Inhalation of volatile substances: on the decline but still dangerous

Intentional inhalation of certain volatile substances produces psychotropic effects that users seek for "recreational" purposes. The products that contain them and that are misused for this purpose are legal, in everyday use, inexpensive and readily available. This study, based on data from poison control centres, showed that the users are young and the inhaled products are mainly deodorants, dust removers and air fresheners. Given the severity of the effects and the risk of death due to the recreational inhalation of these substances, and although the number of poisoning cases has been declining since 2015, it seems necessary to increase awareness of the risks associated with these practices – which are wrongly considered to be harmless – and recommend labelling that indicates the danger.

Sniffing (inhaling from a container), huffing (inhaling from an impregnated cloth) or bagging (inhaling from a bag placed around the mouth and nose) refer to the intentional inhalation of a volatile substance for recreational purposes.

In 2012, the death of a teenager by asphyxiation as a result of deliberately inhaling deodorant drew the attention of the public authorities to this practice. In view of the growing number of prominent cases reported to centres for evaluation and information on drug dependence and addiction monitoring (CEIP-As) in recent years, the French Health Products Safety Agency (ANSM), which is responsible for addictovigilance, asked the poison control centres to update their data on recreational inhalation of volatile substances, with the exception of nitrous oxide and poppers, as these have already been targeted by dedicated investigations.

Young consumers and a declining phenomenon

Between 1 July 2013 and 31 December 2019, poison control centres recorded 408 cases of exposure to volatile substances for recreation or in a context of substance abuse/addiction.

The consumers were young: 50% were under 15 years of age, almost 70% were minors and seven of the children were under 10 years of age. While the temporal analysis showed an increase in the number of cases between 2013 and 2015, they then decreased significantly from 2016 onwards, with the lowest number of cases observed in 2019, the last year of the study (Figure 1). This downward trend was confirmed in 2020 and 2021[1] (data not yet published).

In 64% of people, the substance had been consumed at their home or the home of a friend, 13% in a school and 10% in a medical-welfare establishment. The other places of consumption varied (hospital, public street). It should be noted that 18 clustered cases were reported, mostly in schools or homes, involving a total of 64 adolescents and children.

Lastly, when information was available (n=134), 92% of people (n=123) reported chronic use, ranging from several weeks to several years for some.

Inexpensive substances found in many commercial products

The manufactured products involved are lawful, in everyday use, inexpensive and freely available, easily lending themselves to misuse by young adolescents. They include aerosol dispensers[2] (deodorant, air freshener, hairspray, dust remover, etc.), certain glues, lighter fuels, dry-cleaning products, nail polish remover, correction fluid, marker pens and petrol. They contain multiple chemicals, including for example hydrocarbons (propane, butane, isobutane, tetrafluoroethane) and solvents (toluene, trichloroethylene).

In this study, the vast majority of inhaled products were aerosol dispensers (n=306, 75% of products). Petrol (n=34), stain remover (n=15), nail varnish remover (n=8), helium (n=9), correction fluid (n=7), glue (n=5) and white spirit (n=3) were also used to a lesser extent.

Among the aerosol generators, deodorants were the most represented (n=163, 40% of cases), followed by dust removers (n= 59, 15% of cases) and air fresheners (n=42, 10% of cases). The most common aerosol dispenser gas involved in these poisoning cases was butane-isobutane-propane (BIP) (58% of aerosol dispensers), followed by butane-propane (12%) and isobutane alone (11%). These gases are classified as asphyxiating gases because they block oxygen supply and/or diffusion in the alveoli.

In this study, the consumption method was reported in only 22% of cases (n=88). The majority of these involved huffing (65% of cases) and bagging (31% of cases). Sniffing only concerned 4% of people.

In the vast majority of cases (94%), people had inhaled only volatile substances. A small number had also taken alcohol (10 cases), drugs such as cannabis or heroin (6 cases), or medication such as anxiolytics or sleeping pills (6 cases).

1.Extraction in 2021 of cases reported to poison control centres following a request from the ANSM.

2.Commonly known as aerosols, these are single-use metal, plastic or glass containers holding a product (liquid or solid) specific to aerosol use. The product inside is pressurised with a propellant gas.

Several cardiac arrests and neurological damage

In the study presented here, over half of the people (52%) experienced at least one neurological symptom such as headaches, drowsiness, dizziness or loss of consciousness. Psychological symptoms were reported in one third of patients (inebriation, agitation), digestive symptoms in 15% (vomiting, nausea), respiratory symptoms in 13% (cough, respiratory pain), general symptoms in 11% (asthenia, discomfort) and cardiovascular symptoms in 8% (tachycardia, cardiorespiratory arrest).

