21]. The previously mentioned Rzeszow study showed that the main reasons why DDs were taken were due to curiosity and the desire for excitement/having fun. Of significance, is the finding that after the introduction of official bans, 60% of DD users declared that they would not be giving up DDs, and that they may use newly-emerged DDs as replacements for those declared illegal. Among those respondents, 30% stated with conviction that any future decisions would not be influenced by the legal status, nor by what is learned from the media. However, 15% stated that before taking any further DDs they would wait until the media furore had died down [22].

The 'Flash-Eurobarometer' survey showed the opinion that the best solution would be to ban all substances classified as DDS, although 50% also considered that banning should only concern those substances associated with a health risk. A smaller number (15%) expressed a more moderate standpoint where DDs should become regulated in a similar fashion to alcohol and tobacco. Taking into account only those who have ever tried taking DDs once, only 17% thought that strict controls and bans should cover all stimulant substances; however, 50% declared that this should only apply to those compounds that pose a hazard to health or life itself [16].

## SUMMARY & CONCLUSIONS

It is patently obvious that the new and innovative synthesised analogues of illegal narcotics, including DDs, are bound to continually evolve and appear at ever-increasing rates in order to keep ahead of regulatory/enforcement laws. This, of course, is assisted by the rapid progress made in technological advances, cheap organic synthesis, and the increasing use of the internet for sales and information. It would seem that laws enacted at the political level are destined to inevitably lag behind reality as new substances continually appear, often with minimal modification on existing ones, that can thus bypass any prohibition lists; at least for a while, until they become updated. Unfortunately, what was once a cat-and-mouse game fuelled by enterprising producers has now been taken over by organised crime [5]. Furthermore, the strategy of using amendments to existing laws on Drug Control for legislating against DDs has now been called into question by the Committee for European Integration (CEI) who consider that they violate the rights of free movement of goods within the EU [24]. As an example, over half the plants from which prohibited agents originate are legal in Western European countries and extensively used in the pharmaceutical and cosmetics industries [5, 25].

Thus, DDs constitute a significant public health problem, especially in dealing with drug abuse and addiction. The

market for new psychoactive substances is growing at a dynamic pace in conjunction with the associated health risk and threat to life, particularly for adolescents. It is therefore imperative that effective measures of prevention and education are taken, including trying appropriate experimental approaches. This study has highlighted various factors required to be addressed in any anti-DD strategy [26]. Regrettably, there is still a lack of concrete clinical evidence on the effects of DDs, health risks, addiction potential, side-effects, overdosing and long-term use. Further and rigorous research is therefore urgently needed, especially in assessing DD toxicology, pharmacodynamics and pharmacokinetics on the human body.

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