No deaths were reported, but 13 poisoning cases were very serious. Eight of these users were male and the median age was 16 years. In all but two cases, the person had inhaled aerosol dispensers, mainly deodorants (n=9). In five cases the nature of the volatile substances was known.

They were deodorants containing ethanol, butane and/or the BIP mixture; a compressed-air spray containing butane and propane that caused cardiorespiratory arrest; a glue and shoe cleaner containing solvents.

Seven out of the 13 users had presented with cardiovascular problems, five of whom had suffered cardiorespiratory arrest with a favourable outcome after external electric shock with a defibrillator. Three of them had inhaled deodorant, a fourth had inhaled a compressed-air spray and the last had inhaled lighter fluid. Four people suffered from neurological disorders (three were in a coma and the fourth had temporarily lost consciousness) and one person with a burnt lip developed aspiration pneumonia[3].

Lung infection caused by inhalation of oral secretions, stomach contents or both, due to swallowing disorders.

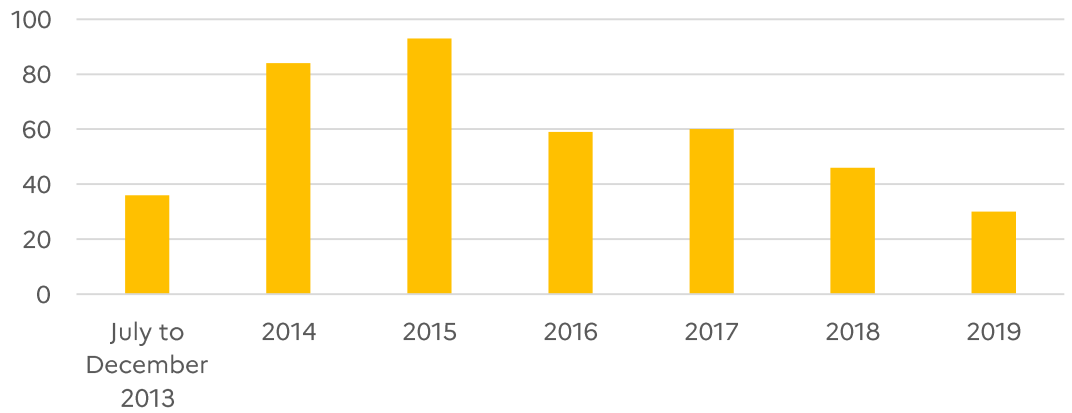

Figure 1: Annual breakdown of exposure cases reported to the poison control centres between 01/07/2013 and 31/12/2019. Source: SICAP.

Similar effects described in the literature

The potential lethality of these asphyxiating gases has been extensively described in the literature. Fatal asphyxiation accidents have been reported in humans almost exclusively as a result of intentional inhalation in the context of substance abuse. Numerous deaths from inhalation of butane emitted from petrol fumes, or contained in aerosol cans or lighter refills, have been reported in the United Kingdom and the United States [2]. The direct cardiac toxicity of hydrocarbons is also well known. This is due to them sensitising the heart, to the effects of adrenaline in particular, leading to arrhythmia that can result in cardiac arrest and death [2].

Serious neurological disorders have also been reported, including severe encephalopathy in consumers of products containing butane, after only a few months of use. In addition, anaesthetic or narcotic effects have been described for butane and isobutane, with an action on the central nervous system and potentially fatal arrhythmia [2].

Moreover, the solvents and halogenated derivatives (chlorinated or fluorinated) also identified in the composition of the products consumed in this study act on the central nervous system by inducing an inebriated narcotic syndrome. Some consumers experience perception disorders that can lead to hallucinations, and then drowsiness sometimes leading to coma. Some halogenated compounds have cardiac toxicity. Several cases of sudden death have been described following the inhalation of volatile substances[5] such as chlorinated solvents, which are known to have pro-arrhythmogenic potential[6], but also with aerosol generators whose propellant gases are hydrofluorocarbons (tetrafluoroethane or norflurane) or difluoroethane. Massive, repeated and prolonged (several months to several years) exposure to solvents can lead to progressive leukoencephalopathy[7] with neurological and neuropsychiatric symptoms [3].

3.Lung infection caused by inhalation of oral secretions, stomach contents or both, due to swallowing disorders.
4.Feeling of drunkenness, dizziness, headache, nausea.
5.Sudden sniffing death syndrome (SSDS).
6.May cause heart rhythm disorders.
7.Neurological disorder due to alteration of brain white matter, regardless of the cause of the injury.

Lastly, the significant drop in the temperature of the gas during its expansion, which can quickly reach negative temperatures (down to -40°C), exposes the consumer to oral, intra-oral, oropharyngeal or respiratory tract burns and can lead to acute respiratory distress.

Raise awareness and improve labelling

There has been a steady decline in the number of cases reported to poison control centres since 2015. These findings are consistent with those of the latest ESCAPAD[8] survey of 2017, which shows a decrease in experimentation with "inhalants" since 2011 [4]. Unfortunately, the decline in the consumption of these substances may be offset by the use of other substances, mainly nitrous oxide, for which the number of poisoning cases has been increasing since 2017 [5]. In view of the seriousness of the cases observed, information campaigns on the risks involved in this practice are still needed.

This information should take the form of specific labelling applied directly on the packaging, explicitly warning of the serious and sometimes fatal risks involved in deliberately inhaling large quantities. In addition to the usual warnings ("avoid intentional inhalation, spraying into the eyes or onto irritated skin"), there should be a message about the risks associated with the abuse and misuse of these aerosol gases. Very explicit labelling such as "SACKI[9]" (Solvent abuse can kill instantly), like the one introduced in the UK, could deter children and young adolescents from trying this practice.

Minors, who were in the majority in this study, should be informed in school settings about the risks and dangers of this practice, which is too often considered to be harmless. Communication in schools should be proposed, in the same way as for the consumption of illicit substances, for example, through associations giving talks that are tailored to the age of the pupils, particularly teenagers, who often begin using due to peer pressure.

Family and friends should also be made aware of this practice, which sometimes begins in childhood, through a national information campaign run by the competent bodies.

This is because some young users engage in recreational inhalation of volatile substances alone at home, without the knowledge of close relatives.

This increases the risk of death by delaying the intervention of emergency medical services in the event of cardiorespiratory arrest.

Healthcare professionals and supervisory staff in educational settings, school health services, paediatricians and general practitioners should also be made aware of these practices. As this study indicates, they involve young children and sometimes occur in the school environment, and may then concern several pupils. It is also important to remind emergency physicians and resuscitators, who are directly involved in treating these poisoning cases, that they can obtain toxicology expertise by calling a poison control centre.

Lastly, people who are already addicted to this consumption should be treated under an addiction treatment monitoring protocol[10] by a doctor or specialised organisation, such as a centre for addiction care, support and prevention (CSAPA), or a young consumers' consultation centre (CJC)[11] if they are minors. These organisations offer a free and confidential service (information, listening, counselling and, if necessary, referral). All the information is available at www.drogues-info-service.fr.

Implementing these measures would help prevent or limit the risks associated with the recreational inhalation of volatile substances, and would also improve the ability to detect and identify practices of this kind that are not exhaustively known. This monitoring will be continued by the CEIP-As as part of their addictovigilance mission, in particular to improve knowledge of medium-term effects or of the occurrence of after-effects.

Chloé GREILLET and Cécilia SOLAL (ANSES)

TO FIND OUT MORE:

https://www.anses.fr/fr/system/files/Toxicovilance2019SA0217Ra.pdf

References

[1]. Centre d'évaluation et d'information de la pharmacodépendance et l'addictovigilance de Lyon (CEIP-A de Lyon). 2014. Potentiel d'abus et de pharmacodépendance des substances volatiles.

[2]. National Institute of Occupational Safety and Health (NIOSH). 2016. Immediately Dangerous to Life or Health (IDLH) Value Profile. Butane. CAS® No. 106-97-8. Department of health and human services. Center for Disease Control and Prevention.

[3]. Aydin K, Sencer S, Demir T, Ogel K, Tunaci A and Minareci O. 2002. Cranial MR findings in chronic toluene abuse by inhalation. Am J Neuroradiol;23(7):1173-1179

[4]. Observatoire français des drogues et des toxicomanies (OFDT). Enquête ESCAPAD. https://www.ofdt.fr/enquetes-et-dispositifs/escapad/

[5]. Agence nationale de sécurité sanitaire de l'alimentation, de l'environnement et du travail (Anses). 2021. Protoxyde d'azote. Bilan des cas rapportés aux Centres antipoison en 2020. https://www.anses.fr/fr/system/files/Toxicovigilance2021AST0027Ra.pdf

8.French Survey on Health and Use on National Defence and Citizenship Day.
9. https://www.bama.co.uk/abuse
10. https://www.drogues.gouv.fr/etre-aide/ou-trouver-laide
11. https://www.drogues-info-service.fr/Tout-savoir-sur-les-drogues/Se-faire-aider/Les-Consultations-jeunes-consommateurs-CJC-une-aide-aux-jeunes-et-a-leur-entourage#